# Appendix G.3

## TERRESTRIAL BIODIVERSITY REPORT (INCLUDING THE ANIMAL AND PLANT SPECIES REPORTS)

# TERRESTRIAL BIODIVERSITY SPECIALIST ASSESSMENT FOR THE PROPOSED PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY PROJECT

WSP Group Africa Pty (Ltd)

September 2024

 x

Submitted to:
Aisling Dower
WSP Group Africa Pty (Ltd)
Building 1, Maxwell Office Park
Waterfall City, Midrand
Gauteng
South Africa

Report Compiled By:
Andrew Zinn (*Pr.Sci.Nat.*)
Hawkhead Consulting

# Acronyms and Abbreviations

| Abbreviation | Explanation |
|---|---|
| AIS | Alien Invasive Species |
| AOO | Area of Occupancy |
| BI | Biodiversity Importance |
| CA | Conservation Areas |
| CBA | Critical Biodiversity Areas |
| CI | Conservation Importance |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Programme |
| EOO | Extent of Occurrence |
| ESA | Ecological Support Area |
| FI | Functional Integrity |
| Ha | Hectare |
| IBA | Important Bird Areas |
| IUCN | International Union for the Conservation of Nature |
| KBA | Key Biodiversity Area |
| MAP | Mean Annual Precipitation |
| MPTA | Mpumalanga Parks and Tourism Agency |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management Biodiversity Act |
| NFEPA | National Freshwater Ecosystem Priority Areas |
| PA | Protected Areas |
| QDS | Quarter Degree Square |
| RR | Receptor Resilience |
| SANBI | South African National Biodiversity Institute |
| SAPAD | South African Protected Areas Database |
| SAS | Strategic Aquatic Services |
| SCC | Species of Conservation Concern |
| SEI | Site Ecological Importance |

| | |
|---|---|
| SWSA | Strategic Water Source Areas |
| ToPS | Threatened or Protected Species |
| WEF | Wind Energy Facility |

# Details of the Expertise of the Specialist

| Specialist Information | |
|---|---|
| **Name** | Andrew D. Zinn<br>Pr.Sci.Nat. - Ecological Science (400687/15) |
| **Designation** | Report Author – Terrestrial Ecologist |
| **Cell Phone Number** | +27 83 361 0373 |
| **Email Address** | andrew@hawkhead.co.za |
| **Qualifications** | M.Sc. Resource Conservation Biology<br>B.Sc. Hons. Ecology and Conservation Biology<br>B.Sc. Zoology and Grassland Science |
| **Summary of Past Experience** | Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research, and is registered as a Professional Natural Scientist (*Pr.Sci.Nat.*) – Ecological Science, with the South African Council of Natural Scientific Professions (SACNASP). Andrew has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia. |

# Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Phefumula Emoyeni One Wind Energy Facility Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

# Contents

# List of Tables



# List of Figures

# 1. Introduction

Hawkhead Consulting was appointed by WSP Group Africa Pty (Ltd), on behalf of Phefumula Emoyeni One (Pty) Ltd, to conduct the Terrestrial Biodiversity Specialist Assessment for the proposed Phefumula Emoyeni One Wind Energy Facility (WEF) Project (hereafter referred to as the 'Project'), near Ermelo in Mpumalanga Province, South Africa.

## 1.1. Scope and Purposes of this Report

This specialist study focused on terrestrial biodiversity, and was conducted in line with the '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 National Environmental Management Act, 1998, When Applying for Environmental Authorisation', and specifically:

- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Terrestrial Biodiversity.

The primary scope of work included:

- Reviewing and summarising pertinent biodiversity information presented in relevant ecological, conservation and biodiversity datasets and literature;
- Conducting a field survey of the Project site to collect field data to verify the ecosystem and biodiversity character and sensitivity of the site and surrounding landscape;
- Identifying and assessing potential negative impacts on terrestrial biodiversity and ecosystems associated with the proposed Project; and
- Recommending appropriate biodiversity mitigation, management and monitoring measures for inclusion in the proposed Project's Environmental Management Plan (EMP) and/or Biodiversity Management Plan (BMP).

Predicated on the above scope items, the purpose of this report is therefore to 1) present a baseline description and sensitivity analysis of terrestrial biodiversity relevant to the site and its surrounding landscape, 2) assess the potential impacts of the proposed Project on on-site biodiversity; 3) detail appropriate management and monitoring measures to avoid/mitigation identified impacts and guide on-site biodiversity management; and 4) provide an impact statement on the appropriateness of the proposed Project with respects to terrestrial biodiversity conservation.

This report should be read in conjunction with the Plant Species Specialist Assessment and Animal Species Specialist Assessment reports, as well as any other biodiversity-related specialist reports.

## 1.2. Location and Delimits of the Study Areas

The proposed Phefumula Emoyeni One WEF site is located approximately 16 km north of Ermelo in the Msukaligwa Local Municipality and Gert Sibande District Municipality, in Mpumalanga Province, South Africa (Figure 1). The entire WEF site was regarded as the 'study area' for this specialist assessment.

## 1.3. Project Description

The proposed Phefumula Emoyeni One WEF will be developed within a proposed Project area of approximately 33 660 hectares (ha). The site will be accessed via the N11 and existing access roads. The proposed project description is outlined in Table 1.

*Table 1: Phefumula Emoyeni One WEF Technical Details*

| Details | Information |
|---|---|
| APPLICANT NAME: | PHEFUMULA EMOYENI ONE (PTY) LTD |
| Municipalities | Msukaligwa Local Municipality<br>Gert Sibande District Municipality |
| Extent | 33 660 ha |
| Buildable area | subject to finalization based on technical and environmental requirements |
| Export Capacity | Up to 550MW |
| Power system technology | Wind |
| Number of Turbines | Up to 88WTG |
| Turbine capacity | Between 6 MW and 15 MW each |
| Rotor Diameter | Up to 200 m |
| Hub Height | Up to 200 m |
| Hard Standing Dimensions | Approximately 75 m x 120 m |
| Turbine Foundations | Diameter of up to 40 m per turbine – excavation up to 6 m deep, constructed of reinforced concrete to support the mounting ring. Once tower established, footprint of foundation is covered with soil. |
| Substation and internal powerlines | • 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.<br>• 3 x 33kV/132kV onsite collector substation (IPP Portion), each being up to 5 ha.<br>• Cabling between turbines, to be laid underground where practical |
| Construction camp and laydown area | • Construction compounds including site office (approximately 300 m x 300 m in total but split into 3 ha each of 150 m x 200 m):<br>• 3 x Batching plant of up to 4ha to 7ha.<br>• 3 x construction compound / laydown area, including site office of 3ha each (150 m x 200 m each).<br>• Laydown and crane hardstand areas (approximately 75 m x 120 m). |
| INTERNAL ROADS | • 12-13 m wide roads with 12 m radius turning circles, gravel surface |
| O&M Building | • 3 x O&M office of approximately 1. 5 ha each adjacent to each collector Sub Station. |
| Batching Plant | • Up to 3 x Batching plants of up to 4 ha to 7 ha. |
| BESS | • Battery Energy Storage System (BESS) (200MW/800MWh).<br>• Type has not been confirmed at this stage. It is proposed that all impacts related to both types be assessed in the EIA.<br>• Export Capacity of up to 200MWh<br>• Total storage capacity 800MW<br>• Storage capacity of up to 6-8 hours<br>• The BESS will be housed in containers covering a total approximate footprint of up to 5 ha. |

| | |
|---|---|
| | • Battery types to be considered: Solid State Batteries as the preferred (Lithium Ion) and Redox Flow Batteries as the alternative (Vanadium Redox). |

## 1.4. Environmental Screening Tool - Project Sensitivities

The proposed Project site was assessed at a desktop level using the National Web-based Environmental Screening Tool. According to the sensitivity report output, the Terrestrial Biodiversity Theme is rated 'Very High' sensitivity due to the presence of the following features:

- Critical Biodiversity Area (CBA) 1;
- Critical Biodiversity Area 2;
- Ecological Support Areas (ESA): Landscape corridor;
- Ecological Support Areas (ESA): Local corridor;
- Freshwater Ecosystem priority Area (FEPA) Sub-catchment;
- National Protected Area Expansion Strategy (NPAES);
- Endangered – Eastern Highveld Grassland; and
- Vulnerable – Soweto Highveld Grassland.

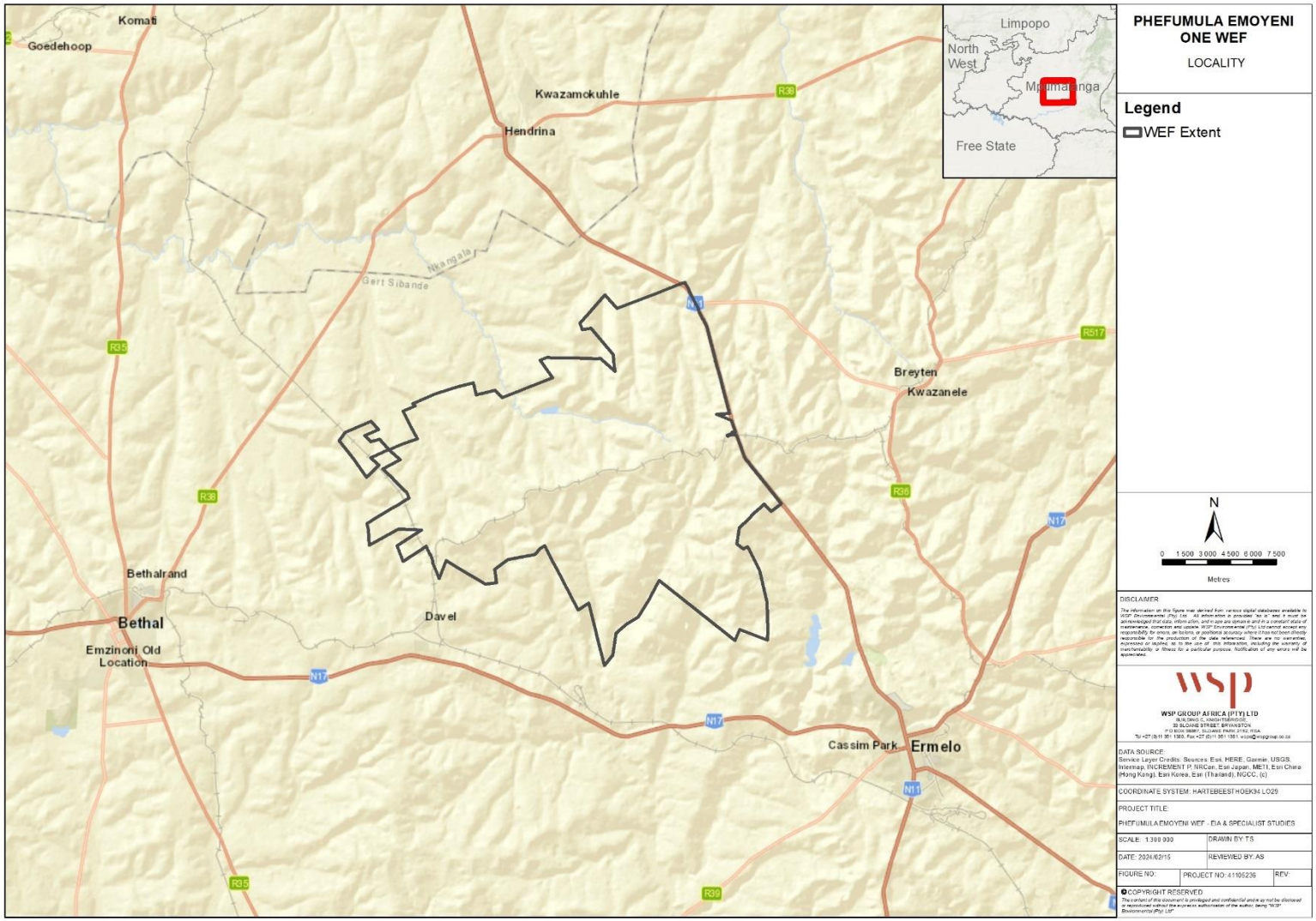



*Figure 1 Map showing the regional location of the proposed Project.*

# 2. Relevant Legislation and Guidelines

Relevant international, national and provincial legislation, associated guidelines and policies that are relevant to the environmental and biodiversity, and which were used to guide the Terrestrial Biodiversity Specialist Assessment are listed in Table 2.

*Table 2: Relevant environmental and biodiversity legislation and guidelines.*

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| National Environmental Management Act, 1998 (Act No 107 of 1998) – NEMA | Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management, and laid down in Chapter 5 of the NEMA. In terms of section 24(1), the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the NEMA with granting of the relevant environmental authorisation. In terms of section 24F (1) of the NEMA no person may commence an activity listed or specified in terms of section 24(2)(a) or (b) unless the competent authority has granted an environmental authorisation for the activity.<br><br>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, the following is relevant to this study:<br><br>• Protocol for the specialist assessment and report content requirements for environmental impacts on terrestrial biodiversity. |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) | The NEMBA is administered by the Department of Forestry, Fisheries and the Environment (DFFE) and provides the framework under the NEMA for the:<br><br>• Management and conservation of South Africa's biodiversity;<br>• The protection of species and ecosystems that warrant protection;<br>• The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; and<br>• The establishment and functions of a South African National Biodiversity Institute (SANBI).<br><br>Amongst other components, the NEMBA includes:<br>• Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (February 2007), with associated amendments (December 2007 and 3 June 2020) (ToPS), published under Section 56(10 of NEMBA;<br>• Threatened or Protected Species Regulations (February 2007); and |

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| | • National list of threatened terrestrial ecosystems for South Africa (2011, and 2021 revision), published under Section 51(1)(a) of NEMBA.<br>• National Biodiversity Offset Guideline (2023), which provides guidance on the need to develop biodiversity offsets.<br><br>The purpose of ToPS lists and regulations are to regulate the permit system concerning restricted activities involving specimens of listed threatened or protected species. The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by identifying 'witness' sites' of exceptionally high conservation value and enabling and facilitating proactive management of these ecosystems.<br><br>Chapter 5 of NEMBA also provides a list of regulations and guidance concerning alien invasive species, including:<br>• A guideline for Monitoring, Control and Eradication Plans (September 2015);<br>• 2020 Alien and Invasive Species Regulations (September 2020); and<br>• 2016 and 2020 Alien and Invasive Species Lists (March 2021). |
| National Environmental Management: Protected Areas Act (2003) | • The NEMPA provides the framework under the NEMA for the protection and conservation of South Africa's biodiversity through the establishment of a system of protected areas that represent the country's diverse ecosystems, landscapes, and seascapes; and<br>• The NEMPA sets out mechanisms and processes for declaring and managing protected areas, including protected environments, with an emphasis on intergovernmental cooperation and public involvement. |
| Mpumalanga Nature Conservation Act (Act No. 10 of 1998) | Amongst other provisions, the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) provides lists of specially protected and protected flora and fauna. Of particular relevance to this specialist study are species of game/wild animals and flora that are listed under:<br>• Schedule 1: Specially Protected Game;<br>• Schedule 2: Protected Game;<br>• Schedule 4: Protected Wild Animals;<br>• Schedule 11 and 12: Protected and Specialist Protected Plants. |
| Other Relevant national and Provincial Policies, Plans and Guidelines | Other relevant policies, plans and guidelines that were considered during this study include:<br>• Mpumalanga Biodiversity Sector Plan (2022);<br>• Species Environmental Assessment Guideline (SANBI, 2020);<br>• National Protected Area Expansion Strategy (2019); and<br>• Mpumalanga Protected Area Expansion Strategy – 20-year Plan. |

# 3. Study Methodology

The methodology used for this study included a desktop literature review component and a field programme. The various tasks associated with these components are discussed below:

## 3.1. Desktop Literature Review

The aim of the desktop literature review component was to collate and review data and information pertaining to the terrestrial biodiversity characteristics and conservation context of the study area and surrounding landscape. Reviewed literature and datasets were obtained from a variety of online and literature sources, as discussed below:

- The South African National Biodiversity Institutes (SANBI) Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018) was consulted to identify the regional vegetation types relevant to the study area;
- Mucina and Rutherford (2011) was reviewed to obtain full descriptions of the relevant regional vegetation type. SANBI (2013) was also reviewed for a biome-level description;
- The National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011 & 2021) was consulted to determine the conservation status of relevant vegetation types and ecosystems;
- The Mpumalanga Biodiversity Sector Plan (MBSP) (2022) spatial data was reviewed to determine the status and distribution of *inter alia*, protected areas, Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA);
- The Strategic Water Source Areas (SWSA) and Freshwater Ecosystem Priority Area (FEPA) databases were reviewed for information on the hydrological setting and management of the study area and surrounding landscape;
- The South African Protected Areas Database website (SAPAD, 2023) was reviewed to identify protected areas (legally gazetted) and conservation areas in the broader region in which the study area is located;
- The DWAF spatial data of Indigenous Forest Patches was consulted to identify any indigenous forests in, or in close proximity to, the study area;
- The National Protected Area Expansion Strategy (NPAES) (2018) and the Mpumalanga Protected Area Expansion Strategy (20 Year Plan) were assessed to identify Priority Focus Areas for protected area expansion;
- Marnewick, *et al*., (2015) was reviewed for descriptions of Important Bird Areas (IBA) in the region surrounding the study area. SANBI (2024) was also consulted for information pertaining to the replacement of IBAs with Key Biodiversity Areas (KBA); and
- Satellite imagery available on Google Earth Pro and GeoTerra spatial data were also studied to develop an understanding of general landcover, likely habitat types, and historic- and current on-site disturbances in the study area.

## 3.2. Field Programme

The field programme comprised a wet-season field survey, conducted from the 22-26$^{th}$ January 2024. This period coincides with the peak vegetation growing period (November to April) for grassland ecosystems in summer rainfall areas, and is therefore an optimal time to assess vegetation and flora species. During this period, activity levels amongst many fauna species are also high, and therefore it is also an optimal time to survey for fauna.

The sampling methodology was aligned with SANBI (2020) recommendations, and included both flora and fauna surveys, as summarised below (for detailed surveying methods, refer to the Animal Species Specialist Assessment and Plant Species Specialist Assessment reports):

- Vegetation was sampled using meander search transects at representative sites in each of the main natural habitat units in the study area. Collected data included habitat character and condition, flora species composition, evidence of current and past disturbances, presence of flora species of conservation concern, and presence of declared alien invasive species;
- Fauna surveys included:
    - Active sampling (e.g., baited motion-triggered camera traps and Sherman traps, and active searches);
    - Passive sampling methodologies, including direct observations/opportunistic encounters and indirect observations (i.e. identification of fauna tracks, scats, burrows etc.); and
    - Interviews with local farmers to obtain anecdotal evidence of fauna known to be present on-site; and
- While on-site, special emphasis was also placed on assessing *inter alia*: habitat connectivity within the study area and across the surrounding landscape; the presence/potential presence of species of conservation concern based on habitat suitability; specific sites of potential sensitivity; and, the prominent ecological drivers of change in the landscape.

## 3.3. Delineation and Mapping of Habitat Units

Mapping of habitat units was conducted using a review and analysis of composite Google Earth aerial imagery, coupled with data and observations obtained during the field survey, and using the wetland delineations developed by Strategic Aquatic Services (SAS).

## 3.4. Assessment of Site Ecological Importance

The ecological importance of habitat units was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).

- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

For tables detailing the rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, refer to Appendix B. Table 3 presents a guideline for interpreting the SEI (SANBI, 2020).

*Table 3: Guidelines for interpreting SEI in the context of the proposed development activities*

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |
| Source: SANBI (2020). | |

# 4. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions, uncertainties and gaps in knowledge are highlighted for this biodiversity assessment:

- The field survey was conducted in January 2024. The timing of the field survey coincided with the peak vegetation growing period (November to April) for grassland ecosystems in summer rainfall areas. It was noted that sufficient rain had fallen prior to the field survey, and vegetation was actively growing and flowering. During this period, there is also increased activity levels amongst many fauna species. Conditions at this time were therefore optimal to assess vegetation condition, general flora species composition and the character of the on-site fauna community. Seasonality was therefore not considered a study limitation;
- Notwithstanding the above, it is possible that certain herbaceous taxa (e.g., annuals and geophytes) that are most readily visible or distinguishable at other periods during the wet/growing season, may not have been detected during the field survey;
- It is also possible that certain rare, cryptic, migrating, aestivating or transient fauna species may not have been present and/or observed during the field survey;

- The absence or non-recording of a specific fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species; and
- Mapping of habitat units was conducted manually at a desktop-level, using available aerial imagery, coupled with field observations and supplementary spatial datasets. It must be noted that agricultural landscapes are dynamic and subject to ongoing farming activities. It is thus possible that the character of individual habitat patches may change over time.

# 5. Regional Vegetation Characteristics

The study area is located in the Grassland Biome, and according to SANBI's regional mapping of South Africa's vegetation types (2018), Eastern Highveld Grassland and Soweto Highveld Grassland are the dominant vegetation types across the study area (Figure 2). The general characteristics of the Grassland Biome and these vegetation types are discussed in more detail below:

## 5.1. Grassland Biome

The regional study area is located in the Grassland Biome, which covers approximately 28% of South Africa and is the dominant biome of the central plateau and inland areas of the eastern subcontinent (SANBI, 2013). Grasslands are typically situated in moist, summer rainfall regions that experience between 400 mm and 2000 mm of rainfall per year. Vegetation consists of a dominant field-layer comprising grasses and herbaceous perennials, with little-to-no woody plants present.

South Africa's grassland ecosystems are parsed into five groups, with the study area located in the Mesic Highveld Grasslands group (SANBI 2013). Mesic Highveld Grasslands occur at mid-altitudes and experience warm, wet summers (MAP 700-1200 mm) and cold winters. They are typically highly productive sourveld grasslands that are dominated by long-lived perennial grasses (SANBI, 2013).

Fire is common in Mesic Highveld Grasslands and maintains these ecosystems in a relatively treeless form (SANBI, 2013). Apart from their importance as rich stores of biodiversity, grasslands are critically important water production landscapes, constituting about half of South Africa's Strategic Water Source Areas (SANBI, 2013).

## 5.2. Eastern Highveld Grassland

Eastern Highveld Grasslands extend from Johannesburg in the east through to Bethel, Ermelo and Piet Retief in the west. This vegetation type is found on slightly- to moderately undulating plains, low hills and wetland depressions. Grasses are typical Highveld species from the genera *Aristida, Digitaria, Eragrostis* and *Tristachya*. Indigenous woody species are mainly restricted to rocky areas and include *Celtis africana, Protea caffra, Protea welwitschii, Diospyros lycioides, Searsia magalismontana* and *Senegalia caffra* (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) note the following species, amongst several others, as important taxa in Eastern Highveld Grassland:

**Shrubs**: *Anthospermum rigidum* and *Seriphium plumosum*.

**Graminoide**s: *Aristida aequiglumis, Aristida congesta, Aristida junciformis, Cynodon dactylon, Digitaria monodactyla, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Eragrostis racemosa, Heteropogon contortus, Loudetia simplex, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Alloteropsis semialata* and *Monocymbium ceresiiforme*.

**Herbs**: *Berkheya setifera, Haplocarpha scaposa, Euryops gilfillanii, Euryops transvaalensis, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Kohautia amatymbica, Lactuca inermis, Gladiolus crassifolius, Haemanthus humilis* and *Selago densiflora*.

**Endemic Taxa**: The geophytic herbs *Agapanthus inapertus, Eucomis vandermerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

## 5.3. Soweto Highveld Grassland

Soweto Highveld Grassland extends in a broad band between Johannesburg and Ermelo in the north, and Perdekop and the Vaal River in the south (Mucina & Rutherford, 2011). Vegetation is characterised by short to medium-high density tufted grassland, occurring on gently- to moderately undulating plains (Mucina & Rutherford, 2011). Grasslands are typically dominated by *Themeda triandra* along with several other co-dominant species. These grasslands are interrupted by small wetlands and rocky ridges and outcrops (Mucina & Rutherford, 2011).

The mean annual precipitation (MAP) of the region is 662 mm. Rainfall occurs in the summer, with winters being typically cold and dry (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) list the following flora species as being important or characteristic taxa in the Soweto Highveld Grassland vegetation type, amongst others:

**Graminoids**: *Themeda triandra, Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Heteropogon contortus, Hyparrhenia hirta, Setaria sphacelata, Aristida junciformis, Aristida congesta, Aristida bipartita* and *Paspalum dilatatum*.

**Herbs**: *Hermannia depressa, Euryops gilfillanii, Geigeria aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum rugulosum, Helichrysum nudifolium, Lippia scaberrima, Senecio coronatus, Vernonia oligocephala* and *Wahlenbergia undulata.*

**Shrubs**: *Anthospermum hispidulum, Anthospermum rigidum, Berkheya annectens, Felicia muricata* and *Ziziphus zeyheriana*.

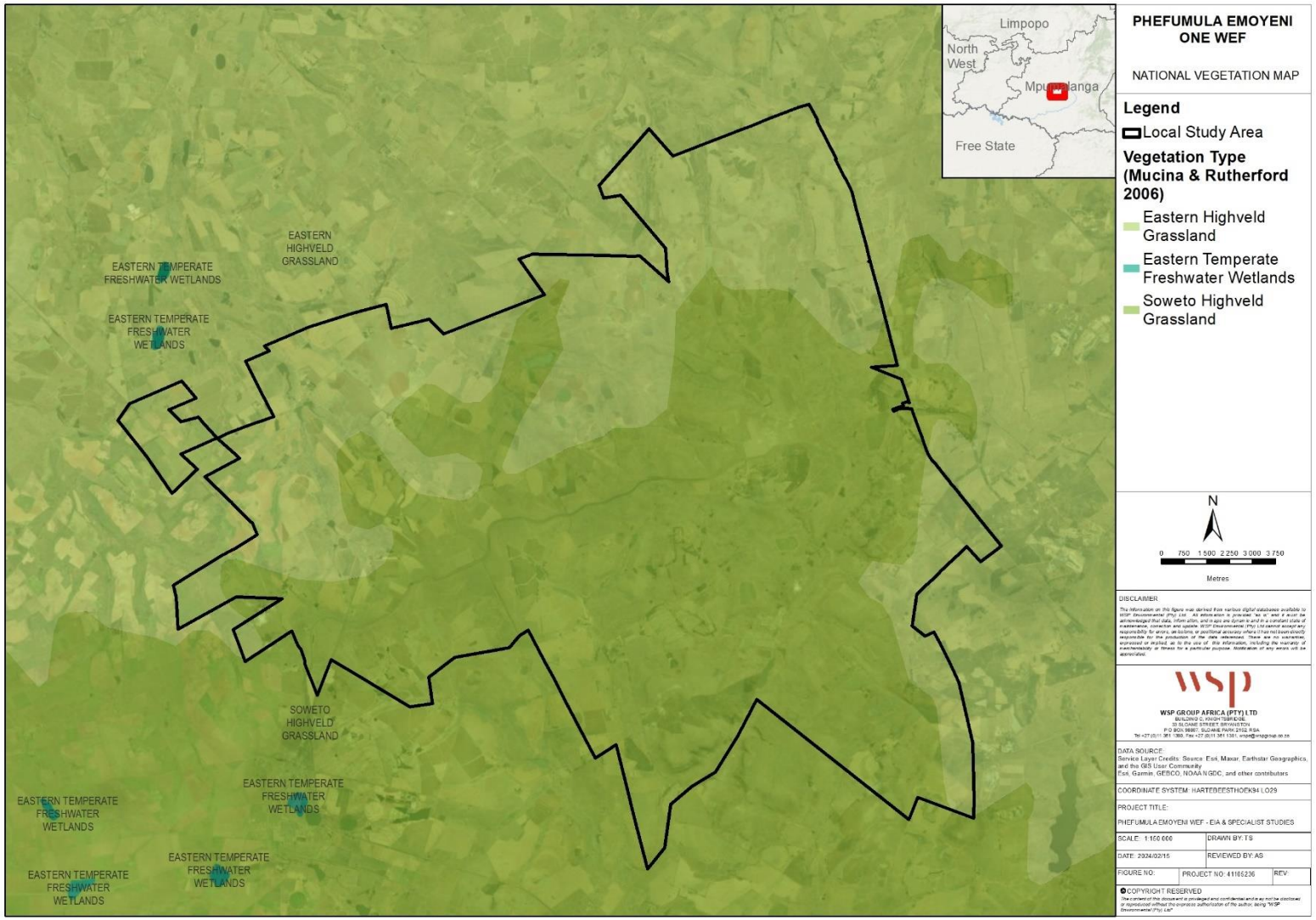



*Figure 2: Study area in relation to the SANBI (2018) vegetation types.*

# 6. Regional Ecological Sensitivity and Conservation Setting

## 6.1. Nationally Threatened Ecosystems

Both Eastern Highveld Grassland and Soweto Highveld Grasslands are listed as threatened, as per the NEMBA Threatened Ecosystems (2021):

Eastern Highveld Grassland is listed as Endangered, and is subject to high rates of habitat loss as a result of cultivation, forestry, mines, urbanisation and the building of dams (Mucina & Rutherford, 2011). Estimates suggest that up to approximately 70% of the original extent of Eastern Highveld Grassland has been transformed. Only a very small fraction is conserved in statutory reserves (e.g., Nooitgedacht Dam and Jericho Dam Nature Reserves) (Mucina & Rutherford, 2011). The mapped remaining extent of Eastern Highveld Grassland, as per SANBI (2021) spatial data, is shown in Figure 3 below.

Cultivation, urbanisation, road infrastructure and mining have similarly resulted in the transformation of more than half of the original extent of Soweto Highveld Grasslands (Mucina & Rutherford, 2011). Only a few patches are conserved in formal protected areas, such as Waldrift Nature Reserve, Krugersdorp Nature Reserve, Leeuwkuil Nature Reserve and Suikerbosrand Nature Reserve. This vegetation type is therefore listed as Vulnerable, according to the NEMBA Threatened Ecosystems (2021) (remaining extent also shown in Figure 3).

The study area is characterised by large areas of intact grassland habitat, comprising both Eastern Highveld Grassland and Soweto Highveld Grassland. Considering the conservation status of these vegetation types, potential loss of natural grassland associated with the proposed Project is a concern and needs to be carefully managed.

## 6.2. Terrestrial Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

The Mpumalanga Biodiversity Sector Plan (MBSP) technical report (Lötter, 2015) defines five categories of conservation focus; protected areas, critical biodiversity areas (CBA), ecological support areas (ESA), other natural areas, and modified habitats. Definitions for each are listed below:

- **Protected Areas**: protected areas recognised in terms of the National Environmental Management Protected Areas Act, No. 57 of 2003, that are currently considered to meet biodiversity targets in the MBSP.
- **Critical Biodiversity Area**: areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition. The MBSP recognises two CBA ranks, *viz*, CBA Irreplaceable and CBA Optimal.
- **Ecological Support Area**: play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. They need to be maintained in at least an ecologically functional state.
- **Other Natural Areas**: often retain much of their natural character and may contribute significantly to maintenance of viable species populations and natural ecosystem functioning,

and may provide important ecological infrastructure and ecosystem services. They are not, however, prioritized for immediate conservation action in the MBSP.

- **Modified**: often referred to as transformed, these areas have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irretrievably), as a result of biodiversity-incompatible land-use practices such as ploughing, hardening of surfaces, mining, cultivation and the construction of houses or other built infrastructure.

The spatial delineations of the Mpumalanga Biodiversity Sector Plan (2022) in relation to the study area are shown in Figure 4. It is evident that large tracts of natural habitat in the study area, particularly in the south, are delineated as CBA Irreplaceable (CBA 1), while many other habitat patches are delineated as CBA Optimal (CBA 2). Other smaller and less extensive patches are also delineated as ESA Local Corridor, ESA Landscape Corridor, and Other Natural Areas (see Figure 4).

The statuses of the various CBA designated habitat patches in the study area are predicated on a combination of the following features, as per data received from the MPTA (M. Lötter):

- Eastern Highveld Grassland;
- Soweto Highveld Grassland;
- Mesic Highveld Grassland– Groups 1-3;
- Intact grassland patches;
- Several fauna species:
    - Giant bullfrog (*Pyxicephalus adspersus*);
    - Blue Korhaan (*Eupodotis caerulescens*);
    - Rudd's Lark (*Hateromirafra ruddi*);
    - Botha's Lark (*Spizocorys fringillaris*);
    - White-bellied Korhaan (*Eupodotis senegalensis*);
    - African Grass Owl (*Tyto capensis*);
    - Oribi (*Ourebia ourebi ourebi*);
- Climate change land facets;
- Macro-corridor;
- Critical linkages;
- Three flora species:
    - *Aspidoglossum xanthosphaerum*;
    - *Khadia carolinensis*;
    - *Brachycorythis conica* subsp. *transvaalensis*; and
- Core and supporting corridors.

The field survey indicated that CBA land in the study area mostly comprises large intact patches of natural dry- and moist grassland and shrubland habitat. Aerial imagery indicates that certain small patches designated as CBA have actually been altered by farming activities, and are currently cultivated or characterised by old lands (shown in Figure 5). Excluding these small modified patches, the remaining extensive tracts of CBA land in the study area are important and functional natural habitat. The continued integrity and protection of these CBA's is crucial to meet conservation targets for biodiversity pattern (species and ecosystems) and ecological processes. The presence of CBA Irreplaceable and CBA Optimal land in the study area is therefore a concern with respects to terrestrial

biodiversity management. As per the MBSP, development in CBA areas should be avoided. It is therefore recommended that, as far as possible, no proposed Project infrastructure should be sited on land designated CBA Irreplaceable and CBA Optimal.

With respects to ESA areas, a greater range of land uses is permissible in such areas, including the development of turbines (under certain conditions). However, the functional state of these areas should not be compromised by proposed Project infrastructure or activities. Proposed Project infrastructure should therefore also ideally not impact designated ESA. Land designated as 'Other Natural Areas' are not required to meet biodiversity targets, and turbine development in these areas is permissible.

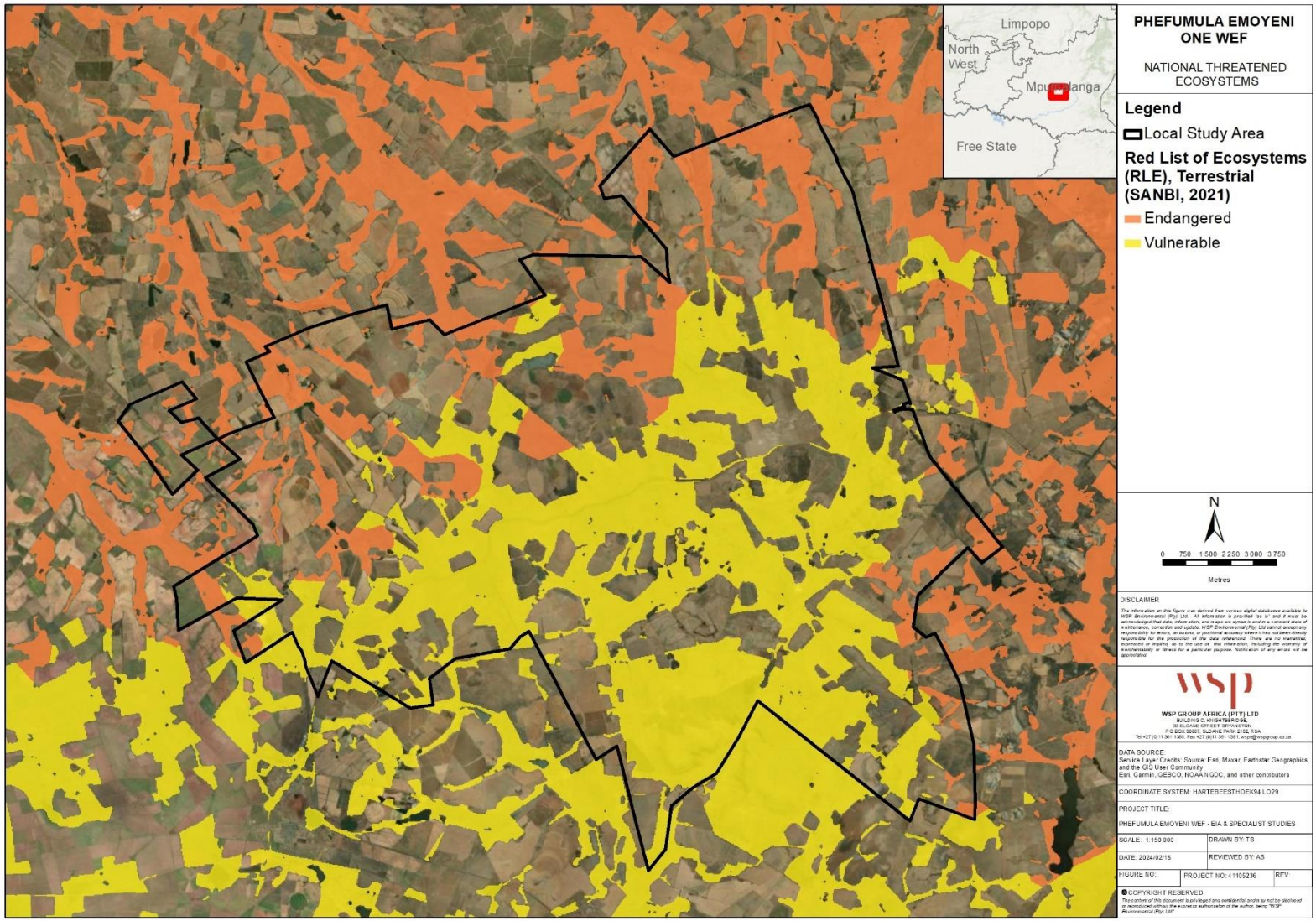



*Figure 3: Study area in relation to delineations of the National Red List of Terrestrial Ecosystems.*

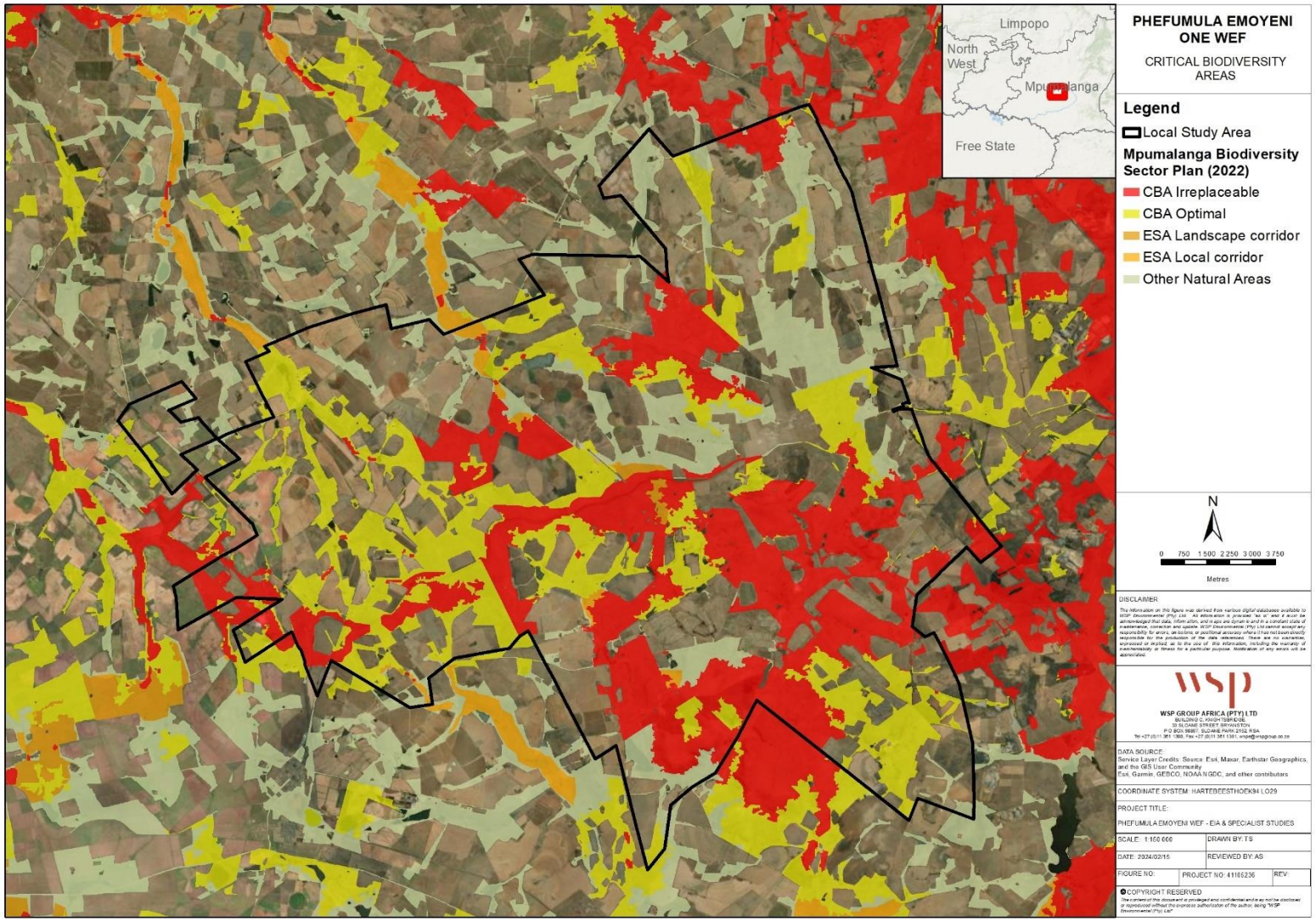



*Figure 4: The study area in relation to mapped Critical Biodiversity Areas and Ecological Support Areas, as per the MBSP (2022).*

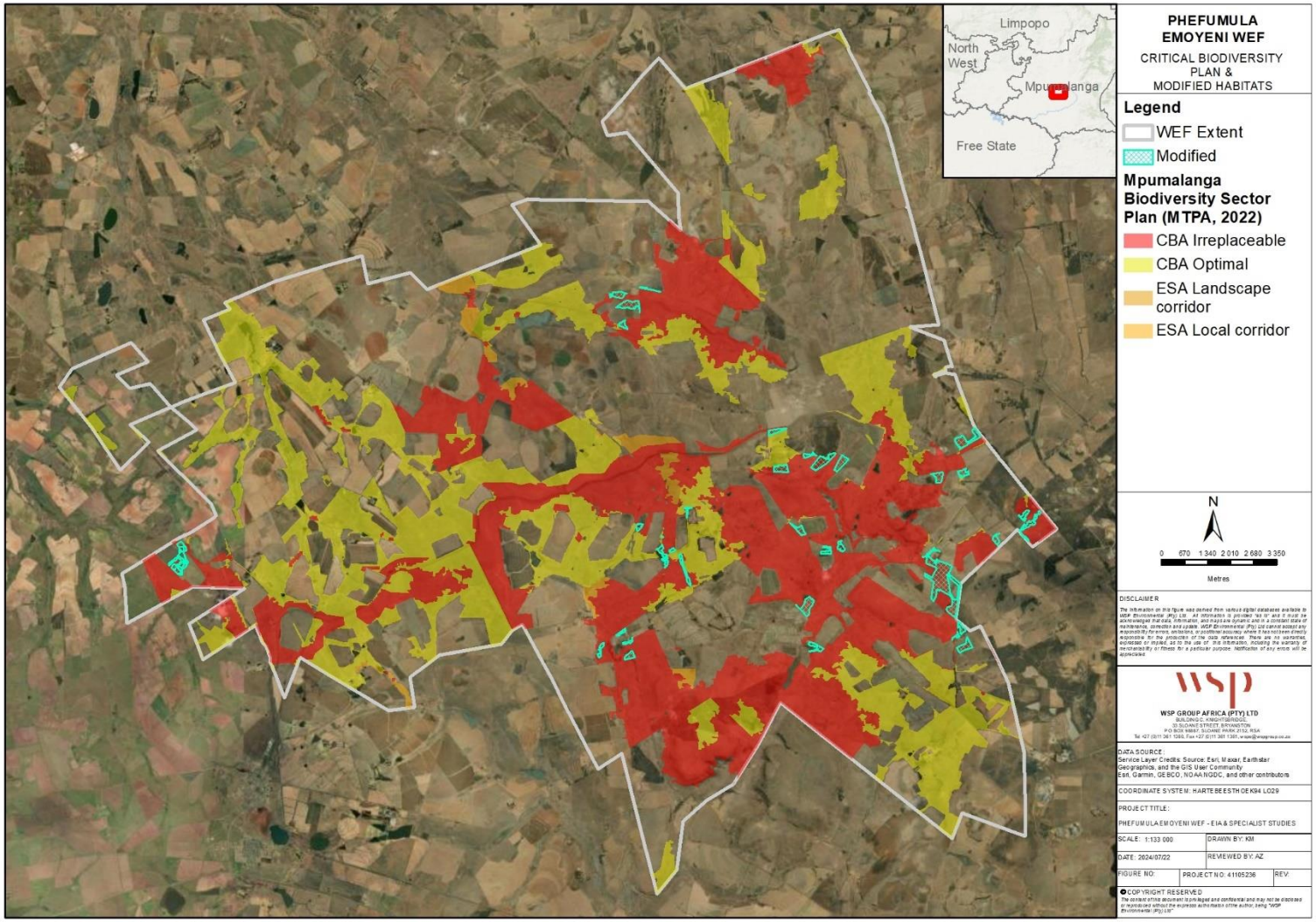



*Figure 5: Patches of CBA land that are actually modified and characterised by cultivation or old lands.*

## 6.3. Water Management

### 6.3.1. Strategic Water Source Areas

The study area is not located within a mapped Strategic Water Source Area (SWSA). The nearest SWSA is located to the south-west of the study area, as shown in Figure 6. SWSAs were not included as a receptor for the impact assessment, or considered further in this report.

### 6.3.2. Freshwater Ecosystem Priority Area Sub-Catchment

Freshwater Ecosystem Priority Areas (FEPA) are rivers and wetlands required to meet biodiversity targets for freshwater ecosystems. Essentially, these areas were identified at a national level as priority areas for conserving freshwater ecosystems and supporting the sustainable use of water resources, as well as upstream catchment management areas (Driver, *et al*., 2012).

According to the mapping of FEPAs, the central/southern portion of the study area is located in a FEPA, while the far south of the study area is designated as an Upstream Management Area. The FEPA also extends along the eastern boundary of the study area, as shown in Figure 7.

According to Driver, *et al*., (2012), FEPAs should be maintained in a natural/near natural condition, and anthropogenic activities in Upstream Management Areas should be carefully managed to prevent degradation of downstream FEPAs.

## 6.4. Indigenous Forests

No indigenous forests occur in the study area. The study area is dominated by cultivated fields and tracts of natural grassland and wetland habitat. Indigenous forests are therefore not included as receptor for the impact assessment, or considered further in this report.

## 6.5. Protected Areas and Conservation Areas

The study area is not located in, or in close proximity to, a protected area. The closest protected areas are shown in Figure 8 and include:

- Rietvlei Private Nature Reserve, which is located to the south of the N17 national road, approximately 12 km south of the study area; and
- Ahlers Private Nature Reserve, which is located approximately 14 km south-east of the study area.

Chrissiesmeer Protected Environment is another important conservation area that was noted in the surrounding landscape (not shown in Figure 8). This protected environment was established in 2014 and covers a large, albeit fragmented area, approximately 23 km east of the study area. It is forms crucial habitat for several threatened bird species, and encompasses the Chrissie Pans Important Bird Area.

## 6.6. Priority Focus Areas for Protected Area Expansion

Priority Focus Areas for protected area expansion are large, intact and unfragmented areas of high biodiversity importance, that are suitable for the creation/expansion of protected areas (Driver, *et al*., 2012). Land-use planning and decision making should avoid fragmenting Priority Focus Areas, to prevent such areas from being excluded from future protected area expansion. (Driver, *et al*., 2012).

According to the National Protected Area Expansion Strategy (2018) shown in Figure 9, large portions of the study area have been mapped as Priority Focus Areas for protected area expansion. These delineations are mirrored by those presented in the Mpumalanga Protected Area Expansion – 20 Year Plan, which parses natural habitat into either Priority 2 or Priority 3 areas for protected area expansion - shown in Figure 10.

## 6.7. Important Bird Areas and Key Biodiversity Areas

The study area is located within the Amersfoort-Bethal-Carolina District Important Bird Area (IBA) (SA014). This IBA is 343 320 ha in extent, and extends from Carolina in the north to Bethal in the east, and southward through Ermelo to Amersfoort (Marnewick, *et al*., 2015) (Figure 11).

Several globally threatened trigger species occur in this IBA including, *inter alia*, Botha's Lark (*Spizocorys fringillaris*), Blue Crane (*Grus paradisea*), Southern Bald Ibis (*Geronticus calvus*), Black Harrier (*Circus maurus*), Black-winged Pratincole (*Vanellus melanopterus*), Secretary Bird (*Sagittarius serpentarius*) and Martial Eagle (*Polemaetus bellicosus*) (Marnewick, *et al*., 2015).

The primary threat to the Amersfoort-Bethal-Carolina District IBA is the expansion of agricultural lands (mainly maize fields), resulting in a loss of natural habitat (Marnewick, *et al*., 2015). Other purported threats include the expansion of nearby urban centres, transecting powerlines and local road networks. No part of the Amersfoort-Bethal-Carolina District IBA is formally protected (Marnewick, *et al*., 2015).

South Africa's IBA network is currently being replaced by the concept of Key Biodiversity Areas (KBA). KBAs are sites of global importance for species and their habitats (SANBI, 2024). They are identified by applying the Global Standard for the Identification of Key Biodiversity Areas that was developed by the International Union for the Conservation of Nature (IUCN) (SANBI, 2024). Unlike IBAs, which only focus on bird conservation, KBAs are more holistic and consider a broader range of biodiversity, including mammals, herpetofauna (reptiles and amphibians), flora and many other taxa. Identified IBAs are automatically considered KBAs.


*Figure 6: Study area in relation to Strategic Water Source Areas.*

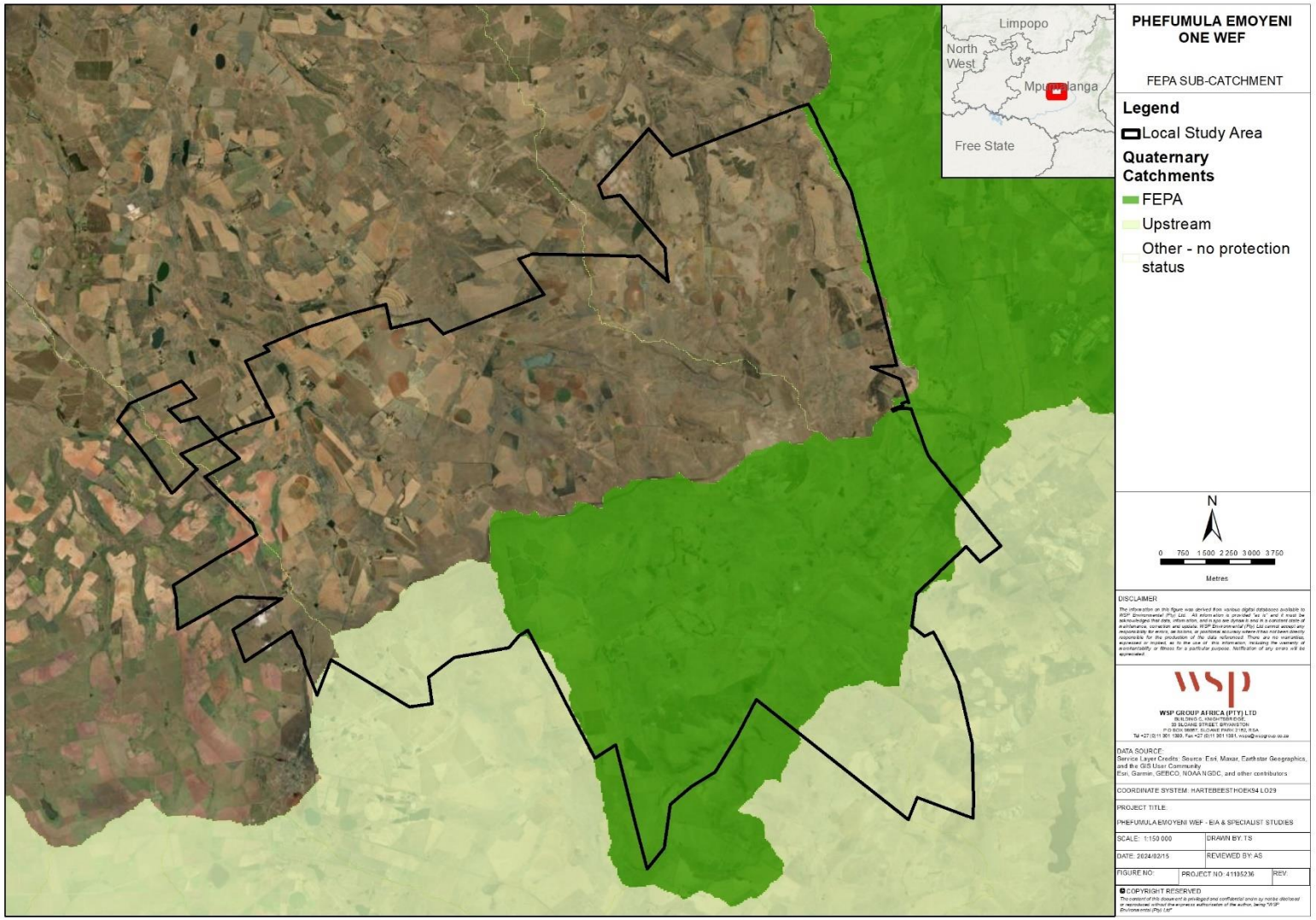



*Figure 7: Study area in relation to recognised Freshwater Ecosystem Priority Area.*

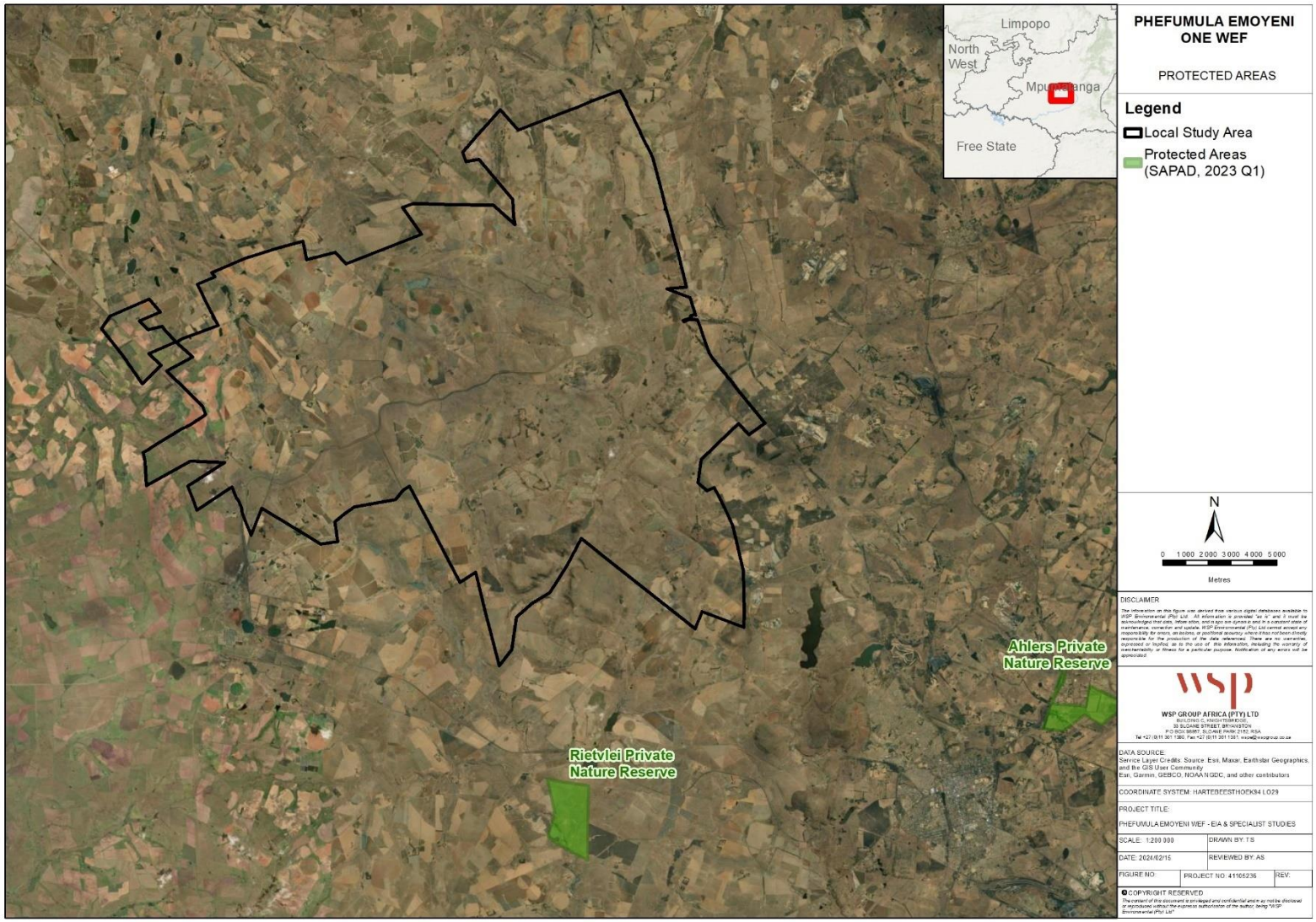



*Figure 8: Study area and Protected Areas in the region.*

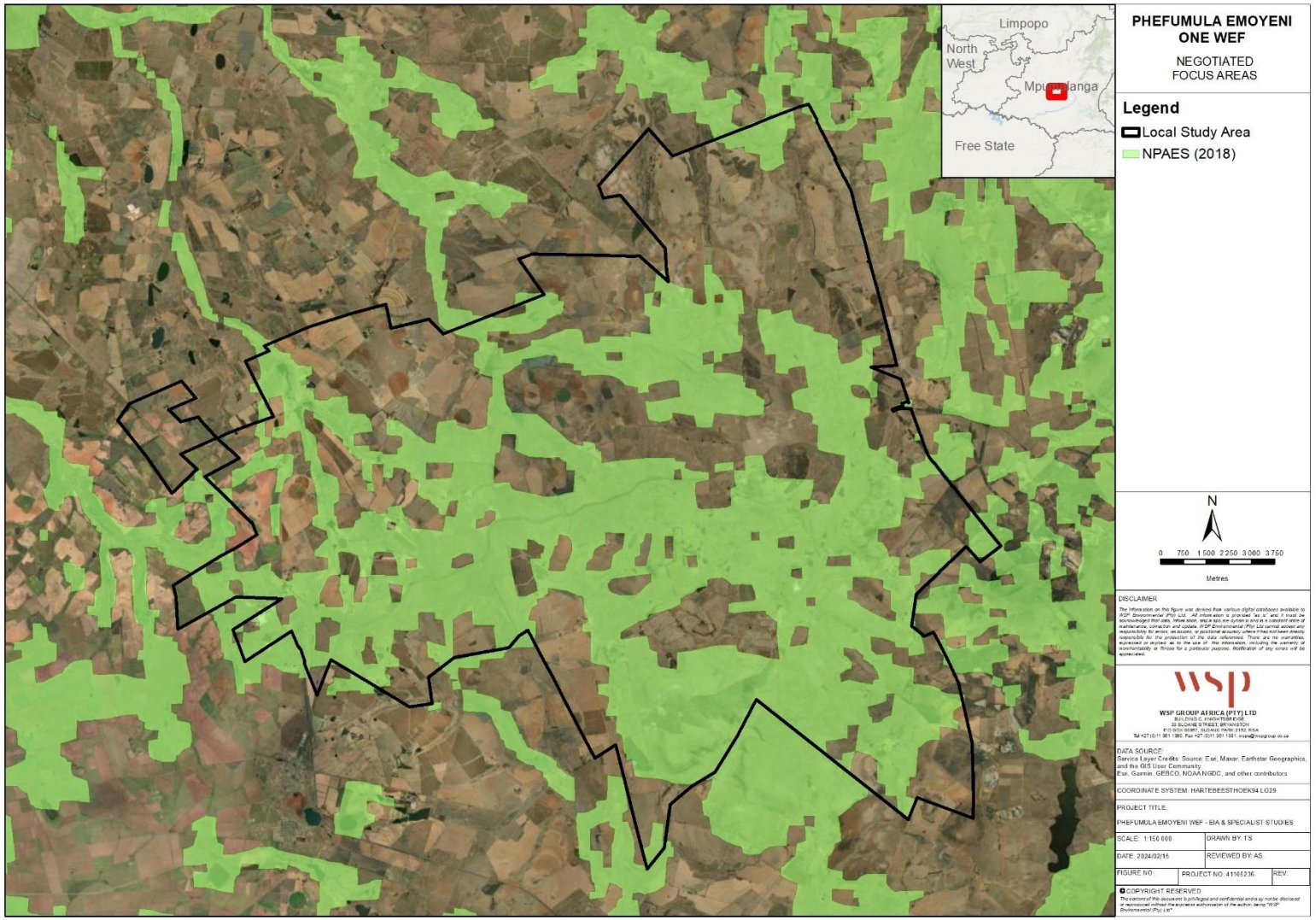



*Figure 9: Study area in relation to national Priority Focus Area, as per the National Protected Areas Expansion Strategy (2018).*

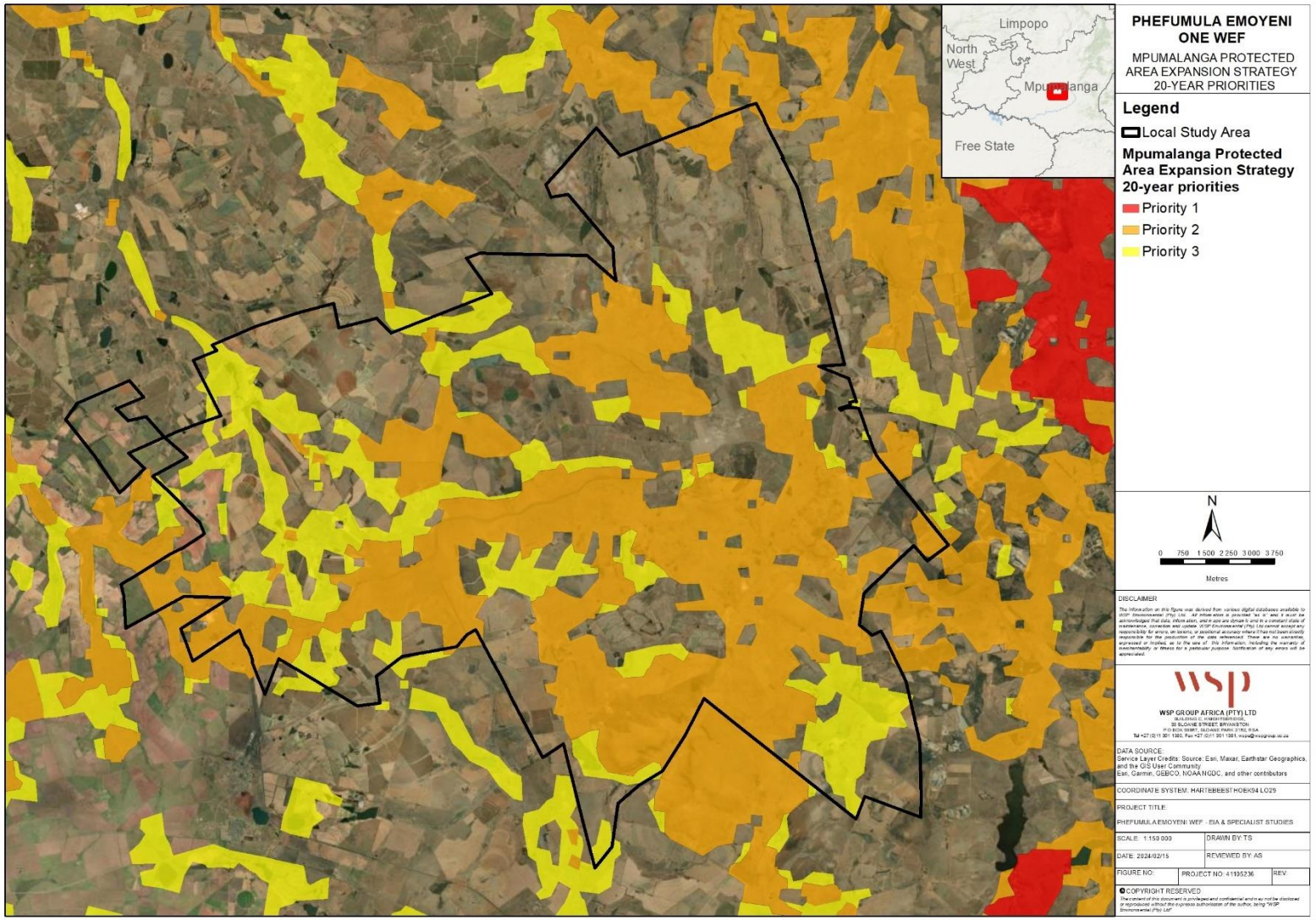



*Figure 10: Study area in relation to provincial Priority Focus Area, as per the Mpumalanga Protected Areas Expansion Strategy – 20 Year Plan.*

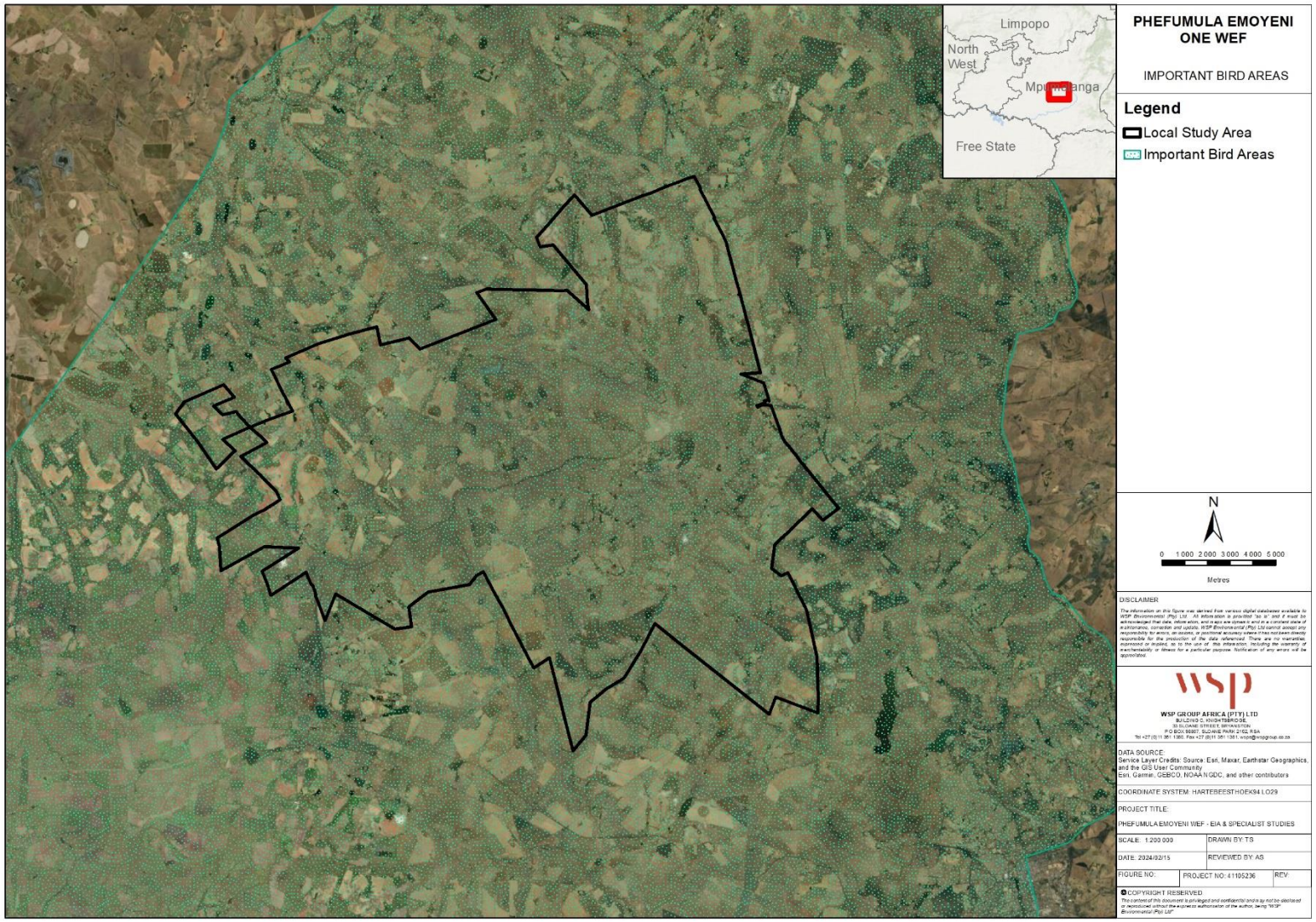



*Figure 11: Study area and the Amersfoort-Bethal-Carolina District Important Bird Area.*

# 7. Landscape Context and Existing Impacts on Terrestrial Biodiversity

The study area is large and defined as a multi-functional rural-agricultural landscape, that is characterised by areas of both modified- and natural habitat. The following notes describe the general landscape context and major existing impacts (anthropogenic activities and infrastructure) that were observed in and around the study area during the 2024 field survey:

- Farming is the dominant land use within the study area, as well as across the surrounding landscape. Irrigated and dry-land cultivation, coupled with livestock production (mostly cattle, but also sheep) are the primary farming activities. These activities over the long term have caused varying degrees of spatial habitat modification and disturbance;
- Mining operations are present in the south-east of the study and to the immediate north of the study area. Mined areas were noted to be completely transformed, with typically little- to no natural habitat remaining;
- Various forms of linear infrastructure are present in the study area and across the broader landscape. These include major national tarred roads (N11 and N17), several gravel district roads, farms roads, informal vehicle tracks, a defunct railway line, and enumerable farm fences. These linear features have caused to varying degrees, and in conjunction with transformative land uses activities (e.g., mining and cultivation), habitat fragmentation across the study area and surrounding landscape. Be that as it may, a large network of natural habitat patches and corridors is still present across the study area;
- Alien invasive species (AIS) are not overly abundant in the study area compared to other locations in Mpumalanga Province. However, localised stands of alien trees are present, with aggressive invaders such as wattle (e.g., *Acacia dealbata* and *Acacia mearnsii*) and *Populus x canescens* noted. The edges of many cultivated field and other degraded locations are also encroached by various herbaceous AIS, such as *Verbena bonariensis*; and
- Other anthropogenic activities and infrastructure in the study area that have resulted in small-scale and localised habitat transformation include *inter alia*, farm residences, rural school buildings, and various agriculture structures (barns).

# 8. Habitat Units in the Study Area

Based on data collected during the field survey, six primary habitat units were identified in the study area. These include three units regarded as natural habitat, and three units regarded as modified habitats:

**Natural Habitats**

- Mixed Dry Grassland;
- Rocky Shrubland;
- Moist Grassland;

**Modified Habitats**

- Old Lands;
- Cultivated Fields; and

- Alien Tree Plantations.

Habitat units are described, with accompanying photographs, in Section 8.1 through to Section 8.6**Error! Reference source not found.Error! Reference source not found.**. A habitat unit map for the study area is shown in Figure 12**Error! Reference source not found.**. It must be noted that the study area is an active agricultural landscape, and subject to ongoing farming activity/disturbances. The temporal and spatial character of Cultivated Fields and Old Lands, is thus often changing.

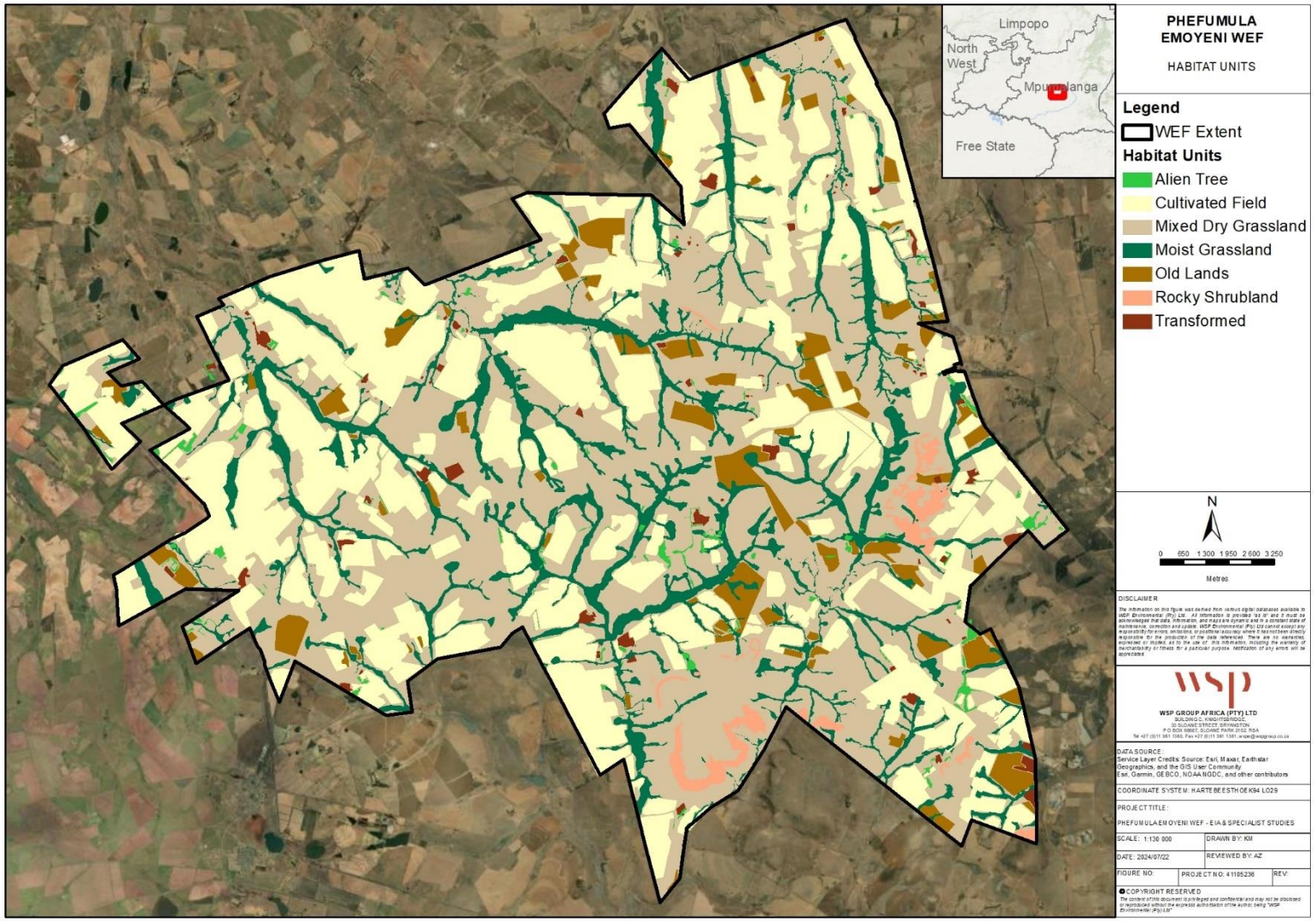



*Figure 12: Habitat unit map of the study area.*

## 8.1. Mixed Dry Grassland

Mixed Dry Grassland is a variable habitat unit that characterises the large intact grasslands of the study area. Based on contemporary and former farming activities, disturbance levels in areas of Mixed Dry Grassland vary.

As per Edwards (1983) structural classification system, the vegetation structure of this unit is defined a low- closed grassland. Compositionally, areas of Mixed Dry Grassland are characterised by a diverse flora assemblage, that is typically grass dominated and forb rich, and with woody species generally occurring as scattered individual trees and shrubs.

Predicated on past livestock grazing levels and wildfire patterns, the grass species composition of these grasslands varies. Areas that have likely experienced high-levels of past selective grazing and/or too frequent wildfires tend to be dominated by early-seral grass species, such as *Eragrostis plana* and *Eragrostis chloromelas* (Figure 13), whereas in areas that have been less intensely grazed, other species are more common, such as the often-dominant *Themeda triandra,* as well as *Brachiaria serrata, Cymbopogon pospischilii, Eragrostis racemosa, Harpochloa falx, Setaria* species and *Tristachya leucothrix* (Figure 14).

Common herbs/forbs recorded in the Mixed Dry Grassland unit include *inter alia*; *Berkheya pinnatifida ingrata, Berkheya radula, Berkheya setifera, Berkheya speciosa, Haplocarpha scaposa, Hermannia transvaalensis, Hilliardiella aristata,* various *Helichrysum* and *Hypoxis* species and *Nidorella podocephala.*

Woody species occur at low abundances in areas of Dry Mixed Grassland and typically include scattered *Diospyros lycioides* and *Seriphium plumosum* shrubs. Higher abundances of *Seriphium plumosum* were noted at certain locations and are likely a result of historic localised overgrazing by livestock. In terms of declared alien invasive species, several species were observed including *inter alia*; *Cirsium vulgare, Solanum elaeagnifolium, Solanum sisymbriifolium, Verbena bonariensis* and *Verbena rigida*.

**Sensitivity Aspects**

This habitat unit characterises large portions of the study area. In conjunction with adjacent Moist Grassland habitat, areas of Mixed Dry Grassland are crucial resource and refuge habitat for flora and fauna. They also act as important ecological corridors, increasing local habitat connectivity and facilitating various ecological processes such as, *inter alia*, flora and fauna movement and dispersal.

In terms of flora SCC, *Kniphofia ensifolia* subsp. *ensifolia* (NT, MP) and several protected flora species were recorded in this habitat unit during the field survey. Habitat suitability assessments also indicate that several other flora SCC are likely to be present in areas of Mixed Dry Grassland. Patches of Mixed Dry Grassland also provide crucial fauna habitat, and will support many of the SCC known from the region. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 13: Eragrostis dominated Mixed Dry Grassland.*

*Figure 14: Themeda triandra dominated Mixed Dry Grassland.*

## 8.2. Rocky Shrubland

Rocky Shrubland is a relatively small habitat unit that occurs along rocky hillside slopes ridges in the study area. Unlike adjacent areas of open grassland, this habitat unit is characterised by a notably higher abundance of indigenous woody vegetation, coupled with the presence of numerous large protruding rocks.

In line with Edwards (1983) structural classification, this habitat unit is defined as low- to short sparse shrubland, with woody vegetation growing as small trees and shrubs (typically < 3m in height). These typically grow in either dense, but spatially discrete aggregations around exposed rocks, or as scattered individuals within the broader grassland matrix – see Figure 15 and Figure 16.

Compositionally, *Diospyros lycioides* is the most abundant woody species. Other common larger woody taxa recorded in this unit include *Asparagus laricinus*, *Euclea crispa, Gymnosporia buxifolia, Kiggelaria africana, Rabdosiella calycina, Searsia dentata, Searsia discolor* and *Searsia pyroides* var. *gracilis.*

The herbaceous layer shares many of the same species as adjacent areas of Mixed Dry Grassland, as well as several additional taxa. Commonly recorded grasses include *Cymbopogon pospischilii, Eragrostis chloromelas, Eragrostis plana, Eragrostis pseudosclerantha, Eragrostis racemosa, Hyparrhenia dregeana, Hyparrhenia hirta, Melinis nerviglumis, Themeda triandra* and *Tristachya leucothrix.*

Various forbs, geophytes and small shrublets are also common in the herbaceous layer including *inter alia; Berkheya radula, Haemanthus humilis, Hilliardiella aristata, Haplocarpha scaposa, Helichrysum rugulosum, Phylica paniculata, Ledebouria ovatifolia* and *Leonotis dysophylla.* Ferns recorded in this unit include *Blechnum cf. australe, Cheilanthes hirta* var. *hirta, Pellaea calomelanos* var. *calomelanos* and *Selaginella dregei*.

**Sensitivity Aspects**

The combination of indigenous woody vegetation and exposed rocks creates a distinctive rocky shrubland habitat that is relatively uncommon within the study area's typical open grassland dominated land cover. Accordingly, areas of Rocky Shrubland increase landscape-scale heterogeneity,

and provide important niche habitat for a variety of flora and fauna, including species of conservation concern that have an affinity for more wooded and/or rocky areas. The provincially protected *Haemanthus humilis* was recorded in this habitat unit, and habitat suitability assessments suggest that several other flora SCC are likely to be present. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 15: Hillside characterised by exposed rocks and indigenous woody vegetation.*

*Figure 16: Pockets of woody trees and shrubs are typically dominated by Diospyros lycioides.*

## 8.3. Moist Grassland

Moist Grassland habitat characterises wetland and riparian systems across the study area. Vegetation structure ranges from low- to tall-, closed grassland (*sensu*. Edwards 1983), and although not widespread or abundant in most areas of Moist Grassland, alien woody vegetation is present and well-established at certain locations (Figure 17 and Figure 18).

Common flora species recorded include a range of grasses and sedges such as*, inter alia*; *Agrostis lachnantha, Andropogon appendiculatus, Arundinella nepalensis, Aristida junciformis, Cyperus congesta, Cyperus denudatus, Cyperus fastigiatus, Cyperus marginatus, Cynodon dactylon, Eleocharis limosa, Eragrostis gummiflua, Eragrostis heteromera, Eragrostis plana, Imperata cylindrica, Juncus dregeanus, Kyllinga erecta, Leersia hexandra* and *Paspalum dilatatum*.* The tall reed *Phragmites australis,* the bulrush *Typha capensis* and *Schoenoplectus brachyceras* are also present in more permanently damp areas (*denotes alien taxa).

Common forbs recorded in this habitat unit include *inter alia*; *Berkheya pinnatifida ingrata, Berkheya radula, Berkheya setifera, Centella asiatica, Helichrysum aureonitens, Helichrysum nudifolium* var. *pilosellum*, *Lobelia flaccida, Monopsis decipiens, Nidorella podocephala, Pelargonium luridum, Pimpinella transvaalensis, Scabiosa columbaria* and *Trifolium repens.*

Several alien woody taxa recorded in this habitat unit include *Eucalyptus sp., Quercus ruber, Populus x canescens, Pyracantha angustifolia* and *Salix babylonica* (Figure 18).

**Sensitivity Aspects**

Moist Grasslands play a crucial in maintaining the hydrological functioning (e.g., filtration and flood attenuation), ecological processes and terrestrial biodiversity of the landscape. In conjunction with adjacent Mixed Dry Grasslands, these habitats significantly increase landscape-scale habitat

connectivity. Several protected flora species, such as *Crinum bulbispermum* and various *Gladiolus* species, were recorded in Moist Grasslands in the study area, and habitat suitability assessments suggest that several other flora SCC are likely to be present.

Moist Grasslands are also functionally very important for fauna SCC. They provide essential resource habitat for feeding, sheltering and hunting, and serve as movement/dispersal corridors across the landscape. Moreover, rivers, streams and other aquatic features (farm dams) also provide key habitat for various aquatic and semi-aquatic fauna taxa. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 17: Typical area of open Moist Grassland in the study area.*

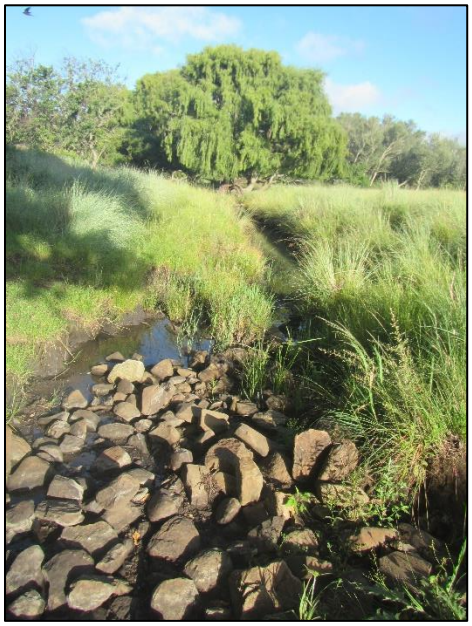


*Figure 18: Small stream encroached by large alien trees including Salix babylonica and Populus x canescens.*

## 8.4. Old Lands

As the name suggests, this habitat unit characterises old, cultivated fields that have been left fallow, for several years, and as a result have subsequently regenerated to a secondary grassland community. As such, this is considered a modified habitat unit.

Vegetation structure is low closed grassland (*sensu*. Edwards, 1983). Compositionally, compared to natural grasslands, Old Lands are depleted of nutrients and thus floristically depauperate. Dominant grass species recorded in this unit during the field survey include the tall, robust thatching grasses *Hyparrhenia dregeana* and *Hyparrhenia hirta,* and relict-pioneer and early-seral taxa such as *Eragrostis chloromelas, Eragrostis curvula* and *Eragrostis plana* (see Figure 19**Error! Reference source not found.**).

Forbs recorded Old Lands include a mixture or indigenous and alien ruderal and weedy species, such as *Bidens pilosa, Conyza bonariensis, Pseudognaphalium luteo-album, Senecio consanguineus, Rumex acetosella, Selago densiflora, Tagetes minuta, Verbena rigida* and *Wahlenbergia undulata.* The only woody species recorded in this habitat unit was *Seriphium plumosum.*

**Sensitivity Aspects**

Despite past disturbances and a secondary vegetation community, Old Lands can retain some of the functional attributes of natural grasslands. They are also very stable and able to persist for extensive periods. This notwithstanding, no flora and fauna species of conservation were recorded in this habitat unit, and it is considered unlikely that Old Lands constitute important life-cycle habitat for any SCC. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 19: Old Land dominated by Hyparrhenia grass species.*

## 8.5. Cultivated Fields

Large portions of the study area are dominated by cultivated agricultural fields, which is considered a modified habitat type. Cultivated Fields include both pivot-irrigated crop fields and dry-land crop fields. These are typically under maize production, and are regularly disturbed through ploughing and harvesting (Figure 20).

This habitat unit also includes open fields that are actively-managed as grass pastures. Unlike areas of natural grassland, grass pastures are often fertilised, and regularly mown and baled to provide reserve forage for livestock during the dry season (shown Figure 21).

**Sensitivity Aspects**

Active Cultivated Fields are denuded of indigenous vegetation, and are subject to regular anthropogenic disturbance. When not dominated by a monoculture of food crop species, these areas are typically colonised by a variety of alien invasive and weedy species.

No flora SCC were recorded in Cultivated Fields during the field survey, and no flora SCC are likely to be present in these areas. Although certain fauna species may move through or periodically forage in Cultivated Fields, due to the high-level of ongoing disturbance and modification, they are not considered important fauna life-cycle habitats. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 20: Dry-land cultivated field, under maize production*

*Figure 21: Recently mown and baled grass pasture. Note prevalence of the declared weed Verbena bonariensis in foreground.*

## 8.6. Alien Tree Plantations

Alien Tree Plantations is a broad-term to describe the numerous and localised stands of alien woody vegetation in the study area. These stands range from narrow wind-rows (typically associated with farms residences and farm roads) to defined plantation-type stands and informal thickets. Alien Tree Plantations are a modified habitat type.

Vegetation structure is defined as short- to tall closed woodland (*sensu*. Edwards, 1983). Dominant alien tree species include alien *Eucalyptus* species*, Acacia* dealbata and *Acacia mearnsii* (wattles), and *Populus x canescen*s. Little indigenous vegetation is present in dense, well-established Alien Tree Plantations, with herbaceous flora typically supressed or in most cases, largely absent.

**Sensitivity Aspects**

Alien Tree Plantations are characterised by an almost complete dominance of one or two non-indigenous tree species. No flora SCC were observed in these areas during the field survey, and no flora SCC are likely to be present in these habitats.

From a fauna perspective, Alien Tree Plantations may be used as refuge habitats by fauna that are sensitive to hunting and other forms of anthropogenic disturbance. They may also be used as roosting/nesting habitat by *inter alia* raptors. Refer to Section 12 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 22: Small stand of Acacia dealbata trees in the study area.*

*Figure 23: Stand of Populus x canescens trees growing in a hillside seep.*

# 9. Flora species of Conservation Concern

This section presents a summary discussion on flora SCC taken from the Plant Species Specialist Assessment Report.

No flora species listed as threatened or Near Threatened on the national Red List were recorded in the study area during the field survey. However, *Kniphofia ensifolia* subsp*. ensifolia,* which is listed as Near Threatened on the Mpumalanga Red List, was recorded in the study area. Based on reviewed literature and data sources, 11 flora species that occur, or potentially occur in the study area are listed as threatened or Near Threatened on the national and/or provincial Red Lists. These are listed in Table 4.

Several flora species that are listed as Protected at a provincial level according to Mpumalanga Nature Conservation Act (Act No. 10 of 1998) were recorded in the study area during the field survey, including *Aloe ecklonis, Boophone disticha, Crinum bulbispermum, Gladiolus crassifolius, Gladiolus longicollis* subsp*. platypetalus, Gladiolus sericeovillosus* subsp. *calvatus* and *Haemanthus humilis*.

Flora species that are listed as Protected (and Specially Protected) under the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) require specific conservation management, i.e., that cannot be cleared or picked without a permit from the provincial authority. No flora species listed on the NEMBA ToPS (2007) List were recorded or potentially occur in the study area.

For additional information on flora SCC occurring/potentially occurring in the study area, including habitat preferences and a 'probability of occurrence' based on habitat suitability assessments, refer to the Plant Species Specialist Assessment Report for the proposed Project.

*Table 4: Threatened flora species occurring or potentially occurring in the study area.*

| Family | Scientific Name[#] | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status |
|---|---|---|---|---|
| Aizoaceae | *Khadia carolinensis* | Vulnerable | Vulnerable | - |
| Apocynaceae | *Aspidoglossum xanthosphaerum* | Vulnerable | Vulnerable | - |
| Apocynaceae | *Miraglossum davyi* | Vulnerable | Vulnerable | - |
| Apocynaceae | *Pachycarpus suaveolens* | Vulnerable | Vulnerable | - |
| Asphodelaceae | *Kniphofia ensifolia* subsp*. ensifolia* | Least Concern | Near Threatened | Protected |
| Hyacinthaceae | *Eucomis autumnalis* | Least Concern | Declining | Protected |
| Orchidaceae | *Eulophia cooperi* | Least Concern | Rare | Protected |
| - | Sensitive species 1252 | Vulnerable | Vulnerable | Protected |
| - | Sensitive species 41 | Vulnerable | Vulnerable | Protected |
| - | Sensitive species 691 | Vulnerable | Near Threatened | - |
| - | Sensitive species 851 | Vulnerable | - | - |
| - | Sensitive species 1200 | Endangered | Endangered | - |

[#]The names of specific taxa that are regarded as being susceptible to overexploitation have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number', as per the species assessment guidelines (SANBI, 2020).

# 10. Fauna Attributes of the Study Area

This section presents a summary discussion on fauna SCC taken from the Animal Species Specialist Assessment Report. For additional information on fauna SCC occurring and potentially occurring in the study area, refer to the Animal Species Specialist Assessment Report.

The large and intact patches of natural habitat in the study area provide important life-cycle habitat for a diverse fauna community, that includes numerous fauna SCC. During the field survey, several fauna SCC were documented in the study area, including the following:

- Four mammal species of conservation concern:
    - Serval (*Leptailurus serval*) - Near Threatened;
    - Mountain Reedbuck (*Redunca fulvorufula fulvorufula*) - Endangered;
    - Cape Clawless Otter (*Aonyx capensis*) - Near Threatened;
    - Swamp Musk Shrew (*Crocidura mariquensis*) - Near Threatened; and
- Six bird species of conservation concern (refer to the Avifauna Specialist Study for additional detailed information on bird SCC):
    - Blue Crane (*Anthropoides paradiseus*) - Near Threatened;
    - Lesser Flamingo (*Phoeniconaias minor*) - Near Threatened;
    - Greater Flamingo (*Phoenicoperus roseus*) - Near Threatened;
    - Southern Bald Ibis (*Geronticus calvus*) - Vulnerable;
    - Yellow-billed Stork (*Mycteria ibis*) - Endangered; and
    - Blue Korhaan (*Eupodotis caerulescens*) - Vulnerable (NEMBA ToPS, 2007).

Habitat suitability assessments conducted for the Animal Species Specialist Assessment also indicate that several additional fauna SCC 'possibly' or 'probably' occur in the study area, and therefore may potentially be impacted by proposed Project activities. It is noted that the observed fauna SCC are associated with grassland and wetland-type habitats in the study area, and the integrity and connectivity of these habitat patches is important to maintaining local metapopulation dynamics and the continued persistence of on-site fauna SCC.

# 11. Key Ecological Attributes and Processes

## 11.1. Habitat Corridors, Resources and Refugia

The study area is a multi-functional landscape that is characterised by large areas of cultivation (Cultivated Fields), but also large intact areas of natural dry grassland and moist grassland habitat. Various forms of linear infrastructure, such as formal roads, farm tracks, farm fences and an old railway line, and the presence of modified habitat patches, have caused habitat fragmentation. However, it is noted that the general level of habitat connectivity across the study area and to the broader landscape surrounding the study area remains high.

On-site natural habitat patches provide a large network of dispersal and movement corridors for fauna, and the topographically linked ecological productivity gradients of dry upland sites and moist low-lying sites (i.e. wetland and watercourses) also provide important and functionally-adaptive foraging resources for fauna. This will sustain local metapopulation dynamics and a diverse fauna community that includes several species of conservation concern.

Within the grassland-dominated habitat matrix, the altitudinal variability, exposed rocks and abundance of indigenous woody flora that defines the Rocky Shrubland habitat unit, also creates diverse and unique micro-habitats that significantly increase broader-scale habitat heterogeneity. This will increase local flora and fauna diversity by providing niche habitats for, amongst others, obligate and facultative rupicolous[1] and shrubland-favouring species that are unlikely to be resident in adjacent open grassland.

Although Alien Tree Plantations are considered a modified habitat type, it is also noted that within the context of generally grassland-dominated habitat-matrix, these tall, densely wooded areas are likely to provide a form of refuge (or sheltering) habitat for several fauna species that are sensitive to disturbance and/or are persecuted. They are also likely to provide important roosting and nesting habitat for raptors, amongst other bird species.

The proposed Project will impact local habitat connectivity through habitat loss and fragmentation, and this may affect various ecological processes, such as the movement and dispersal of flora (propagules and pollinators) and fauna across the landscape.

## 11.2. Ecological Processes and Drivers of Change

The following notes summarise the key ecological processes and drivers of change that are present in the landscape and their possible influence on terrestrial biodiversity and ecological processes.

### 11.2.1. Wildfire – Grassland Burning

Fire is a natural, albeit often human initiated, disturbance agent in grassland ecosystems. Mesic Highveld Grasslands are considered fire-prone and fire-dependent landscapes, and fire is essential to the maintenance of biodiversity patterns and ecological processes (SANBI, 2013). Wildfire's have several key ecological effects with respects to fauna, including:

- Removal of moribund vegetation and increasing plant productivity and palatability, which improves grazing for wild herbivores;
- Controls the encroachment of both alien and indigenous woody plant species and weeds; and
- Increases overall habitat heterogeneity by creating a structural mosaic of tall- and short grassland.

Notwithstanding the positive ecological benefits of fire, wildfires that are too frequent, or too intense, can have negative consequences for fauna populations. These include the killing of fauna species (typically slow-moving taxa, or taxa trapped by fences), and the homogenisation of on-site habitat, which can limit the availability of key adaptive resources.

Fire is considered an important driver of change in the study area. It is anticipated that the proposed Project may result in altered wildfire patterns across the study area due to increased habitat fragmentation. It is also possible however, that the number of accidental fires initiated from proposed on-site Project infrastructure may increase. Changes in local fire patterns may impact vegetation productivity, which may affect the local fauna and flora diversity community, including SCC.

### 11.2.2. Herbivory - Livestock Grazing and Trampling

High levels of grazing (overgrazing) and trampling by herbivores is a common cause of dryland degradation (Scholes, 2009). Overgrazing occurs when herbivores (both wildlife and domestic) are kept

[1] Flora and fauna species that are specifically adapted to rocky habitat.

at excessive stocking rates and/or can concentrate their grazing to a limited foraging area, without suitable rest periods. A common degradation syndrome that is linked to overgrazing, at least in part, is a change in plant species composition. In grassland habitats, this typically manifests as a reduction in palatable grass species and a reduction in grassland productivity (Scholes, 2009), which can negatively affect local fauna communities. Excessive cattle grazing and trampling can also cause soil erosion and gulley formation, and modify and homogenise vegetation structure, which can potentially impact sensitive fauna species that have specific life-cycle habitat requirements.

Cattle grazing (Figure 24) and trampling are considered important drivers of change in the study area. However, it is anticipated that the proposed Project is unlikely to alter livestock grazing patterns in the study area.

*Figure 24: Cattle grazing is common in the study area.*

### 11.2.3. Alien Invasive Species Colonisation

Several formal alien tree plantations (e.g., *Eucalyptus* trees) and wattle infestations (*Acacia mearnsii* and *Acacia dealbata*) are present in the study area, and many disturbed sites (e.g., cultivated fields) are encroached by herbaceous alien invasive species (e.g., *Verbena bonariensis*). If not actively controlled, species such as wattle may spread into adjacent natural habitats, where they will shade-out and competitively exclude many indigenous species. This will have several deleterious impacts on the integrity and function of these habitats, such as *inter alia*:

- A loss of natural habitat and floristic diversity, with the resulting habitat patches unable to support diverse fauna communities;
- A reduction in grass productivity for grazing herbivores (e.g., Mountain Reedbuck), and
- Increased exposed soil surfaces and incidences of erosion.

The spread of alien invasive vegetation is therefore considered a significant driver of change in the study area and surrounding landscape, and one capable of negatively impacting terrestrial biodiversity.

### 11.2.4. Subsistence Bushmeat Hunting

Small- and medium-sized antelope were recorded in the study area, and these species, amongst others, are frequently the target of subsistence bushmeat hunting. Common subsistence hunting techniques include the use of snares (which is essentially indiscriminate) and hunting dogs (which is partly discriminate). Local subsistence hunters with hunting dogs were observed in the study area during the field survey.

An escalation of bush-meat hunting is likely to negatively affect local fauna communities, with species like the Mountain Reedbuck (Endangered) particularly at risk. Subsistence bushmeat hunting is therefore regarded as a potential driver of change in the study area, which could impact certain mammals SCC.

An increase in on-site construction workers and contractors linked with the proposed Project may result in a temporary increase in levels of subsistence bushmeat hunting in the study area, and this will need to be correctly managed during Project implementation.

# 12. General Sensitivity and Site Ecological Importance

The ecological importance (SEI) of identified habitat units in the study area were assessed using the SANBI (2020) protocol (refer to Section 3.4 and Appendix B for the methodology). The results of the assessment are presented in Table 5, and shown in Figure 25.

To assess the overall ecological sensitivity of the study area, additional regional factors were also considered, as discussed below:

- **Biodiversity Significance**: Significant portions of the study area are delineated under the MBSP (2022) as CBA Irreplaceable and CBA Optimal. Several ecological features are germane to these CBA's, including *inter alia*, the presence of large tracts of intact grassland, the presence/potential presence of both flora and fauna SCC, macro-corridor and habitat linkages. These areas are crucial to meeting provincial targets for biodiversity patterns and ecological processes;
- **Threatened Vegetation Types**: At a regional level, it is noted that both vegetation types that characterise the study area, namely Eastern Highveld Grassland (EN) and Soweto Highveld Grassland (VU), are threatened and warrant careful management and protection. Natural grassland habitat should therefore, in general, be managed as sensitive and any potential negative impacts should be minimised; and
- **Wetland Importance**: Wetlands (referred to floristically as Moist Grasslands in this report) are functionally important from both a hydrological and biodiversity perspective, and delineated wetlands (refer to the wetland specialist study report) are subject to restrictions with respects to infrastructure development.

Based on these considerations, the findings of this specialist assessment confirm the 'Very High' sensitivity rating of the DFFE screening tool for the study area.

*Table 5: Site Ecological Importance of habitat unit in the study area*

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| Mixed Dry Grassland | HIGH: Highly likely occurrence of CR, EN, VU species (=Mountain Reedbuck, EN). Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors. BUT Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Rocky Shrubland | HIGH: Highly likely occurrence of CR, EN, VU species (=Mountain Reedbuck, EN). Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Large (> 5 ha but <100 ha) intact area for any conservation status. Good habitat connectivity with potentially functional ecological corridors. Only minor current negative ecological impacts with limited signs of major past disturbance and good rehabilitation potential. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Moist Grassland | HIGH: Highly likely occurrence of CR, EN, VU species (=Yellow-billed Stork, EN & Southern Bald Ibis, VU). Small area of natural habitat of EN ecosystem (=Eastern | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| | Highveld Grassland, EN & Soweto Highveld Grassland, VU). | Good habitat connectivity with potentially functional ecological corridors.<br>BUT<br>Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | | | |
| Old Lands | LOW: No confirmed or highly likely populations of SCC or range-restricted species. | MEDIUM/LOW: Narrow corridors of good connectivity. Mostly minor current negative ecological impacts, BUT with major past impacts (i.e., former cultivation). | LOW | HIGH: Habitat that can recover relatively quickly to restore >75% of the original species composition and functionality | VERY LOW |
| Cultivated Fields | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |
| Alien Tree Plantations | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |

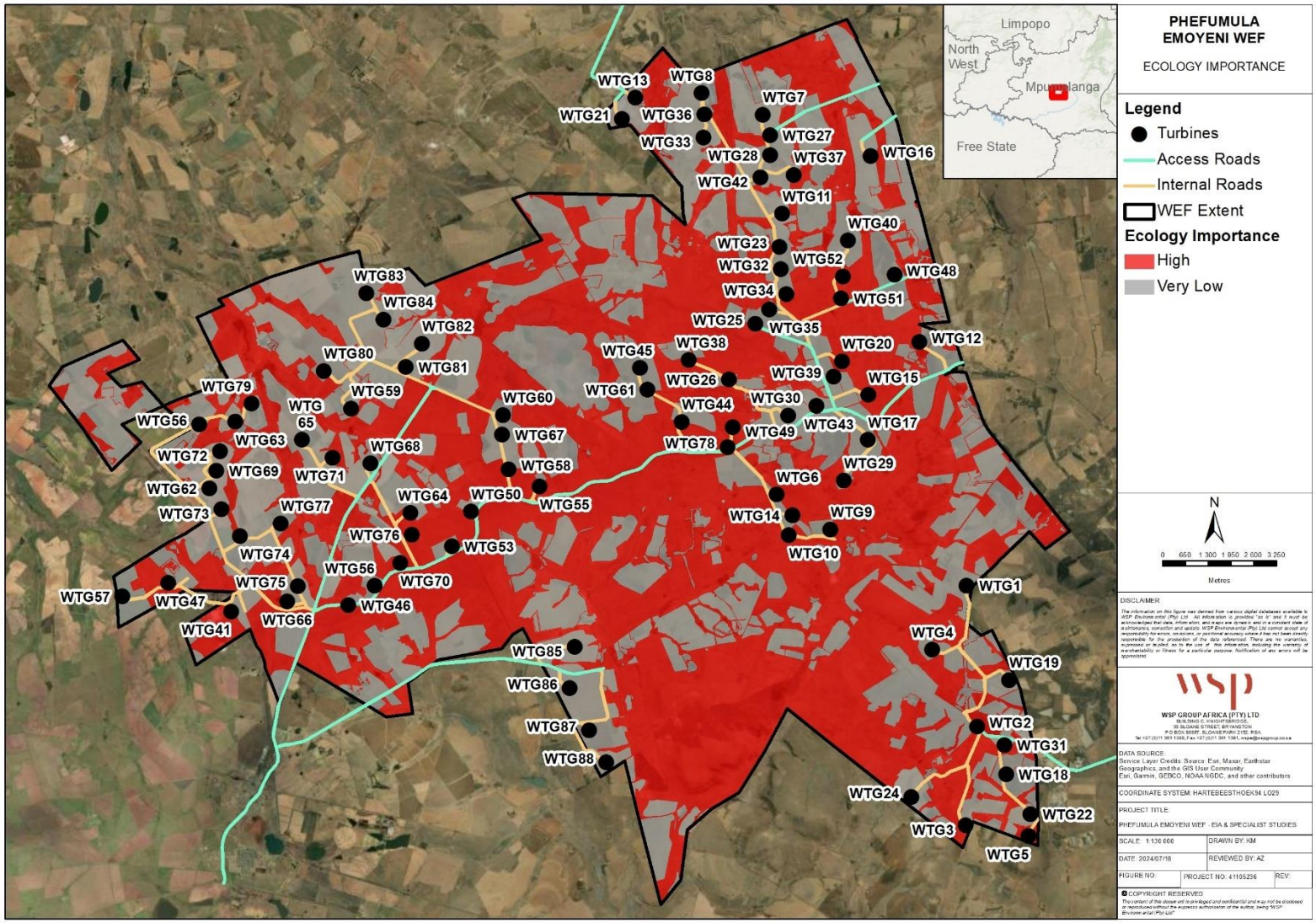



*Figure 25: Site Ecological Importance of the study area, showing current proposed layout of the Project infrastructure*

# 13. Terrestrial Biodiversity Impact Assessment

## 13.1. Impact Assessment Methodology

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[2], indirect[3], secondary[4] as well as cumulative[5] impacts.

A standard risk assessment methodology is 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[6] presented in Table 6.

*Table 6: Impact Assessment Criteria and Scoring System*

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** 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 |
| **Impact Extent (E)** 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 |
| **Impact Reversibility (R)** 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 |

[2] Impacts that arise directly from activities that form an integral part of the Project.
[3] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[4] Secondary or induced impacts caused by a change in the Project environment.
[5] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects
[6] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Duration (D)** 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 |
| **Probability of Occurrence (P)** 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: | $[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | **4 to 15** | **16 to 30** | **31 to 60** | **61 to 80** | **81 to 100** |
| **Environmental Significance Rating (Negative (-))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |
| **Environmental Significance Rating (Positive (+))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |

## 13.2. 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 26 below.

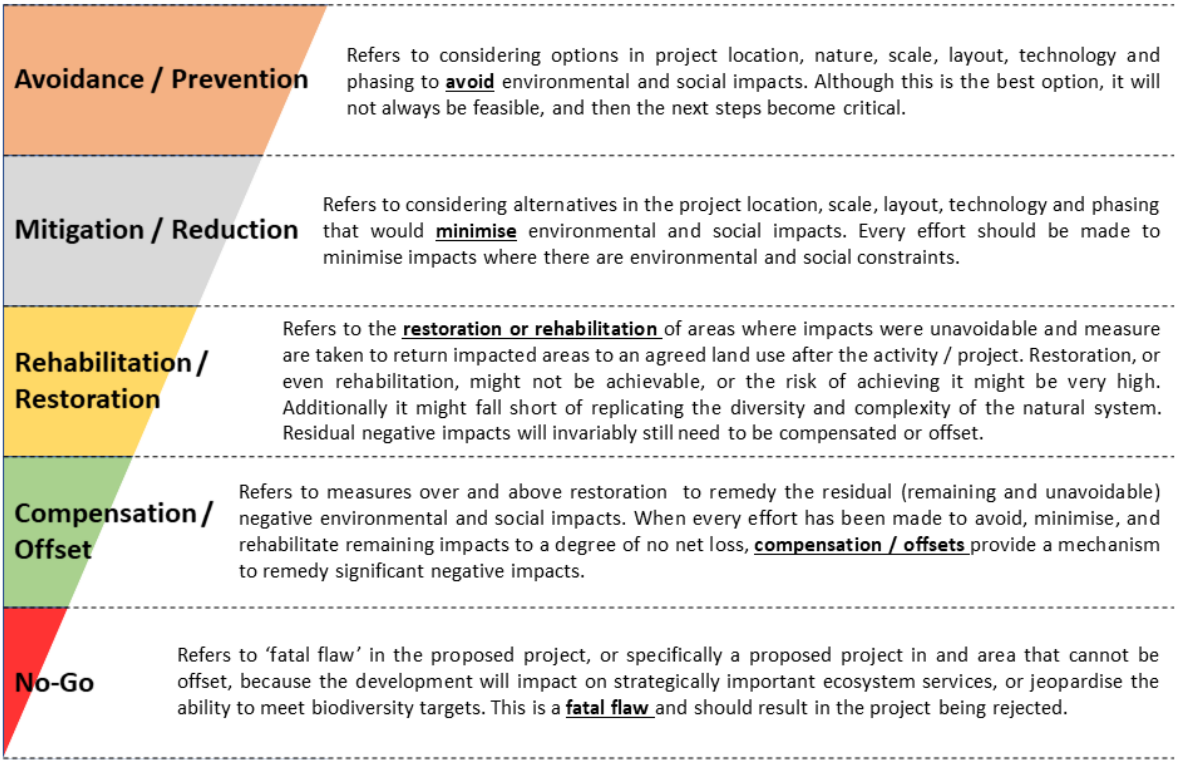



*Figure 26: Mitigation Sequence/Hierarchy*

A discussion on assessed impacts for each phase (i.e., Construction Operational and Decommissioning) of the proposed Project is provided in sections below, along with an analysis of anticipated cumulative impacts in Section 13.3.4. A summary table presented in Table 9.

This impact assessment section should be read in conjunction with the impact assessments presented in the Animal Species Specialist Assessment and Plant Species Specialist Assessment reports.

## 13.3. Assessment of Impacts on Terrestrial Biodiversity

### 13.3.1. Construction Phase

#### *13.3.1.1. Direct loss and disturbance of natural habitat*

Habitat loss refers to the removal or complete degradation of natural habitat. In terrestrial ecosystems, this primarily occurs through vegetation clearing and bulk earth works during construction. Habitat disturbance refers to the modification of habitat to the extent that it loses important functionality. These impacts can negatively impact ecosystem functioning and integrity, and the viability of local fauna and flora populations.

Following the scoping phase identification of biodiversity sensitivities, the proposed Project layout was optimised to minimise impacts on identified sensitivities, such as designated CBA's. This notwithstanding, the proposed Project will result in the clearing of natural vegetation for the installation of turbine infrastructure (hard standing footprint ~75 m X 120 m) and the construction of the internal access roads (12-13 m width). An overlay of the current proposed Project layout (turbine footprints and access roads) on the habitat unit map is shown in Figure 27, with Table 7 presenting an indication of the approximate infrastructure footprints spanning each habitat unit at the study area scale.

It is noted that 20 of the proposed 88 turbines are located fully or partly in areas of natural habitat, specifically Mixed Dry Grassland and Rocky Shrubland habitat. The remainder of the turbines are located in modified habitat (i.e., Cultivated Fields and Old Lands). With respects to CBA's, 19 turbines are located directly in, or have the potential to impact designated CBA's. Of these, it is noted that five turbine footprints (WTG 1, WTG, 2, WTG8, WTG 26 & WTG 42) are located in areas of modified habitat that have been incorrectly designated as CBA's. The approximate extent of infrastructure footprint in CBA's and ESA's, based on the current proposed Project layout, is presented in Table 8.

The impact prior to further mitigation is considered to be of very high magnitude. Duration of impact will be permanent, and habitat within and potentially adjacent to the development footprints (local) will be impacted. Probability is rated definite. This results in an impact of "high" significance.

Several management/mitigation measures can be taken to further minimise impact significance. These include: further repositioning turbines and internal roads where possible to avoid directly impacting CBA's (refer to Table 11 in Section 13.2); in-field micro-siting of footprints to already disturbed sites; minimising disturbance footprints to the absolute necessary for construction and operational purposes; and, rehabilitating all disturbed areas after construction.

With the application of these, and other recommended mitigation measures, impact magnitude can be reduced to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to medium. This results in an after-mitigation impact of "Moderate" significance.

*Table 7: Indicative extent of possible impacts on the identified habitat units, based on the current proposed turbine and access road layout.*

| Habitat Unit | Approximate Extent of Possible Habitat Loss / Disturbance (Ha) |
|---|---|
| Alien Tree Plantations | 2.06 |
| Cultivated Fields | 128.27 |
| Mixed Dry Grassland | 104.91 |
| Moist Grassland | 5.93 |
| Old Lands | 18.67 |
| Rocky Shrubland | 1.22 |
| Transformed (e.g., farm houses and other built-infrastructure) | 0.62 |

*Table 8: Approximate extent of impacts on Critical Biodiversity Areas and Ecological Support Areas in the study area, based on the current proposed turbine and access road layout.*

| Critical Biodiversity Areas and Ecological Support Areas | Approximate Extent of Possible Habitat Loss / Disturbance |
|---|---|
| CBA Irreplaceable | 27.90 ha (22.54 ha)[#] |
| CBA Optimal | 47.09 ha |
| ESA | 0.18 ha |
| [#]Figure in bracket's excludes infrastructure footprints in CBA that are actually modified. | |

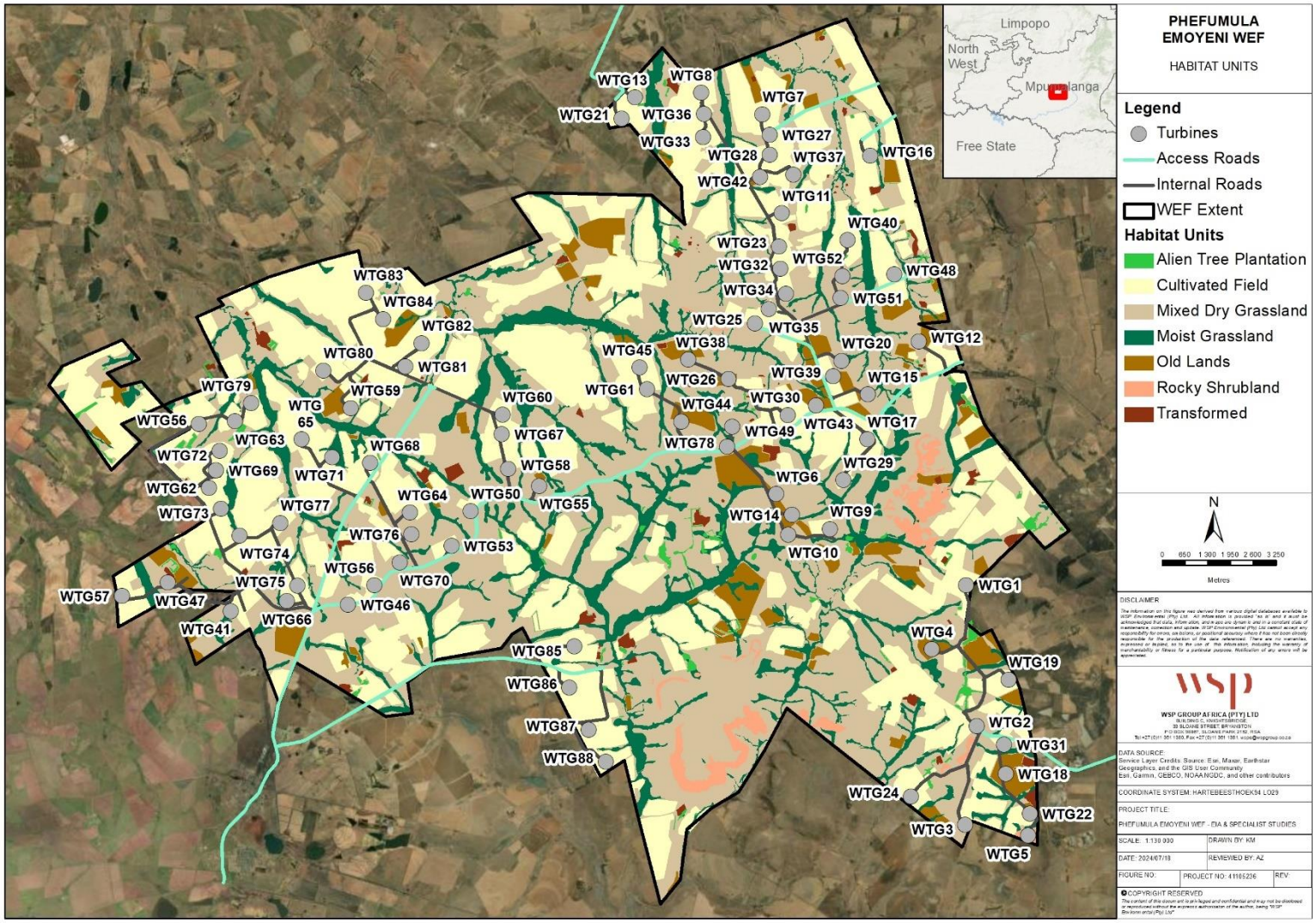



*Figure 27: Habitat units and the currently proposed infrastructure layout.*

#### *13.3.1.2. Fragmentation reducing natural habitat connectivity and integrity*

Habitat fragmentation is caused when vegetation clearing and/or the development of infrastructure (e.g., roads and fences) result in the partitioning of habitat into smaller, discontinuous patches. This leads to altered habitat configuration that typically manifests as an increase in patch number and isolation, yet a decrease in overall patch size. These alterations change the ecological properties of remaining patches (edge effects) and can affect various ecological processes (e.g. fire patterns) and metapopulation dynamics, such as fauna dispersal, movement and migration, and flora pollination and propagule dispersal. This can, in turn, affect flora and fauna species richness and population stability.

The proposed internal access road network is likely to cause the fragmentation of areas of natural habitat within the study area, and this will have negative ecological impacts. During the planning stage, the internal access road layout was aligned with existing farm roads and tracks, and this will reduce possible fragmentation effects. However, fragmentation effects are likely to still occur as the new access roads will be more substantive than many of the existing farm roads and tracks.

Prior to mitigation, this impact is considered to be of very high magnitude, permanently affecting natural habitat within and potentially adjacent to the development footprint (local). It is also considered to have a definite probability, resulting in an impact of "High" significance.

With the application of mitigation measures, such as in-field micro-siting of internal access road footprints to already disturbed sites and minimising the clearance footprint to the minimum area required for construction and operational purposes, and rehabilitating all disturbed footprints, impact magnitude can be reduced to medium. Duration can be reduced to the long-term, and probability to medium, but spatial scale will remain local. This results in a residual impact of "Moderate" significance.

#### *13.3.1.3. Establishment and spread of alien invasive species*

Habitat disturbances caused by vegetation clearing and earth works during construction can facilitate the establishment and spread of AIS. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may impact ecological integrity and functioning and terrestrial biodiversity. Twenty NEMBA listed AIS have been recorded in the study area. Construction activities will cause the physical disturbance of vegetation and soils which will facilitate the spread of AIS.

Before mitigation, impact magnitude is high, while the duration is long term, and the impact has a high probability of occurrence. The spatial extent of AIS spread is local. Prior to mitigation, the establishment and spread of AIS is rated an impact of "moderate" significance.

This impact is relatively easy to mitigate though the implementation of an AIS control programme during the construction phase. This impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "Low" significance.

#### *13.3.1.4. Increased soil erosion and sedimentation*

Vegetation clearance and earth works is likely to increase potential incidences of soil erosion, which may lead to the mobilisation and transportation of sediment into drainage features in the study area. High levels of sedimentation could have a smothering effect and impact the integrity and functioning of affected habitats, and reduce terrestrial biodiversity.

Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent is local. Prior to mitigation, increased soil erosion and sedimentation is rated an impact of "moderate" significance.

This impact is relatively easy to mitigate with active interventions, such as *inter alia*, rehabilitation and the erection of silt traps. With the implementation of the required mitigation measures during the construction phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "Low" significance.

### 13.3.2. Operational Phase

#### *13.3.2.1. Establishment and spread of alien invasive species*

The potential establishment and spread of AIS in the study area will continue to be an impact of concern during the operational phase.

Before mitigation, impact magnitude is high, while duration is long term and the impact has a medium probability of occurring as predicted. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance.

With the continued implementation of an active alien species control programme during the operational phase this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and probability at low. After mitigation, this impact is rated to be of "Low" significance.

#### *13.3.2.2. Increase in wildfires from Project workers or faulty infrastructure*

Wildfires are considered a natural and important disturbance agent in grassland ecosystems, and are essential to the maintenance of biodiversity patterns and ecological processes. They are also important in maintaining grassland productivity for local livestock farmers. An increase in unplanned or undesirable wildfires from faulty Project infrastructure or accidental/intentional fire-setting by Project workers may negatively impact ecological processes, which may affect terrestrial biodiversity and grassland productivity.

Before mitigation, this impact is of medium magnitude, with a long-term duration affecting terrestrial biodiversity within and potentially adjacent to the development footprint (local). It is also considered to have a medium probability, resulting in an impact of "Moderate" significance.

With the application of the recommended mitigation measures, impact magnitude can be reduced to low. Duration can be reduced to the short-term, and probability to improbable, but spatial scale will remain local. This results in a residual impact of "Very Low" significance.

### 13.3.3. Decommissioning Phase

#### *13.3.3.1. Establishment and spread of alien invasive species*

As Project infrastructure is dismantled and removed from site during the decommissioning phase, the associated disturbances are likely to facilitate alien invasive species colonisation in, and immediately adjacent to, the study area.

Before mitigation, impact magnitude is high, while duration is long term, and the impact has a high probability of occurring as predicted. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of “moderate” significance.

With the continued implementation of an active alien species control programme during decommissioning and for a defined period thereafter, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring would be low. After mitigation, this impact is rated to be of “Low” significance.

#### *13.3.3.2. Increased soil erosion and sedimentation*

Earth works during decommissioning may increase potential incidences of soil erosion, which may lead to the mobilisation and transportation of sediment into drainage features in the study area.

Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent is local. Prior to mitigation, increased soil erosion and sedimentation is rated an impact of “moderate” significance.

With the implementation of the required mitigation measures during the decommissioning phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “Low” significance.

*Table 9: Impact assessment scoring for terrestrial biodiversity*

| CONSTRUCTION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** |
| **Impact 1:** | Terrestrial habitat | Direct loss and disturbance of natural habitat | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 1 | 3 | 4 | 3 | **33** | **N2** |
| | | | | | **Significance** | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 2:** | Terrestrial habitat | Fragmentation reducing natural habitat connectivity and integrity | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 2 | 3 | 4 | 3 | **36** | **N2** |
| | | | | | **Significance** | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 3:** | Terrestrial habitat | Establishment and spread of alien invasive species | Construction | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | **Significance** | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 4:** | Terrestrial habitat | Increased soil erosion and sedimentation | Construction | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **OPERATIONAL** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Terrestrial habitat | Establishment and spread of alien invasive species | Operational | Negative | High | 4 | 2 | 3 | 4 | 3 | **39** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | **Significance** | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Terrestrial habitat | Increase in wildfires from Project workers or faulty infrastructure | Construction | Negative | High | 3 | 2 | 3 | 4 | 3 | **36** | **N2** | 2 | 2 | 1 | 2 | 1 | **7** | **N1** |
| | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **DECOMISSIONING** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Terrestrial habitat | Establishment and spread of alien invasive species | Decommissioning | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | **Significance** | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Terrestrial habitat | Increased soil erosion and sedimentation | Decommissioning | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | **Significance** | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **CUMULATIVE** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Terrestrial habitat | Cumulative impact of loss, disturbance and fragmentation of natural habitat | Construction | Negative | Moderate | 5 | 3 | 3 | 5 | 5 | **80** | **N3** | 3 | 3 | 3 | 4 | 2 | **26** | **N1** |
| | | | | | **Significance** | **N3 - High** | | | | | | | **N1 - Low** | | | | | | |

### 13.3.4. Cumulative Impacts

#### *13.3.4.1. Cumulative impact of natural habitat loss, disturbance and fragmentation.*

The landscape in which the study area is located is already modified and fragmented because of historic and current agriculture, and other land use activities such as mining. The current degree of existing habitat modification and fragmentation in the landscape places significant pressure on the functioning and integrity of remaining natural and semi-natural habitat patches, and their ability to support terrestrial biodiversity.

Although the proposed Project is not located within a promulgated Renewable Energy Development Zone (REDZ), several renewable energy developments are, or may be, taking place in the broader region surrounding the study area. Some of the main developments within a 55 km radius of the study area include *inter alia*; Halfgewonnen solar photovoltaic (PV) facilities, Forzando North Coal Mine Solar PV Facility, Eskom Arnot PV Facility, Haverfontein WEF, Camden I WEF, Camden I Solar, Camden II WEF, Hendrina North WEF, Hendrina South WEF and Ummbila Emyonei WEF.

Collectively, these projects will cause direct habitat loss, disturbance and fragmentation through vegetation clearing that is much greater in extent than that of a single constituent project, and this is a cumulative impact of concern with respects to terrestrial biodiversity and the proposed Project.

Prior to any form of mitigation, the cumulative impact on terrestrial biodiversity from vegetation clearing is rated 'high'. The proposed Project's contribution to cumulative impacts can be minimised by strictly implementing the required mitigation measures and addressing any significant residual impacts via additional conservation actions. The cumulative impacts on terrestrial biodiversity can therefore be reduced to 'Low' significance.

# 14. Assessment of the No Go Alternative

If the proposed Project does not proceed, it is anticipated that the current agricultural land use status quo will continue across most of the study area into the future. The tracts of grassland and wetland habitat in the study area will continue to be used for livestock (cattle) production and game farming, and the croplands will continue to be actively cultivated to produce maize and other crop types.

Certain portions of the study area are subject to heavy grazing and trampling by cattle, and it is possible that overtime, the condition of grassland and wetland habitat with respects to flora species diversity and ability to carry livestock (productivity) may deteriorate because of long-term overgrazing. This may compromise the agricultural profitability of on-site farming operations. With respects to biodiversity, overgrazing is likely to drive the homogenisation of habitats which will reduce on-site terrestrial biodiversity.

# 15. Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed in the preceding section.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following main Project phases:

- Construction (incl. Pre-Construction);
- Operational; and
- Decommissioning

For each impact management action, the following information is provided:

- Category: The category within which the potential impact/risk occurs;
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning of the proposed Project;
- Description: Description of the possible impact management action;
- Prescribed standards or practices: Prescribed environmental standards or practices with which the impact management action must comply. Note that only key standards or practices have been listed;
- Mitigation type: The type of mitigation measure. This includes the following:
    - Avoidance;
    - Minimisation;
    - Rehabilitation or restoration;
    - Offsetting;
- Time period: The time period when the impact management actions must be implemented; and
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions.

Table 10**Error! Reference source not found.** presents a summary of the proposed impact mitigation actions during the pre-construction, construction, operational, and decommissioning phases of the proposed Project.

*Table 10: Summary of proposed impact mitigation actions.*

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| **1. Pre-Construction and Construction Phase** | | | | | | | |
| 1.1 | Terrestrial Habitat | Direct loss and disturbance of natural habitat. | Avoidance<br>• If possible, proposed Project infrastructure footprints should be further repositioned to avoid areas designated CBA and ESA (refer to Table 11 for recommendations concerning repositioning of turbines);<br>• As far as possible other proposed permanent Project infrastructure (e.g., O&M Office and Batching Plant) should be located in areas of modified habitat (i.e., Cultivated Fields, Old Lands);<br>• All temporary construction footprints, (e.g., construction camps, laydown areas), should only be located in areas of modified habitat;<br>• A pre-construction walkdown of the approved development footprints should be conducted during the | N/A | Avoidance, Minimisation, Rehabilitation & Offsetting | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | wet/growing season to identify sensitive biodiversity and inform the micro-siting of Project infrastructure to already disturbed footprints and other relevant management measures.<br><br><u>Minimisation</u><br><br>• All vegetation clearing for the Project should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas;<br>• The footprints to be cleared of vegetation should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas;<br>• No heavy vehicles should travel beyond the marked works zone;<br>• Removed topsoil should be stockpiled and used to rehabilitate all disturbed areas. | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | <u>Rehabilitation</u><br><br>A rehabilitation/ landscaping protocol should be developed and implemented to stabilise and revegetate all non-operational sites that have been disturbed by construction. The protocol should include:<br><br>• Stockpiling of topsoil that was cleared from development footprints during site preparation;<br>• Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment;<br>• Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and<br>• Grass species used during rehabilitation should be indigenous, locally-occurring perennial species. | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | <u>Offsetting</u><br>• Following finalisation of the exact Project infrastructure layout and quantification of habitat losses, it is likely that a biodiversity offset programme in line with the NEMBA National Biodiversity Offset Guideline (2023) may be required to offset the losses of CBA's and mapped remaining areas of threatened vegetation types. This should be developed under consultation with the Mpumalanga Parks and Tourism Agency (MPTA). | | | | |
| 1.2 | Terrestrial Habitat | Fragmentation reducing natural habitat connectivity and integrity | <u>Avoidance and Minimisation</u><br>See mitigation measures for *Direct loss and disturbance of natural habitat*, and<br>• Proposed access roads should be aligned, as far as possible, with existing farm roads and tracks and | N/A | Avoidance and Minimisation | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | micro-sited to already disturbed sites.<br><br><u>Rehabilitation</u><br><br>See rehabilitation measures for *Direct loss and disturbance of natural habitat* | | | | |
| 1.3 | Terrestrial Habitat | Establish and spread of alien invasive species | An AIS control and eradication plan must be developed for the Project that focuses on controlling and eradicating AIS occurring at sites disturbed by project activities in the study area. The plan must include:<br>• Identification of AIS management units;<br>• Prioritisation of sites and species requiring control;<br>• Targets and indicators of success;<br>• Scheduling of AIS control;<br>• Species-specific control methods, using a combined approach of both chemical and mechanical control methods; and | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • Provision for follow-up treatments, as informed by regular AIS monitoring. | | | | |
| 1.4 | Terrestrial Habitat | Increased soil erosion and sedimentation | • All sites disturbed by construction activities should be stabilised and actively revegetated, as per the rehabilitation/ landscaping protocol; and<br>• Erosion prevention and control measures (e.g., brush-packing, gabions, silt-traps) should be implemented at any sites of erosion. | N/A | Minimisation & Rehabilitation | During Construction Phase | Project Manager |
| **2. Operational phase** | | | | | | | |
| 2.1 | Terrestrial Habitat | Establish and spread of alien invasive species | • Active alien invasive species control should continue throughout the operational phase, as per the approved AIS control and eradication programme. | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | During Operational Phase | Facility Manager |
| 2.1 | Terrestrial Habitat | Increase in wildfires from Project workers | • The Project proponent should approach all relevant farmers and | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | or faulty infrastructure | the local fire protection association (FPA) to investigate developing a co-ordinated Grassland Burning Management Programme for the study area;<br>• As required, firebreaks should be maintained around infrastructure that are susceptible to faults/shorts that may cause accidental wildfires; and<br>• Construction- and maintenance workers should be trained on the dangers of wildfire and the need to actively prevent unplanned/accidental fires. | | | | |
| **3. Decommissioning phase** | | | | | | | |
| 3.1 | Terrestrial Habitat | Establish and spread of alien invasive species | • Active alien invasive species control should continue on an annual basis during the decommissioning phase and annual follow-up control should be carried out for a five- year period following decommissioning. | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | Annually during decommissioning and annually for a five-year period after decommissioning | Facility Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| 3.2 | Terrestrial Habitat | Increased soil erosion and sedimentation | • All sites disturbed by decommissioning activities should be stabilised and actively revegetated, as per the rehabilitation/ landscaping protocol; and<br>• Erosion prevention and control measures (e.g., brush-packing, gabions, silt-traps) should be implemented at any sites of erosion. | N/A | Rehabilitation | During the Decommissioning Phase | Facility Manager |

Based on the proposed infrastructure layout, 18 turbines are located on land mapped as CBA's. Of these, five are located in areas of modified habitat that have been incorrectly designated as CBAs (discussed in Table 11). Of the remaining 13 turbines sites, there is scope to further reposition the turbine footprints and some internal roads to further avoid directly impacting CBA land. These options are also discussed in more detail in Table 11.

*Table 11: Recommendations concerning turbines that are located in, or in close proximity to, designated CBA's.*

| Turbine Name. | Habitat Unit | MBSP Designation | Comment and Recommendations |
|---|---|---|---|
| WTG1 | Cultivated Field | Heavily or moderately modified & CBA Irreplaceable | Entire area around WTG1 comprises Cultivated Fields. The CBA Irreplaceable habitat adjacent to the site has been incorrectly designated. No further recommendations. |
| WTG2 | Cultivated Field | CBA Optimal | The WTG2 footprint is in an old Cultivated Field. The CBA Optimal designation of this land is incorrect. No further recommendations. |
| WTG3 | Mixed Dry Grassland | CBA Optimal | WTG3 is located in an area of Mixed Dry Grassland that is designated CBA Optimal. It is recommended that this turbine footprint be moved approximately 150 m to the north-east into a Cultivated Field. |
| WTG8 | Cultivated Field | CBA Optimal | The entire area around WTG8 comprises Cultivated Fields. The CBA Optimal habitat at this site has been incorrectly designated. No further recommendations. |
| WTG10 | Old Lands & Mixed Dry Grassland | Heavily or moderately modified & CBA Irreplaceable | The WTG10 footprint is likely to impact Mixed Dry Grassland that is designated CBA Irreplaceable that surrounds this site. It is recommended that the footprint be moved further north (approx. 150 m) so that the entire footprint is located in Old Lands.<br><br>The internal access road linking WTG10 to WTG9 should remain in its current alignment, as it is within the footprint of an existing farm road. |
| WTG12 | Mixed Dry Grassland | CBA Optimal | The WTG12 footprint is located in a band of Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 200 m east so that the entire footprint is located in Old Lands and/or Cultivated Fields. |
| WTG14 | Old Lands & Mixed Dry Grassland | Heavily or moderately modified & CBA Irreplaceable | The WTG14 footprint is likely to impact Mixed Dry Grassland that is designated CBA Irreplaceable and that borders this site to the west. It is recommended that the footprint be |

| Turbine Name. | Habitat Unit | MBSP Designation | Comment and Recommendations |
|---|---|---|---|
| | | | moved west by approx. 150 m so that the entire footprint is located in Old Lands. |
| WTG15 | Mixed Dry Grassland | CBA Optimal | The WTG15 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 350 m west so that the footprint is located in Cultivated Fields. |
| WTG20 | Mixed Dry Grassland | CBA Optimal | The WTG15 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 300 m west so that the footprint is located in Old Lands. |
| WTG26 | Old Lands | CBA Optimal | The WTG26 footprint is located in Old Lands, that has been incorrectly designated as CBA Optimal. No further recommendations. |
| WTG42 | Old lands | CBA Optimal | The WTG42 footprint is located in Old Lands with adjacent Cultivated Fields. The CBA Optimal designation of the Old Lands is incorrect. No further recommendations. |
| WTG44 | Old Lands & Mixed Dry Grassland | Heavily or moderately modified & Other Natural Areas | The initial 330 m of the internal access road to WTG44 should be orientated directly north along the edge of the cultivated field before turning west toward the WTG44 footprint. |
| WTG46 | Mixed Dry Grassland | CBA Optimal | The WTG46 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 200 m north-east so that the footprint is located in Cultivated Fields. |
| WTG55 | Mixed Dry Grassland | CBA Optimal & CBA Irreplaceable | The WTG55 footprint is located in Mixed Dry Grassland that is designated CBA Irreplaceable and CBA Optimal. It is recommended that the footprint be moved approx. 250 m north-east so that the footprint is located in Old Lands. |
| WTG58 | Mixed Dry Grassland | CBA Optimal | The WTG58 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 200 m north-east so that the footprint is located in Old Lands.<br><br>The internal road linking WTG58 directly to Access Road 4 should be removed as this turbine can be accessed from the north internal access road. |
| WTG64 | Mixed Dry Grassland | CBA Optimal | The WTG64 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 220 m north so that the footprint and |

| Turbine Name. | Habitat Unit | MBSP Designation | Comment and Recommendations |
|---|---|---|---|
| | | | internal access road are located in Cultivated Fields. |
| WTG66 | Mixed Dry Grassland | CBA Optimal | The WTG66 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. It is recommended that the footprint be moved approx. 100 m north so that the footprint is located in Cultivated Fields. |
| WTG70 | Mixed Dry Grassland | CBA Optimal & CBA Irreplaceable | The WTG70 footprint is located in Mixed Dry Grassland that is designated CBA Irreplaceable and CBA Optimal. It is recommended that the footprint be moved approx. 200 m north so that the footprint is located in Cultivated Fields. |
| WTG76 | Mixed Dry Grassland | CBA Optimal | The WTG76 footprint is located in Mixed Dry Grassland that is designated CBA Optimal. The closest option to avoid impacting CBA Optimal land is for the footprint to be moved approx. 530 m west so that it is located in Cultivated Fields. |

# 16. Monitoring Measures

The following section presents the proposed measures for monitoring and reporting on the implementation of the impact mitigation actions presented in the preceding section.

The content of this section is largely based on the monitoring requirements outlined in Appendix 4 of the EIA Regulations, 2014.

For each monitoring action, the following information is provided:

- Category: The category within which the potential impact and/or risk occurs
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning of the proposed Project
- Method for monitoring: The method for monitoring the implementation of the recommended mitigation measures
- Time period: The time period over which the monitoring actions must be implemented
- Frequency of monitoring: The frequency of monitoring the implementation of the recommended mitigation measures
- Mechanism for monitoring compliance: The mechanism for monitoring compliance with the impact management actions
- Responsible persons: The persons who will be responsible for the implementation of the monitoring actions

As with the impact management actions, the proposed monitoring actions have been arranged according to the following project phases:

- Construction;
- Operational; and
- Decommissioning.

Table 12 presents a summary of the proposed monitoring actions during the construction, operational and decommissioning phases.

*Table 12: Summary of monitoring measures*

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| **1. Construction and Operational phase** | | | | | | |
| 1.1 | Alien invasive species | • Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:<br>  ○ All sites disturbed during the construction phase;<br>  ○ Wetland areas adjacent to construction sites; and<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | Wet/growing season | Annual | Annual Monitoring Report | Project Manager |
| **2. Decommissioning phase** | | | | | | |
| 2.1 | Alien invasive species | • Alien invasive species monitoring should be conducted on an annual basis during decommissioning and annually for a five-year period following decommissioning. Monitoring should focus on:<br>  ○ All sites disturbed during decommissioning; | Wet/growing season | Annually during decommissioning for a five-year period after decommissioning | Annual Monitoring Report | Facility Manager |

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| | | ○ Wetland areas adjacent to former development sites; and<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | | | | |

# 17. Reasoned Opinion and Environmental Impact Statement

## 17.1. Summary of Main Findings

The study area is located within the Eastern Highveld Grassland and Soweto Highveld Grassland vegetation types, which according to the NEMBA Threatened Ecosystems (2021), are listed as Endangered and Vulnerable, respectively. The study area is not located within a delineated SWSA, but according to the mapping of FEPA's, the central/southern portion of the study area is located in a FEPA, while the far south of the study area is designated as an Upstream Management Area.

From a biodiversity conservation planning perspective, large tracts of natural habitat in the study area are delineated as CBA Irreplaceable (CBA 1), while many other patches of habitat are delineated as CBA Optimal (CBA 2). The study area is not located within, or contain, a protected area. However, large portions of the study area have been mapped as Priority Focus Areas for protected area expansion, as per the National Protected Area Expansion Strategy (2018), with the Mpumalanga Protected Area Expansion – 20 Year Plan showing a similar spatial distribution of land designated as Priority 2 and Priority 3. Land designated as such, aligns with patches of natural habitat that comprise Mixed Dry Grassland, Moist Grassland and Rocky Shrubland. These habitats were assessed to provide important habitat for flora and fauna, and contribute to broader habitat connectivity, which is an important component of maintaining various landscape-scale ecological processes and terrestrial biodiversity.

The National Web-based Environmental Screening Tool rates the Terrestrial Biodiversity Theme for the proposed Project as 'Very High' sensitivity on account of several conservation planning features. It is noted that the portions of the study area that have been modified by active and historic crop farming (i.e., Cultivated fields and Old Lands) and severely encroach by AIS (i.e., Alien Tree Plantations), do not support this sensitivity rating. However, remaining patches of natural habitat in the study area are of high biodiversity importance with respect to the sensitivity features mentioned above and support the 'Very High' sensitivity rating of the screening tool.

The loss, disturbance and fragmentation of natural habitat from vegetation clearing during construction is the primary impact of concern, particularly where CBA areas are impacted. Vegetation clearing coupled with earth works are also likely to be accompanied by other indirect impacts, such as AIS colonisation and erosion, all of which are likely to negative affect on-site terrestrial biodiversity

The impact significance rating for habitat loss and disturbance prior to mitigation is 'high'. This can be reduced to a residual impact significance of 'Medium' by the implementation of the measures outlined in this report. Key measures include: 1) as far as possible, avoiding CBAs and ESAs, as well as wetlands and their associated buffers (as delineated in the wetland assessment specialist report; 2) micro-siting as much of the proposed Project infrastructure in areas that have already been modified (i.e., croplands); 3) clearing only the minimum footprint areas required for construction activities; and 4) actively rehabilitating all disturbance footprints and controlling alien invasive species colonisation and erosion post-construction.

A suite of terrestrial biodiversity management measures has been recommended for inclusion in the proposed Project's environmental management plan (EMP). The successful implementation of each measure will effectively mitigate negative impacts on terrestrial biodiversity that may result from the proposed Project. It is noted however, that based on the final Project infrastructure layout and quantification of habitat losses, it is likely that additional conservation measures, such as the

development of a biodiversity offset programme, will still be necessary to offset the loss of CBA's and mapped remaining areas of threatened vegetation types in line with the NEMBA National Biodiversity Offset Guideline (2023). The biodiversity offset programme should be developed under consultation with the MPTA.

### 17.2. Conditions to be Included in the Environmental Authorisation

No additional conditions are recommended for inclusion in the proposed Project's environmental authorisation.

### 17.3. Specialist Opinion

In accordance with the outcomes of the impact assessment and taking cognisance of the baseline conditions and impact management measures presented herein, the proposed Project is not deemed to present significant negative ecological issues or impacts, and it should thus be authorised.

## 18. References

DEA (Department of Environmental Affairs) (2018). National Protected Areas Expansion Strategy for South Africa. Department of Environmental Affairs, Pretoria, South Africa.

Driver, A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniel, F., Jonas, Z., Majiedt, P.A., Harris, L. and 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.

Edwards, D. (1983). A broad-scale structural classification of vegetation for practical purposes. Bothalia. 14, 3 & 4; 705-712.

Marnewick, M.D., Retief, E.F., Theron, N.T., Wright, D.R. and Anderson, T.A (2015). Important Bird and Biodiversity Areas of South Africa. Johannesburg: Birdlife South Africa.

MPTA (2014). Mpumalanga Biodiversity Sector Plan Handbook. Compiled by Lotter, M.C., Cadman, M.J. and Lechmere-Oertel, R.G. Mpumalanga Parks and Tourism Agency. Mbombela.

Mpumalanga Nature Conservation Act (Act No. 10 of 1998)

Mucina, L. and Rutherford, M.C. (eds) (Reprint 2011) The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute (SANBI), Pretoria.

National Environmental Management Act (NEMA) (Act No. 107 of 1998) The National Biodiversity Offset Guideline. 2023

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - National list of threatened terrestrial ecosystems for South Africa (NEMBA Threatened Ecosystems, 2011 and 2021). South Africa.

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004). Alien and Invasive Species Lists, 2016 and 2020.

National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57of 2003).

NFEPA (National Freshwater Ecosystem Priority Areas) (2023). South African National Biodiversity Institute. Accessed at http://bgisviewer.sanbi.org. [Accessed 23 October 2023]

SANBI (2013). Grassland Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and McCulloch, D. South African National Biodiversity Institute, Pretoria.

SANBI (2018). 2018 National Vegetation Map. South African National Biodiversity Institute, Pretoria.

SANBI (2020). Species Environmental Assessment Guideline. Guideline 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. Version 1. 2020.

SANBI (2024). What is a KBA Map? SANBI Factsheet series. South African National Biodiversity Institute, Pretoria.

SAPAD (South African Protected Area Database) (2023). Protected Area Register Interactive Mapservice. Department of Forestry, Fisheries and the Environmental. Accessed at https://dffeportal.environment.gov.za/portal/apps/webappviewer [Accessed 23 October 2023]

Scholes, R.J. (2009). Syndromes of dryland degradation in southern Africa. African Journal of Range and Forage Science. 26(3): 113-215.

SWSA (Strategic Water Source Areas) (2017). South African National Biodiversity Institute. Accessed at http://bgisviewer.sanbi.org. [Accessed 23 October 2023]

---

This report has been compiled by Andrew Zinn (Hawkhead Consulting).

Andrew Zinn (*Pr.Sci.Nat*.)

Terrestrial Ecologist
Hawkhead Consulting

# Appendix A: Curriculum Vitae – Andrew Zinn

# Hawkhead Consulting

# Curriculum Vitae of Andrew Zinn (Pr.Sci.Nat.)

## Details

Andrew David Zinn
Terrestrial Ecologist
B.Sc. (Hons.), M.Sc., Pr.Sci.Nat.

Email: andrew@hawkhead.com
Mobile: +27 83 361 0373
Address: 58 Central Rd, Linden Ext., Johannesburg, 2195
South Africa
Date of birth: 14 July 1982
Nationality: South African

## Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and 15 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

## Education and Qualifications

- University of the Witwatersrand, M.Sc. Resource Conservation Biology (2013).
- University of KwaZulu-Natal, BSc. Hons. Ecology and Conservation Biology (2005).
- University of KwaZulu-Natal, BSc. Zoology and Grassland Science (2004).
- Bryanston High School, Johannesburg. Matric Exemption. (2000).

## Affiliations

- Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).
- Member of the South African Wildlife Management Association.
- Member of the South African Association of Botanists.

## Work Experience

1. **Independent Ecologist**

**Hawkhead Consulting, South Africa**
**September 2020 – Present**

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- Biodiversity study design and implementation;
- Biodiversity baseline and impact assessment reporting;
- Mitigation measure design and application;
- Vegetation surveys and vegetation community mapping;
- Fauna surveys for mammals, birds, reptiles and amphibians;
- Development of biodiversity management plans;
- Development of rehabilitation and revegetation plans; and
- Alien invasive species control and eradication plans.

2. **Ecologist**

**Golder Associates Africa, South Africa**
**June 2011 – September 2020**
Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa. Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's (IFC) Performance Standard 6 (PS6)

3. **Independent Ecologist**

**Subcontracted to KPMG, United Arab Emirates**
**March – April 2011**
Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

4. **Environmental Consultant**

**WSP Environment and Energy, South Africa**
**August 2008 – March 2011**
Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes,
conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

5. **Research Technician**

**Yale University, Kruger National Park, South Africa**
**October 2007 – May 2008**
Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

## Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.
- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

# Appendix B: Methodology Supplement

**Rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, as per (SANBI, 2020).**

The ecological sensitivity of habitats in the study area was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystems types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

**Table 1: Conservation Importance (CI) criteria.**

| Conservation Importance (CI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10km$^2$;<br>• Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type; and<br>• Globally significant populations of congregatory species (>10% of global population). |
| **High** | • Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of > 10km$^2$, IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining;<br>• Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type;<br>• Presence of Rare species;<br>• Globally significant populations of congregatory species (>1% but < 10% of global population). |
| **Medium** | • Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals;<br>• Any area of natural habitat of threatened ecosystem type with status of VU;<br>• Presence of range-restricted species; and<br>• >50% of receptor contains natural habitat to support SCC. |
| **Low** | • No confirmed or highly likely populations of SCC;<br>• No confirmed or highly likely populations of range-restricted species; and<br>• <50% of receptor contains natural habitat with limited potential to support SCC. |
| **Very Low** | • No confirmed and highly unlikely populations of SCC;<br>• No confirmed and highly unlikely populations of range-restricted species; and<br>• No natural habitat remaining. |

**Table 2: Functional Integrity (FI) criteria.**

| Functional Integrity (FI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type;<br>• High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches;<br>• No or minimal current negative ecological impacts with no signs of major disturbance (e.g., ploughing) |
| **High** | • Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types;<br>• Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches; and<br>• Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. |
| **Medium** | • Medium (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type or >20 ha for VU ecosystem type;<br>• Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches;<br>• Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. |
| **Low** | • Small (> 1 ha but <5ha) area;<br>• Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential; and<br>• Several minor and major current negative ecological impacts. |
| **Very Low** | • Very small (<1 ha) area;<br>• No habitat connectivity except for flying species or flora with wind-dispersed seeds;<br>• Several major current negative ecological impacts. |

**BI = CI + FI**

**Biodiversity Importance (BI) Rating Matrix**

| **Biodiversity Importance (BI)** | | **Conservation Importance** | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Functional Integrity** | **Very High** | Very High | Very High | High | Medium | Low |
| | **High** | Very High | High | Medium | Medium | Low |
| | **Medium** | High | Medium | Medium | Low | Very Low |
| | **Low** | Medium | Medium | Low | Low | Very Low |
| | **Very Low** | Medium | Low | Very Low | Very Low | Very Low |

**Table 3: Receptor Resilience criteria (RR)**

| Resilience | Fulfilling Criteria |
|---|---|
| **Very High** | Habitat that can recover rapidly (˜less than 5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed. |
| **High** | Habitat that can recover relatively quickly (˜ 5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed. |
| **Medium** | Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed. |
| **Low** | Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed. |
| **Very Low** | Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed. |

**SEI = BI + RR**

**Site Ecological Importance (SEI) Rating Matrix**

| Site Ecological Importance | | Biodiversity Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Receptor Resilience** | **Very Low** | Very High | Very High | High | Medium | Low |
| | **Low** | Very High | Very High | High | Medium | Very Low |
| | **Medium** | Very High | High | Medium | Low | Very Low |
| | **High** | High | Medium | Low | Very Low | Very Low |
| | **Very High** | Medium | Low | Very Low | Very Low | Very Low |

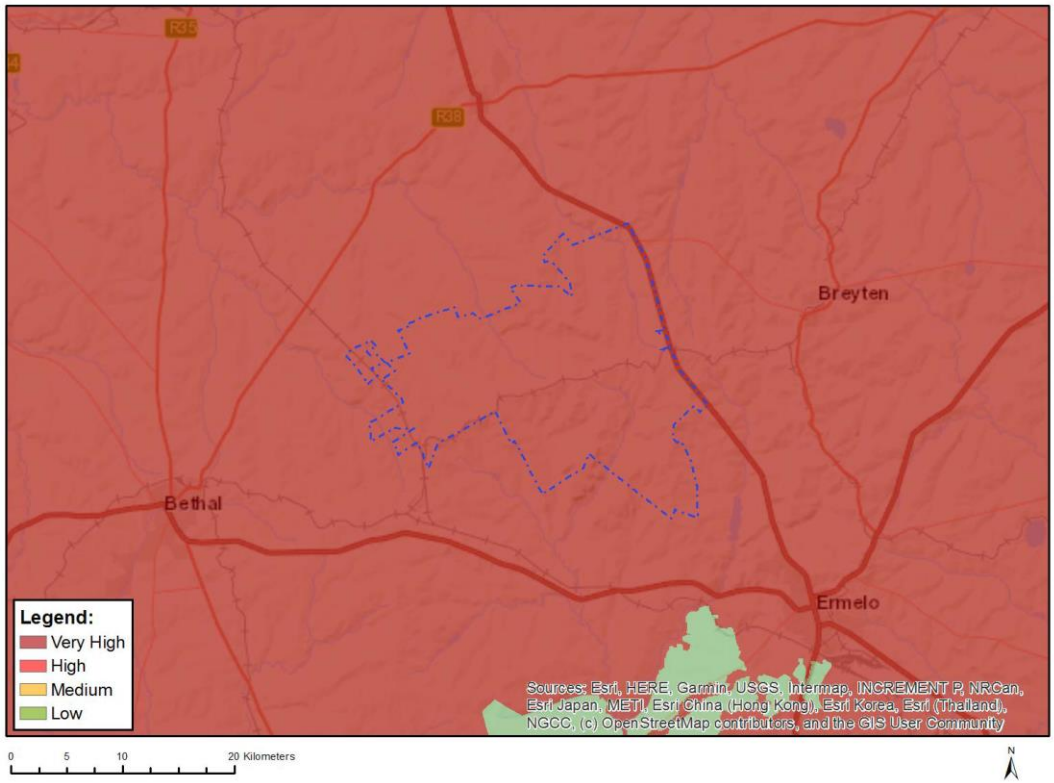
**Table 4: Guidelines for interpreting SEI in the context of the proposed development activities.**

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |

# Appendix C: Summary and Comment on the Sensitivity Rating of the DFFE Screening Tool

## Sensitivity Rating of the National Web Based Screening Tool

The National Web-based Environmental Screening Tool rates the Terrestrial Biodiversity Theme for the proposed Project as 'Very High' sensitivity on account of several conservation planning features. These are listed in the table below. Refer to the map showing the spatial sensitivity. It must be noted that the screening tool only allows for sensitivity ratings of 'Very High' or 'Low' for terrestrial biodiversity.




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| X | | | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| Very High | CBA 1 |
| Very High | CBA 2 |
| Very High | ESA: Landscape corridor |
| Very High | ESA: Local corridor |
| Very High | FEPA Subcatchment |
| Very High | National Protected Area Expansion Strategy (NPAES) |
| Very High | EN_Eastern Highveld Grassland |
| Very High | VU_Soweto Highveld Grassland |

## Appraisal of the Sensitivity Rating

It is noted that the portions of the study area that have been modified by active and historic crop farming (i.e., Cultivated fields and Old Lands) and severely encroach by AIS (I.e., Alien Tree Plantations), do not support this sensitivity rating. However, remaining patches of natural habitat in the study area are of biodiversity importance with respect to the highlighted sensitivity features, i.e., CBA's, ESA's, FEPA subcatchment, National Priority Focus Areas for protected area expansion; and, Eastern Highveld

Grassland (EN) and Soweto Highveld Grassland (VU), and support the ‘Very High’ sensitivity rating of the screening tool.

# Appendix D: Compliance with Terrestrial Biodiversity Protocol.

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity | Relevant Section in Report |
|---|---|
| **The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:** | |
| 2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these | Section 11 |
| 2.3.2. ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site; | Section 11 |
| 2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna; | Section 11 and Section 13.3 |
| 2.3.4. 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; | Section 5, Section 6 & Section 8 |
| 2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site,<br>including:<br>a) main vegetation types;<br>b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;<br>c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and<br>d) species, distribution, important habitats (e.g., feeding grounds, nesting sites,<br>etc.) and movement patterns identified. | Section 5 to Section 11 |
| 2.3.6. 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 | Section 12 to Section 15 |
| 2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:<br>2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:<br>a) the reasons why an area has been identified as a CBA;<br>b) 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;<br>c) 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);<br>d) the impact on ecosystem threat status;<br>e) the impact on explicit subtypes in the vegetation;<br>f) the impact on overall species and ecosystem diversity of the site; and<br>g) the impact on any changes to threat status of populations of species of conservation concern in the CBA | Section 5, Section 6 & Section 13 |
| 2.3.7.2. terrestrial ecological support areas (ESAs), including:<br>a) the impact on the ecological processes that operate within or across the site;<br>b) the extent the proposed development will impact on the functionality of the ESA; and<br>c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or | Section 6 & Section 13 |

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity | Relevant Section in Report |
|---|---|
| introducing barriers that impede migration and movement of flora and fauna | |
| 2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including –<br>a) an opinion on whether the proposed development aligns with the objectives<br>or purpose of the protected area and the zoning as per the protected area management plan; | Section 6.5 |
| 2.3.7.4. priority areas for protected area expansion, including-<br>a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network; | Section 6.6 |
| 2.3.7.5. SWSAs including:<br>a) the impact(s) on the terrestrial habitat of a SWSA; and<br>b) the impacts of the proposed development on the SWSA water quality and<br>quantity (e.g., describing potential increased runoff leading to increased sediment load in water courses); | Section 6.3.1 |
| 2.3.7.6. FEPA sub-catchments, including<br>a) the impacts of the proposed development on habitat condition and species in<br>the FEPA sub catchment; | Section 6.3.2 |
| 2.3.7.7. indigenous forests, including:<br>a) impact on the ecological integrity of the forest; and<br>b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas. | Section 6.4 |
| **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; | Page 3 & Appendix A |
| 3.1.2. a signed statement of independence by the specialist; | Page 3 |
| 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 | Section 3 & Section 4 |
| 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; | Section 3.1 & Section 3.2 |
| 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; | Section 4 |
| 3.1.6 a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant); | Section 6.2, Section 13 |
| 3.1.7. additional environmental impacts expected from the proposed development; | Section 13 |
| 3.1.8. any direct, indirect and cumulative impacts of the proposed development; | Section 13 |
| 3.1.9. the degree to which impacts and risks can be mitigated; | Section 15 |
| 3.1.10. the degree to which the impacts and risks can be reversed; | Section 15 |
| 3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources; | Section 15 |

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity | Relevant Section in Report |
|---|---|
| 3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr); | Section 15 & Section 16 |
| 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 | Section 17 |
| 3.1.15. any conditions to which this statement is subjected. | Section 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. | 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. | EAP to incorporate |

# ANIMAL SPECIES SPECIALIST ASSESSMENT FOR THE PROPOSED PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY PROJECT

WSP Group Africa Pty (Ltd)

September 2024

Submitted to:
Aisling Dower
WSP Group Africa Pty (Ltd)
Building 1, Maxwell Office Park
Waterfall City, Midrand
Gauteng
South Africa

Report Compiled By:
Andrew Zinn (*Pr.Sci.Nat.*)
Hawkhead Consulting

# Acronyms and Abbreviations

| Abbreviation | Explanation |
|---|---|
| AIS | Alien Invasive Species |
| AOO | Area of Occupancy |
| BI | Biodiversity Importance |
| CA | Conservation Areas |
| CI | Conservation Importance |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Programme |
| EOO | Extent of Occurrence |
| FI | Functional Integrity |
| Ha | Hectare |
| IUCN | International Union for the Conservation of Nature |
| MPTA | Mpumalanga Parks and Tourism Agency |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management Biodiversity Act |
| QDS | Quarter Degree Square |
| RR | Receptor Resilience |
| SANBI | South African National Biodiversity Institute |
| SAPAD | South African Protected Areas Database |
| SCC | Species of Conservation Concern |
| SEI | Site Ecological Importance |
| ToPS | Threatened or Protected Species |
| WEF | Wind Energy Facility |

# Details of the Expertise of the Specialist

| Specialist Information | |
|---|---|
| Name | Andrew D. Zinn<br>Pr.Sci.Nat. - Ecological Science (400687/15) |
| Designation | Report Author – Terrestrial Ecologist |
| Cell Phone Number | +27 83 361 0373 |
| Email Address | andrew@hawkhead.co.za |
| Qualifications | M.Sc. Resource Conservation Biology<br>B.Sc. Hons. Ecology and Conservation Biology<br>B.Sc. Zoology and Grassland Science |
| Summary of Past Experience | Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research, and is registered as a Professional Natural Scientist (*Pr.Sci.Nat.*) – Ecological Science, with the South African Council of Natural Scientific Professions (SACNASP). Andrew has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia. |
| Refer to Appendix A for a full Curriculum Vitae of Andrew Zinn. | |

# Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Phefumula Emoyeni One Wind Energy Facility Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

Andrew Zinn

# Contents

# List of Tables

# List of Figures

# 1. Introduction

Hawkhead Consulting was appointed by WSP Group Africa Pty (Ltd), on behalf of Phefumula Emoyeni One (Pty) Ltd, to conduct the Animal Species Specialist Assessment for the proposed Phefumula Emoyeni One Wind Energy Facility (WEF) Project (hereafter referred to as the 'Project'), near Ermelo in Mpumalanga Province, South Africa.

## 1.1. Scope and Purposes of this Report

This specialist study focused on terrestrial animals (fauna), specifically mammals (excl. bats), herpetofauna (reptiles and amphibians) and invertebrates of conservation concern. Separate avifauna and bat specialist assessments have been undertaken for the proposed Project. This report therefore only provides high-level comment on any bird species of conservation concern that were observed on-site during the field survey for this specialist study (For additional detailed information on birds, refer to the Avifauna Specialist Assessment Report).

The study has been conducted in line with the '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 National Environmental Management Act, 1998, When Applying for Environmental Authorisation', and specifically:

- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Animals.

The primary scope of work included:

- Collating and reviewing information and data on terrestrial fauna species that occur or potentially occur on-site and in the surrounding landscape;
- Conducting a field programme to assess the presence and potential presence of terrestrial fauna species present on-site, with specific focus on species of conservation concern and sensitive habitats;
- Assessing the suitability of the Proposed project and the potential negative impacts on terrestrial fauna that may result from proposed Project activities; and
- Recommending mitigation and management measures for inclusion in the proposed Project's Environmental Management Programme (EMP) and/or Biodiversity Management Plan (BMP).

In line with the above scope, the purpose of this report is to; 1) present a baseline description of terrestrial fauna species occurring on-site, highlighting the presence/potential presence of species of conservation concern and sensitive habitats; 2) present the findings of an impact assessment for the proposed Project; 3) recommend applicable biodiversity mitigation and management measures; and, 4) provide an impact statement on the appropriateness of the proposed Project with respects to terrestrial animal species conservation.

This report should be read in conjunction with the Plant Species Specialist Assessment and Terrestrial Biodiversity Specialist Assessment reports, as well as any other biodiversity-related reports.

## 1.2. Location and Delimits of the Study Area

The proposed Phefumula Emoyeni One WEF site is located approximately 16 km north of Ermelo in the Msukaligwa Local Municipality and Gert Sibande District Municipality, in Mpumalanga Province,

South Africa (**Error! Reference source not found.**). The entire WEF site was regarded as the 'study area' for this specialist assessment.

## 1.3. Project Description

The proposed Phefumula Emoyeni One WEF will be developed within a project area of approximately 33 660 hectares (ha). The site will be accessed via the N11 and existing access roads. The proposed project description is outlined in Table 1.

*Table 1: Phefumula Emoyeni One WEF Technical Details*

| Details | Information |
|---|---|
| APPLICANT NAME: | PHEFUMULA EMOYENI ONE (PTY) LTD |
| Municipalities | Msukaligwa Local Municipality<br>Gert Sibande District Municipality |
| Extent | 33 660 ha |
| Buildable area | subject to finalization based on technical and environmental requirements |
| Export Capacity | Up to 550MW |
| Power system technology | Wind |
| Number of Turbines | 88 |
| Turbine capacity | Between 6 MW and 15 MW each |
| Rotor Diameter | Up to 200 m |
| Hub Height | Up to 200 m |
| Hard Standing Dimensions | Approximately 75 m x 120 m |
| Turbine Foundations | Diameter of up to 40 m per turbine – excavation up to 6 m deep, constructed of reinforced concrete to support the mounting ring. Once tower established, footprint of foundation is covered with soil. |
| Substation and internal powerlines | • 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.<br>• 3 x 33kV/132kV onsite collector substation (IPP Portion), each being up to 5 ha.<br>• Cabling between turbines, to be laid underground where practical |
| Construction camp and laydown area | • Construction compounds including site office (approximately 300 m x 300 m in total but split into 3 ha each of 150 m x 200 m):<br>• 3 x Batching plant of up to 4 ha to 7 ha.<br>• 3 x construction compound / laydown area, including site office of 3ha each (150 m x 200 m each).<br>• Laydown and crane hardstand areas (approximately 75 m x 120 m). |
| INTERNAL ROADS | • 12-13 m wide roads with 12 m radius turning circles, gravel surface |
| O&M Building | • 3 x O&M office of approximately 1. 5ha each adjacent to each collector Sub Station. |
| Batching Plant | • Up to 3 x Batching plants of up to 4 ha to 7 ha. |
| BESS | • Battery Energy Storage System (BESS) (200MW/800MWh).<br>• Type has not been confirmed at this stage. It is proposed that all impacts related to both types be assessed in the EIA.<br>• Export Capacity of up to 200MWh<br>• Total storage capacity 800MW<br>• Storage capacity of up to 6-8 hours |

| Details | Information |
|---|---|
| | • The BESS will be housed in containers covering a total approximate footprint of up to 5ha.<br>• Battery types to be considered: Solid State Batteries as the preferred (Lithium Ion) and Redox Flow Batteries as the alternative (Vanadium Redox). |

## 1.4. Results of the Environmental Screening Tool

The proposed Project site was assessed at a desktop level using the National Web-based Environmental Screening Tool. According to the National Web Based Screening Tool, the Animal Species Theme for the study area was rated 'High' sensitivity on account of the potential presence of several threatened fauna species, including:

- Three mammal species:
  - Maquassie Musk Shrew (*Crocidura maquassiensis*);
  - Spotted-necked Otter (*Hydrictis maculicollis*);
  - Oribi (*Ourebia ourebi ourebi*);
- Several bird species:
  - Southern Bald Ibis (*Geronticus calvus*);
  - Martial Eagle (*Polemaetus bellicosus*);
  - Secretarybird (*Sagittarius serpentarius*);
  - Yellow-billed Stork (*Mycteria ibis*);
  - Caspian Tern (*Hydroprogne caspia*);
  - African Grass Owl (*Tyto capensis*);
  - Denham's Bustard (*Neotis denhamii*);
  - White-bellied Bustard (*Eupodotis senegalensis*); and
- One invertebrate species: Potchefstroom Blue (*Lepidochrysops procera*).

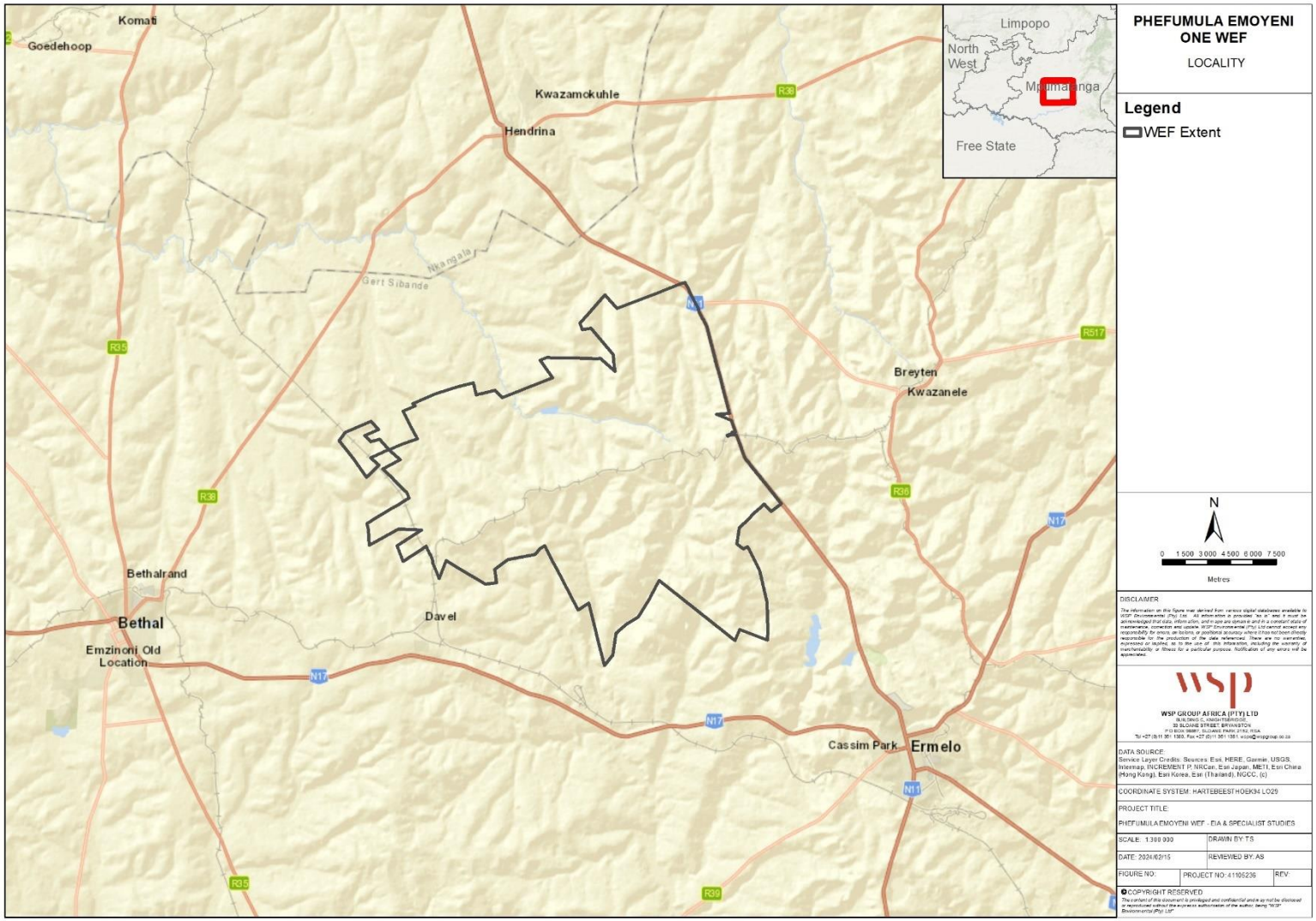



*Figure 1: Map showing the regional location of the proposed Project.*

# 2. Relevant Legislation and Guidelines

Relevant international, national and provincial legislation, associated guidelines and policies that are relevant to the environment and biodiversity, and which were used to guide the Animal Species Specialist Assessment are listed in Table 2.

*Table 2: Relevant environmental and biodiversity legislation and guidelines.*

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| National Environmental Management Act, 1998 (Act No 107 of 1998) – NEMA | Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management, and laid down in Chapter 5 of the NEMA. In terms of section 24(1), the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the NEMA with granting of the relevant environmental authorisation. In terms of section 24F (1) of the NEMA no person may commence an activity listed or specified in terms of section 24(2)(a) or (b) unless the competent authority has granted an environmental authorisation for the activity.<br><br>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, the following is relevant to this study:<br><br>• Protocol for the specialist assessment and report content requirements for environmental impacts on terrestrial animal species. |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) | The NEMBA is administered by the Department of Forestry, Fisheries and the Environment (DFFE) and provides the framework under the NEMA for the:<br><br>• Management and conservation of South Africa's biodiversity;<br>• The protection of species and ecosystems that warrant protection;<br>• The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; and<br>• The establishment and functions of a South African National Biodiversity Institute (SANBI).<br><br>Amongst other components, the NEMBA includes:<br>• Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (February 2007), with associated amendments (December 2007 and 3 June 2020) (ToPS), published under Section 56(10 of NEMBA;<br>• Threatened or Protected Species Regulations (February 2007); and |

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| | • National list of threatened terrestrial ecosystems for South Africa (2011, and 2021 revision), published under Section 51(1)(a) of NEMBA.<br>• National Biodiversity Offset Guideline (2023), which provides guidance on the need to develop biodiversity offsets.<br><br>The purpose of ToPS lists and regulations are to regulate the permit system concerning restricted activities involving specimens of listed threatened or protected species. The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by identifying 'witness' sites' of exceptionally high conservation value and enabling and facilitating proactive management of these ecosystems.<br><br>Chapter 5 of NEMBA also provides a list of regulations and guidance concerning alien invasive species, including:<br>• A guideline for Monitoring, Control and Eradication Plans (September 2015);<br>• 2020 Alien and Invasive Species Regulations (September 2020); and<br>• 2016 and 2020 Alien and Invasive Species Lists (March 2021). |
| National Environmental Management: Protected Areas Act (2003) | • The NEMPA provides the framework under the NEMA for the protection and conservation of South Africa's biodiversity through the establishment of a system of protected areas that represent the country's diverse ecosystems, landscapes, and seascapes; and<br>• The NEMPA sets out mechanisms and processes for declaring and managing protected areas, including protected environments, with an emphasis on intergovernmental cooperation and public involvement. |
| Mpumalanga Nature Conservation Act (Act No. 10 of 1998) | Amongst other provisions, the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) provides lists of specially protected and protected flora and fauna. Of particular relevance to this specialist study are species of flora that are listed under:<br>• Schedule 1: Specially Protected Game;<br>• Schedule 2: Protected Game; and<br>• Schedule 4: Protected Wild Animals. |
| Other Relevant national and Provincial Policies, Plans and Guidelines | Other relevant policies, plans and guidelines that were considered during this study include:<br>• Mpumalanga Biodiversity Sector Plan;<br>• Species Environmental Assessment Guideline (SANBI, 2020);<br>• National Protected Area Expansion Strategy (2019); and<br>• Mpumalanga Protected Area Expansion Strategy – 20-year Plan. |

# 3. Study Methodology

The methodology used for this study included a desktop literature review component and a field programme. The various tasks associated with these components are discussed below:

## 3.1. Desktop Data Collation and Literature Review

The aim of the desktop literature review component was to collate and review data and information pertaining to terrestrial animal species that may occur in the study area and surrounding landscape, based on historic distribution ranges or recent records.

Literature and data that were reviewed were obtained from a variety of online and literature sources, as discussed below:

### 3.1.1. Mammals

- A list of mammal species that are known to occur in the region was compiled based on the historic distribution ranges presented in Stuart and Stuart (2007); and
- These data were cross-referenced with mammal species listed for the 2629BD and 2629BC Quarter Degree Squares (QDS) on the MammalMAP database (Fitzpatrick Institute of African Ornithology, 2023).

### 3.1.2. Birds

- To obtain a list of bird species of conservation concern that may be present in the study area, a list of bird species was obtained from Southern African Bird Atlas Project 2 (SABAP2) for the main pentads that cover the study area, *viz*. 2615_2945, 2620_2935, 2620_2940, 2620_2945, 2620_2950 and 2625_2950.

### 3.1.3. Herpetofauna (Reptiles and Amphibians)

- A list of herpetofauna that potentially occur in the study area was compiled based on the distribution maps presented in Bates *et al*., (2014) for reptiles, and Du Preez and Carruthers (2009) for amphibians; and
- Additional herpetofauna data were also sourced from ReptileMAP and FrogMAP for the 2629BD and 2629BC QDS (Fitzpatrick Institute of African Ornithology, 2023).

### 3.1.4. Invertebrates of Conservation Concern

- Lists of invertebrate species potentially occurring in the study area were obtained from LepiMAP, LacewingMAP, OdonataMAP, DungbeetleMAP, ScorpionMAP and SpiderMAP for the 2629BD and 2629BC QDS in which the study area is located (Fitzpatrick Institute of African Ornithology, 2023); and
- These were screened against available Red Lists to identify potential species of conservation concern.

## 3.2. Field Programme

The field programme comprised a wet-season field survey, conducted over the mid-summer from 22-26$^{th}$ January 2024. During this period, there is increased activity levels amongst many fauna species and therefore it is an optimal time to survey fauna communities. The sampling methodologies used during the field survey were based, in part, on those recommended in SANBI (2020), and included the following:

### 3.2.1. Mammals

Mammal sampling included both active and passive sampling methodologies:

- Active sampling of mammals included the use of baited motion-triggered camera traps (large- and medium-sized mammals) placed at select sampling sites in the study area:
    - Camera traps were placed at seven fauna sampling sites (ratio of one trap per approx. 4 808 ha). Sites were selected based on consideration of a combination of factors including 1) habitat type (grassland and wetland/riparian), 2) coverage of the study area, 3) proximity to water source, 4) presence of game trails/paths, and 5) general accessibility to field workers (refer to Appendix B (1) for map showing the location). The traps were operational continuously for the 24-hour cycle of each day of the survey. All devices were programmed to medium-sensitivity, with a one-minute delay between successive photographs to limit repeat triggers. Chicken pieces were used as a bait; and
    - A grid of six Sherman traps was laid at three of the sampling sites in the study area. A home-made bait consisting of a mixture of oats, peanuts, peanut-butter, syrup and polony was used for the Sherman traps. Sherman traps were inspected each morning of the survey and rebaited as required;
- Passive sampling aimed to record mammals of all sizes and included direct observations, indirect observations and anecdotal evidence:
    - Direct observations included the visual sighting and identification of a species. These were made while walking and driving in the study area (opportunistic encounters) or during point scans of the landscape (32 point-scan locations across the study area) using a pair of binoculars;
    - Indirect observations included the identification of mammal tracks, faeces, burrows and mounds made while walking and driving in the study area; and
    - Farmers were also consulted to obtain anecdotal evidence of mammal species present in the study area.

### 3.2.2. Birds

A separate Avifauna Specialist Assessment was conducted for the proposed Project, and therefore no formal bird sampling was conducted as part of this study scope. However, any opportunistic encounters/observations of bird SCC that were made while driving and walking in the study area were recorded and are reported on in Section 6.2 of this report.

### 3.2.3. Herpetofauna (reptiles and amphibians)

- Sampling for reptiles and amphibians was based on active searches and opportunistic observations made while driving/working in the study area; and
- Farmers and other land users were also consulted to obtain anecdotal evidence of reptile/amphibian species present in the study area.

## 3.3. Assessment of Species of Conservation Concern

### 3.3.1. Threatened, Near Threatened and/or Protected Species Status

Species of conservation concern (SCC) were based on the national Red Lists of threatened/near threatened fauna species, and the Protected status of species, as per national and provincial legislation. These included:

- Red List of Mammals of South Africa, Lesotho and Swaziland (Child *et al*., 2016);
- The 2015 Eskom Red Data Book of Birds of South Arica, Lesotho and Swaziland (Taylor, *et al.*, 2014);
- SANBI's online Red List of South Africa Species (for reptiles, amphibians and invertebrates) (www.speciesstatus.sanbi.org);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998); and
- Mpumalanga Red List of Threatened Fauna.

### 3.3.2. Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of SCC potentially present on-site, a 'probability of occurrence' of a species being present in the study area was determined by conducting habitat suitability assessments. The following parameters were used in the assessments:

- Habitat requirements: Most threatened species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of SCC.

Probability of occurrence is presented in the following categories:

- Recorded: Any SCC observed/documented in or close to the study area;
- Probable: the species is likely to occur in the study area due to suitable habitat and resources being present;
- Possible: The species may occur in the study area, or move through the study area (in the case of mobile species), due to potential habitat and/or resources; and
- Unlikely: the species will not likely occur in the study area due to lack of suitable habitat and resources, or significant differences in its Area of Occupancy (AOO) compared to its Extent of Occurrence (EOO).

## 3.4. Assessment of Site Ecological Importance

The ecological importance of habitat units was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

BI = CI + FI

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of International Union for Conservation of Nature (IUCN) threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

For tables detailing the rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, refer to Appendix B. Table 3 presents a guideline for interpreting the SEI (SANBI, 2020).

*Table 3: Guidelines for interpreting SEI in the context of the proposed development activities*

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |
| Source: SANBI (2020). | |

# 4. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions, uncertainties and gaps in knowledge are highlighted for this specialist study:

- Field work was conducted in January 2024. The timing of the field survey covered the mid-wet season period. During this period, fauna presence and activity across the Mpumalanga Highveld are generally high, as summer aligns with the breeding periods of many fauna

species. Seasonality was therefore not considered a limiting factor with respect to assessing the character of on-site fauna communities;

- Notwithstanding the above, it is possible that certain rare, cryptic, migrating, aestivating or transient fauna species may not have been present and/or observed during the field survey;
- The absence or non-recording of a specific fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species; and
- Given the difficulty of fully sampling and characterising the abundance and distribution of fauna species in the study area during the short period of time allocated to field work, the baseline descriptions were qualitative.

# 5. Characterisation of on-site Fauna Habitats

This section presents a brief description of the primary habitat types in the study area, as they relate to fauna spatial use and life-cycle requirements. Six primary habitat units were identified in the study area during the field survey. These include three units regarded as natural habitat, and three units regarded as modified habitats:

**Natural Habitats**

- Mixed Dry Grassland;
- Rocky Shrubland;
- Moist Grassland;

**Modified Habitats**

- Cultivated Fields;
- Old Lands; and
- Alien Tree Plantations.

These are briefly described below, with Figure 2 presenting a habitat unit map of the study area. For full habitat unit descriptions refer to the Plant Species Specialist Assessment Report.

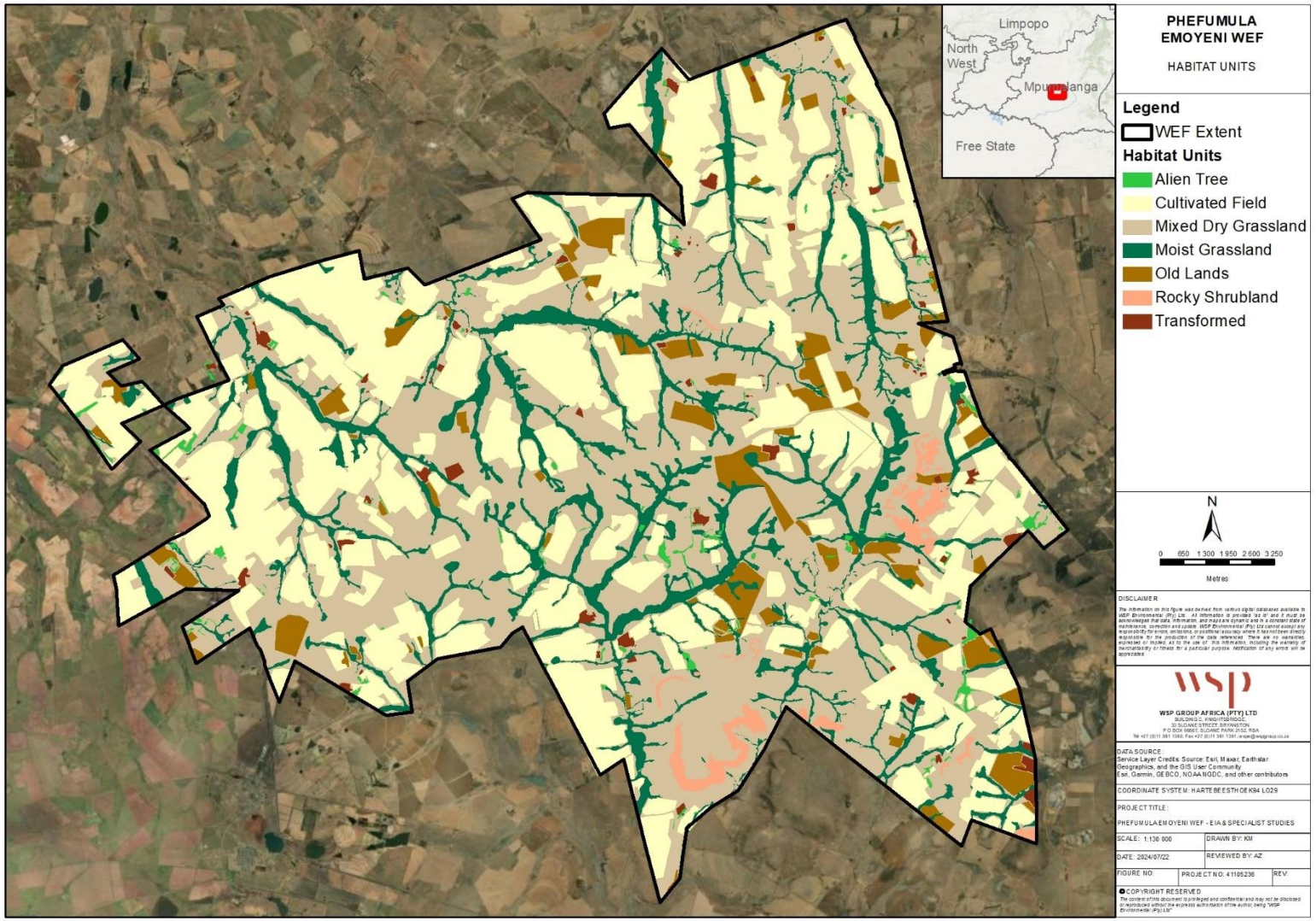



*Figure 2: Habitat unit map of the study area.*

### 5.1.1. Mixed Dry Grassland

Mixed Dry Grassland is a variable habitat unit that characterises the large intact grasslands of the study area. Based on contemporary and former farming activities disturbance levels in areas of Mixed Dry Grassland vary.

As per Edwards (1983) structural classification system, the vegetation structure of this unit is defined a low- closed grassland (Figure 3). Compositionally, areas of Mixed Dry Grassland are characterised by a diverse flora assemblage, that is typically grass dominated and forb rich, and with woody species generally occurring as scattered individual trees and shrubs.

Predicated on past livestock grazing levels and wildfire patterns, the grass species composition of these grasslands varies. Areas that have likely experienced high-levels of past selective grazing and/or too frequent wildfires tend to be dominated by early-seral grass species, such as *Eragrostis plana* and *Eragrostis chloromelas,* whereas in areas that have been less intensely grazed, other species are more common, such as the often-dominant *Themeda triandra,* as well as *Brachiaria serrata, Cymbopogon pospischilii, Eragrostis racemosa, Harpochloa falx, Setaria* species and *Tristachya leucothrix*.

In conjunction with adjacent Moist Grassland habitat, areas of Mixed Dry Grassland are crucial resource habitat for fauna. They also act as important ecological corridors, increasing local habitat connectivity and facilitating various ecological processes such as, *inter alia*, fauna movement and dispersal. Many of the diverse fauna assemblages that are likely to occur in the study area, including many species of conservation concern, will depend on the continued integrity of on-site Mixed Dry Grassland habitat.

*Figure 3: Mixed Dry Grassland in the study area.*

### 5.1.2. Rocky Shrubland

Rocky Shrubland is a relatively small habitat unit that occurs along rocky hillside and ridges in the study area. Unlike adjacent areas of open grassland, this habitat unit is characterised by a notably higher abundance of indigenous woody vegetation, coupled with the presence of numerous large protruding rocks (Figure 4).

In line with Edwards (1983) structural classification, this habitat unit is defined as low- to short sparse shrubland, with woody vegetation growing as small trees and shrubs (typically < 3m in height). These typically grow in either dense, but spatially discrete aggregations around exposed rocks, or as scattered individuals within the broader grassland matrix.

The combination of indigenous woody vegetation and exposed rocks creates a distinctive rocky shrubland habitat that is relatively uncommon within the study area's typical open grassland dominated land cover. Accordingly, areas of Rocky Shrubland increase landscape-scale heterogeneity, and provide important niche habitat for a variety of flora and fauna, including species of conservation concern that have an affinity for more wooded and/or rocky areas.

*Figure 4: Rocky Shrubland.*

### 5.1.3. Moist Grassland (i.e., Wetland/Aquatic Habitats)

Moist Grassland habitat characterises wetland and riparian systems across the study area. Vegetation structure ranges from low- to tall closed grassland (*sensu*. Edwards 1983) (Figure 5), and although not widespread or abundant in most areas of Moist Grassland, alien woody vegetation is present and well-established at certain locations.

Moist Grasslands are also functionally very important for fauna SCC. They provide essential resource habitat for feeding, sheltering and hunting, and serve as movement/dispersal corridors across the landscape. Moreover, rivers, streams and other aquatic features (farm dams) also provide key habitat for various aquatic and semi-aquatic fauna taxa.

*Figure 5: Moist grassland flanking an open water stream in the study area.*

### 5.1.4. Old Lands

As the name suggests, this habitat unit characterises old cultivated fields that have been left fallow, for several years, and as a result have subsequently regenerated to a secondary grassland community. As such, this is considered a modified habitat unit.

Vegetation structure is low closed grassland (*sensu*. Edwards, 1983). Compositionally, compared to natural grasslands, Old Lands are depleted of nutrients and thus floristically depauperate. Dominant grass species recorded in this unit during the field survey include *inter alia*; tall, robust thatching grasses and early-seral taxa (Figure 6).

Despite past disturbances and a secondary vegetation community, Old Lands can retain some of the functional attributes of natural grasslands, and therefore these areas can constitute habitat for some fauna species.

*Figure 6: Old Land dominated by Hyparrhenia grass species.*

### 5.1.5. Cultivated Fields

Large portions of the study area are dominated by cultivated agricultural fields, which is considered a modified habitat type. Cultivated Fields include both pivot-irrigated crop fields and dry-land crop fields (Figure 7). These are typically under maize production, and are regularly disturbed through ploughing and harvesting.

This habitat unit also includes open fields that are actively-managed as grass pastures. Unlike areas of natural grassland, grass pastures are often fertilised, and regularly mown and baled to provide reserve forage for livestock during the dry season.

Although certain fauna species may move through or periodically forage in Cultivated Fields, due to the high-level of ongoing disturbance and modification, they are not considered important fauna life-cycle habitats.

*Figure 7: Cultivated Field.*

### 5.1.6. Alien Tree Plantations

Alien Tree Plantations is a broad-term to describe the numerous and localised stands of alien woody vegetation in the study area. These stands range from narrow wind-rows (typically associated with farms residences and farm roads) to defined plantation-type stands and informal thickets. Alien Tree Plantations are a modified habitat type.

Vegetation structure is defined as short- to tall closed woodland (*sensu*. Edwards, 1983). Dominant alien tree species include alien *Eucalyptus, Acacia* (wattle) and *Populus* (e.g., *Populus x canescens*) species. Little indigenous vegetation is present in dense, well-established Alien Tree Plantations, with herbaceous flora typically supressed or in most cases, largely absent (Figure 8).

Alien Tree Plantations may be used as refuge habitats by fauna that are sensitive to hunting and other forms of anthropogenic disturbance. They may also be used as roosting/nesting habitat by *inter alia* raptors.

*Figure 8: Alien Tree Plantations.*

# 6. Fauna Assessment

## 6.1. Mammals

### 6.1.1. Mammal Species Richness and Habitat Availability

Nineteen mammal species were recorded in the study area during the field survey. These are listed in Table 4, with Figure 9 to Figure 16 showing select photographs of mammals (or evidence of their presence) taken in the study area.

The recorded mammal's range in size from small rodents to medium-sized antelope, and include herbivores, carnivores and omnivores. Apart from Blesbok (*Damaliscus pygargus phillipsi*), which is a managed taxon (i.e. actively bred and managed by local farmers), all recorded taxa are free-roaming species, i.e., part of self-sustaining populations that are able move freely across the landscape, and occur naturally in the Mpumalanga Highveld grasslands.

According to a review of historic distribution range maps presented in Stuart & Stuart (2007) and Child *et al*., (2016), up to 70 mammal species have distribution ranges that overlap with the study area and therefore potentially occur in the study area (listed in Appendix C). Of these, MammalMAP records indicate that 23 mammal species have previously been reported for the 2629BD and 2629BC QDS (Fitzpatrick Institute of African Ornithology, 2023).

The extent of natural habitat across the study area, coupled with the confirmed presence of free-roaming medium-sized taxa, such as the two Reedbuck species, indicates that the study area possesses a diversity of functional habitats, that are in good condition, and characterised by a high-level of connectivity. This suggests that the study area likely supports a rich mammal community, that approximates a present-day reference assemblage for the region.

*Table 4: Mammal species recorded in the study area during the field survey.*

| Family | Scientific Name | Common Name | 2024 Field Survey |
|---|---|---|---|
| Bovidae | *Damaliscus pygargus phillipsi* | Blesbok | Visual observation |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Tracks |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Visual observation |
| Bovidae | *Raphicerus campestris* | Steenbok | Anecdotal evidence* |
| Canidae | *Canis mesomelas* | Black-backed Jackal | Camera trap data<br>Tracks |
| Erinaceidae | *Atelerix frontalis* | South African Hedgehog | Anecdotal evidence |
| Felidae | *Leptailurus serval* | Serval | Camera trap data |
| Felidae | *Caracal caracal* | Caracal | Anecdotal evidence |
| Herpestidae | *Atilax paludinosus* | Water Mongoose | Tracks<br>Camera trap data |
| Herpestidae | *Cynictis penicillata* | Yellow Mongoose | Visual observation |
| Herpestidae | *Herpestes sanguineus* | Slender Mongoose | Camera trap data |
| Herpestidae | *Suricata suricatta* | Suricate | Visual observation |
| Hystricidae | *Hystrix africaeaustralis* | Cape Porcupine | Scat |
| Leporidae | *Lepus saxatilis* | Scrub Hare | Visual observation |
| Mustelidae | *Aonyx capensis* | Cape Clawless Otter | Tracks |
| Mustelidae | *Mellivora capensis* | Honey Badger | Anecdotal evidence |
| Soricidae | *Crocidura mariquensis*[#] | Swamp Musk Shrew | Sherman trapping |
| Suidae | *Potamochoerus larvatus* | Bushpig | Anecdotal evidence |
| Viverridae | *Genetta genetta* | Small-spotted Genet | Camera trap data |
| *Anecdotal evidence is based on an interview with local farmer Mr. J. Jacobsz | | | |
| [#] Identified by the Small Mammal Department at Ditsong Museum of Natural History. Catalogue No. TM 50905. | | | |

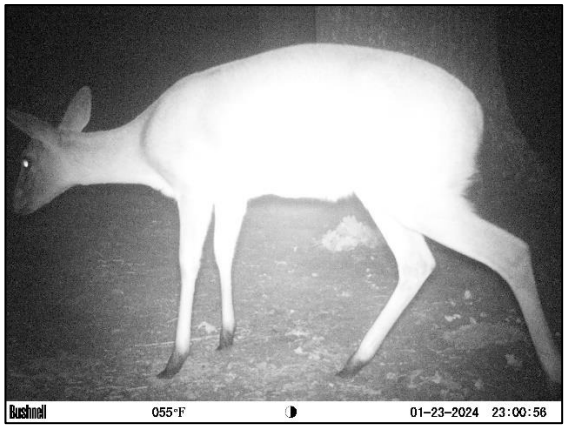



*Figure 9: Common Duiker (Sylvicapra grimmia).*


*Figure 10: Black-backed Jackal (Canis mesomelas).*


*Figure 11: Serval (Leptailurus serval).*


*Figure 12: Slender Mongoose (Herpestes sanguineus).*


*Figure 13:* Yellow Mongoose (*Cynictis penicillata*).


*Figure 14: Small-spotted genet (Genetta genetta).*


*Figure 15: Water Mongoose (Atilax paludinosus)*

*Figure 16: Cape Clawless Otter (Aonyx capensis) track*

### 6.1.2. Mammal Species of Conservation Concern

Four mammal species that were recorded in the study area during the field survey are listed as threatened or Near Threatened on the national mammal Red List (Child *et al.*, 2016), namely the Mountain Reedbuck (*Redunca fulvorufula fulvorufula*), Serval (*Leptailurus serval*), Cape Clawless Otter (*Aonyx capensis*) and Swamp Musk Shrew (*Crocidura mariquensis*). These are discussed in more detail in the subsections below.

Also discussed in more detail are the three mammal species that were highlighted by the web-based screening tool as potentially sensitive features for the study area, namely the Maquassie Musk Shrew (*Crocidura maquassiensis*), Spotted-necked Otter (*Hydrictis maculicollis*) and Oribi (*Ourebia ourebi ourebi*).

It is noted that reviewed literature and datasets also indicate that an additional 24 mammal SCC potentially occur in the study area. These are listed in Table 5Table 5: Mammal species of conservation concern occurring or potentially occurring in the study area., along with their national and provincial conservation statuses, habitat preferences and a 'probability of occurrence', based on field observations or habitat suitability assessments.

#### *6.1.2.1.Mountain Reedbuck*

The Mountain Reedbuck is listed as Endangered on the regional Red List (Taylor *et al.*, 2016a). This medium-sized grazing antelope favours rolling grassy hillsides and mountain slopes above 1 500 m (Estes, 1991). Mountain Reedbuck are territorial and gregarious, and found in small herds ranging from 3 to 6 individuals (Taylor *et al.*, 2016a). The estimated regional population size of Mountain Reedbuck is between 10 217 and 13 669 mature individuals, with purported densities in protected areas ranging from 10 to 1 150 individuals per 100 $km^2$ (Taylor *et al.*, 2016a). It is noted that no data are cited for private agriculture land. Moreover, no data are available on the EOO or AOO of this species. The primary threats to Mountain Reedbuck include poaching, increased natural predation, and disturbance from cattle herders and livestock (Taylor *et al.*, 2016a).

A single Mountain Reedbuck was observed in Mixed Dry Grassland habitat in the centre of the study area. It is expected that this individual is likely part of a small breeding herd. Considering the Red List status of this species (i.e., Endangered), the conservation importance of Mountain Reedbuck in the study area is considered high.

#### 6.1.2.2.Serval

The Serval (Near Threatened) is a small feline predator. They are solitary and territorial, and favour wetland, tall grassland and well-watered savanna habitats (Ramesh, *et al.*, 2016). Population densities range from 0.1 to 1.5 individuals per km$^2$, with a regional population estimated at 10 264 ±812 individuals (Ramesh, *et al.*, 2016). This species is frequently found in farmland and mining/industrial land, provided sufficient suitable habitat is present and levels of persecution remain low (Ramesh, *et al.*, 2016). Indeed, the highest known Serval densities (between 76.20 - 101.21 animals per 100 km$^2$) were recorded at an industrial site 50 km west of the study area (Loock, *et al*, 2018). Serval were recorded on one camera trap along a stream in the study area during the field survey. It is likely that this species is abundant in Moist Grassland and adjacent Mixed Dry Grassland habitat in the study area.

#### 6.1.2.3.Cape Clawless Otter

Cape Clawless Otter is listed as Near Threatened on the regional Red List (Okes, *et al*., 2016). This species has a fairly widespread, but patchy distribution. Population estimates range from 21 500 to 30 276 animals, with mature individuals numbering between 16 552-19 377 (Okes, *et al*., 2016). The Cape-clawless Otter is an aquatic species that is rarely found far from permanent water (Okes, *et al*., 2016). It favours riverine habitats, characterised by large rocks, dense vegetation and large areas of long grass (Okes, *et al*., 2016). Cape-clawless Otter tracks were observed along a stream channel in the centre of the study area (Figure 16). It is likely that this species is fairly abundant in areas of suitable aquatic habitat (e.g., streams and farm dams) in the study area.

#### 6.1.2.4. Swamp Musk Shrew

The Swamp Musk Shrew is listed as Near Threatened on the regional Red List (Taylor, *et al.,* 2016b). This species occurs in a patchy distribution across the eastern half of South Africa, with an inferred EOO of 397 992 km$^2$ (Taylor, *et al.,* 2016b). Applying a 500 m buffer to suitable habitat, the calculated AOO is estimated at between 50 377-63400 km$^2$. With a more restrained buffer of 32 m, the AOO is estimated at 2 395 - 2 794 km$^2$ (Taylor, *et al.,* 2016b). The preferred habitat of Swamp Musk Shrew is reedbeds, wetlands and thick moist grassland in riverine habitats, and it can be locally common and abundant (Taylor, *et al.,* 2016b). A single Swamp Musk Shrew was recorded in Moist Grassland habitat in the study area during the field survey (Catalogue No. TM 50905[1]).

#### 6.1.2.5.Spotted-necked Otter

Spotted-necked Otter is listed as Vulnerable on the regional Red List (Ponsonby, *et al*., 2016). This species has a widespread distribution, but is restricted to areas of permanent, large open-water bodies (Ponsonby, *et al*., 2016). The estimated range of Spotted-necked Otter totals 31 407 km of river, resulting in an estimated population size (taking into account both undisturbed and disturbed river habitats), of approximately 17 117 individuals (Ponsonby, *et al*., 2016). The numerous open water farm dams in the study area provide suitable habitat for this species, and therefore it is probable that Spotted-necked Otter is present.

#### 6.1.2.6.Maquassie Musk Shrew

Maquassie Musk Shrew (Vulnerable) is a rare shrew species. The EOO is estimated at 284 735 km$^2$; however, it is thought to be patchily distributed and, based on its preference for wetland habitats, its AOO is inferred at between 40 496 to 47 246 km$^2$ and 1 790-2 089 km$^2$ (based on a 500 and 32 m

[1] Ditsong Museum of Natural History

buffer around wetland habitat, respectively) (Taylor *et al*., 2016c). The population size of Maquassie Musk Shrew is estimated at 179 000 individuals. This species appears to favour moist grassland habitats in savanna and grassland ecosystems (Taylor *et al*., 2016c). Suitable habitat is present in the study area, but this species has not been recorded in Mpumalanga since 1999 (Taylor *et al*., 2016c). It is therefore considered unlikely that Maquassie Musk Shrew is present on-site.

#### *6.1.2.7.Oribi*

The Oribi (Endangered) is a medium-sized, territorial grazing antelope. They live in monogamous pairs, with a tendency to polygyny (Estes, 1991). They have a widespread, but patchy distribution across their range, and their regional population is facing increasing fragmentation (Schrader *et al*., 2016). Oribi densities vary considerably depending on habitat suitability, but in areas where this species is uncommon, its density ranges from 0.1 to 0.4 animals per $km^2$ (Schrader *et al*., 2016). The minimum estimated population size of Oribi in South Africa is 3 098 individuals, with approximately 274 occurring on private land in Mpumalanga (Schrader *et al*., 2016). The AOO of Oribi is estimated at 158.61 $km^2$ (SANBI, 2020). This species favours short open grassland and floodplains, with patches of taller grass (Schrader *et al*., 2016). Although suitable habitat is present in the study area, during interviews local farmers indicated they have never observed this species on their farms. It is therefore considered unlikely/possible that Oribi are present.

*Table 5: Mammal species of conservation concern occurring or potentially occurring in the study area.*

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Bathyergidae | *Cryptomys hottentotus* | Common Mole-rat | Data Deficient | - | Data Deficient | Prefers deep sandy soils along rivers and in montane areas. | Probable – suitable habitat present. |
| Bovidae | *Connochaetes gnou* | Black Wildebeest | Least Concern | Protected | - | Open grassland plains and arid shrubland. | Unlikely - some suitable habitat present, but an actively managed taxon. |
| Bovidae | *Ourebia ourebi ourebi* | Oribi | Endangered | Endangered | Endangered / Protected | Short open grassland, with patches of taller grass. | Unlikely/Possible - suitable habitat present. |
| Bovidae | *Pelea capreolus* | Grey Rhebok | Near Threatened | - | Protected | Sourveld grassland and scrubland in hills and mountainous areas. | Probable – suitable habitat present. |
| Bovidae | *Raphicerus campestris* | Steenbok | Least Concern | - | Protected | Range of habitats, including grassland and savanna. | Recorded |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Least Concern | Protected | Protected | Savanna and grassland habitats in mountainous areas. | Recorded |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Endangered | - | Protected | Rolling grassy hillsides and mountain slopes. | Recorded |
| Canidae | *Vulpes chama* | Cape Fox | Least Concern | Protected | - | Range of habitats, including grassland and arid savanna. | Possible - suitable habitat present. |
| Chrysochloridae | *Amblysomus robustus* | Robust Golden Mole | Vulnerable | Endangered | Vulnerable | Sandy soils in grassland areas. | Possible - suitable habitat present. |
| Chrysochloridae | *Amblysomus septentrionalis* | Highveld Golden Mole | Near Threatened | - | Near Threatened | Sandy soils in grassland areas. | Possible - suitable habitat present. |
| Chrysochloridae | *Chrysospalax villosus* | Rough-haired Golden Mole | Vulnerable | Critically Endangered | - | Sandy soils in grassland areas. | Possible - suitable habitat present. |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Felidae | *Felis nigripes* | Black-footed Cat | Vulnerable | Protected | Near Threatened | Open short grass areas in savanna and grassland habitats. | Possible - suitable habitat present. |
| Felidae | *Leptailurus serval* | Serval | Near Threatened | Protected | Near Threatened | Wetland, tall grassland and well-watered savanna habitats. | Recorded |
| Felidae | *Panthera pardus* | Leopard | Vulnerable | Vulnerable | Near Threatened | Wide range of habitats, including grassland and savanna. | Unlikely– suitable habitat present, but a large and shy predator that is vulnerable to human persecution. |
| Hyaenidae | *Parahyaena brunnea* | Brown Hyaena | Near Threatened | Protected | Near Threatened / Protected | Savanna and grassland habitats. | Possible – suitable habitat present, but a large and shy predator that is vulnerable to human persecution. |
| Hyaenidae | *Proteles cristata* | Aardwolf | Least Concern | - | Protected | Savanna and grassland habitats. | Probable - suitable habitat present. |
| Muridae | *Dasymys incomtus* | African Marsh Rat | Near Threatened | - | Near Threatened | Moist grassland and wetland habitats. | Probable - suitable habitat present. |
| Muridae | *Otomys auratus* | Vlei Rat (Grassland type) | Near Threatened | - | - | Moist grassland and wetland habitats. | Probable - suitable habitat present. |
| Mustelidae | *Aonyx capensis* | Cape Clawless Otter | Near Threatened | Protected | Protected | Riparian habitats, with permanent water. | Recorded |
| Mustelidae | *Hydrictis maculicollis* | Spotted-necked Otter | Vulnerable | Protected | Near Threatened / Protected | Riparian habitats, favouring large, open water bodies. | Probable - suitable habitat present. |
| Mustelidae | *Mellivora capensis* | Honey Badger | Least Concern | Protected | Near Threatened / Protected | Savanna and grassland habitats | Recorded |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Orycteropodidae | *Orycteropus afer* | Aardvark | Least Concern | - | Protected | Savanna and grassland habitats. | Probable - suitable habitat present. |
| Muridae | Mystromys albicaudatus | White-tailed Rat | Vulnerable | - | Vulnerable | Known from calcrete soils sites in grassland habitat. | Unlikely – limited suitable habitat present |
| Soricidae | *Crocidura maquassiensis* | Maquassie Musk Shrew | Vulnerable | - | Vulnerable | Moist grassland habitats in savanna and grassland ecosystems. | Unlikely - suitable habitat present, but no recent records in Mpumalanga |
| Soricidae | *Crocidura mariquensis* | Swamp Musk Shrew | Near Threatened | - | Near Threatened | Reedbeds, wetlands and thick moist grassland in riverine habitats. | Recorded |
| *Habitat preferences as per Stuart and Stuart (2007) and Child *et al.,* (2016). | | | | | | | |

## 6.2. Birds

### 6.2.1. Bird Species Richness and Habitat Availability

*A separate Avifauna Specialist Assessment has been undertaken for the proposed Project. This section therefore provides only high-level comment on bird species, and specifically any SCC opportunistically observed on-site during the field survey. For additional detailed information on birds, refer to the Avifauna Specialist Assessment Report.*

The study area is located within the Amersfoort-Bethal-Carolina District Important Bird Area (IBA) (SA018). This IBA is 343 320 ha in extent and extends from Carolina in the north to Bethal in the east, and southward through Ermelo to Amersfoort (Marnewick, *et al*., 2015).

According to Marnewick, *et al*., (2015), the region has a potentially rich bird assemblage, which includes several globally threatened trigger species occur including, *inter alia*, Botha's Lark (*Spizocorys fringillaris*), Blue Crane (*Grus paradisea*), Southern Bald Ibis (*Geronticus calvus*), Black Harrier (*Circus maurus*), Black-winged Pratincole (*Vanellus melanopterus*), Secretary Bird (*Sagittarius serpentarius*) and Martial Eagle (*Polemaetus bellicosus*).

Data retrieved from SABAP 2 indicates that up to 134 bird species have previously been recorded in the primary pentads that encompass the study area.

### 6.2.2. Bird Species of Conservation Concern

During the 2024 field survey, six bird SCC were noted in the study area based on opportunistic observations, including the Blue Crane (*Anthropoides paradiseus*), Lesser Flamingo (*Phoeniconaias minor*), Greater Flamingo (*Phoenicoperus roseus*), Southern Bald Ibis (*Geronticus calvus*), Yellow-billed Stork (*Mycteria ibis*) and Blue Korhaan (*Eupodotis caerulescens*).

These SCC are discussed in more detail in the subsections below, along with the four bird taxa highlighted by the national web-based screening tool as potentially sensitive features for the study area, i.e., the Secretary Bird (*Sagittarius serpentarius*), White-bellied Bustard (*Eupodotis senegalensis*), Caspian Tern (*Hydroprogne caspia*) and African Marsh Harrier (*Circus ranivorus*).

Based on the SABAP 2 records, it is also noted that 22 additional bird species that have previously been documented in the landscape surrounding the study area are of conservation concern. These are listed in Table 6, along with their national and provincial conservation statuses, habitat preferences and a 'probability of occurrence' - based on habitat suitability assessments.

#### *6.2.2.1.Blue Crane*

The Blue Crane is listed as Near Threatened on the regional bird Red List (Shaw, 2015), but it is listed as Endangered on the NEMBA ToPS List (2007) and Vulnerable on the Mpumalanga Provincial Red List. This species is near endemic to South Africa, with a regional population estimated at approximately 21 000 mature individuals, of which, about 2 600 occur in the eastern grasslands of Mpumalanga, KwaZulu-Natal and north-eastern Free State (Shaw, 2015). Blue Crane favour dry grasslands, but are also known to utilise pastures and crop fields (Shaw, 2015). This species was observed in grassland habitat in the study area during the 2024 field survey (Figure 17).

*Figure 17: Blue Crane (Grus paradisea) photographed in the study area during the 2024 field survey.*

#### *6.2.2.2.Southern Bald Ibis*

Southern Bald Ibis is listed as Vulnerable on both the regional bird Red List (Henderson, 2015) and on the NEMBA ToPS List (2007). This species is endemic to the region, and available estimates indicate the existence of approximately 1 825 breeding pairs and about 3 290 mature individuals (Henderson, 2015). The AOO is estimated at 33 362.67 km$^2$ (SANBI, 2020). Southern Bald Ibis favour high-altitude grassland and wetland habitats (Henderson, 2015). They have also been known to use sports fields, golf courses and grass pastures (Henderson, 2015). A large group of Southern Bald Ibis was recorded in moist grassland in the study area during the 2024 field survey.

#### *6.2.2.3.Blue Korhaan*

The Blue Korhaan is listed as Least Concern on the regional bird Red List (Taylor, *et al*., 2015), but it is listed as Vulnerable on the NEMBA ToPS List (2007) and Near Threatened on the Mpumalanga Provincial Red List. This species favours open grassland habitats, and was recorded in the study area during the 2024 field survey.

#### *6.2.2.4.Lesser Flamingo*

The Lesser Flamingo (Near Threatened) occurs throughout sub-Saharan Africa. In South Africa, it's non-breeding range is centred on the Highveld (McCulloch, *et al*., 2015). The South African population of Lesser Flamingo is estimated at anywhere between 40 000 and 60 000 birds, although this may be an underestimate. This species is a colonial nester (McCulloch, *et al*., 2015). Lesser Flamingo favour open, eutrophic and shallow saline wetland habitats, including inland pans, coastal lagoons and estuaries (McCulloch, *et al*., 2015). Lesser Flamingo were observed at a farm dam, immediately adjacent to the study area.

#### *6.2.2.5.Greater Flamingo*

The Greater Flamingo is listed as Near Threatened on the regional bird Red List (Anderson, 2015). This species occurs throughout Africa, and is fairly common on the central plateau (Anderson, 2015). The South Africa population of Greater Flamingo is estimated at between 50 000 and 60 000 birds (Anderson, 2015). Greater Flamingo favour saline or brackish shallow pans, large dams and coastal mudflats (Anderson, 2015). Greater Flamingo were observed at a farm dam in the centre of the study area.

#### *6.2.2.6.Yellow-billed Stork*

The Yellow-billed Stork is listed as Endangered on the regional bird Red List (Evans, 2015). This species occurs throughout sub-Saharan Africa. The regional population is estimated at between 150-350

individuals, although large fluctuations in bird number are likely (Evans, 2015). Yellow-billed Stork favour seasonal and permanent wetland habitats, where open, shallow water free of vegetation is present (Evans, 2015). Two Yellow-billed Stork were observed at a large dam in the study area during the field survey (shown in Figure 18).

*Figure 18: Yellow-billed Stork (Mycteria ibis) photographed in the study area during the 2024 field survey.*

#### *6.2.2.7.Secretary Bird*

Secretary Bird is listed as Vulnerable on the regional bird Red List (Retief, 2015). Population estimates vary; however, the South Africa population is estimated at between 3 500 and 5 000 mature individuals (Retief, 2015). Secretary Bird favour open grassland and scrub, with scattered trees to use as roosting and nesting sites (Retief, 2015). The AOO for this species is 27 547.79 km$^2$ (SANBI, 2020). Suitable habitat is present in the study area, and it is therefore probable that Secretary Bird is present.

#### *6.2.2.8.White-bellied Bustard*

The White-bellied Bustard is listed as Vulnerable on the regional bird Red List (Du Plessis, *et al*., 2015). It is patchily distributed across West Africa and eastern South Africa and has a AOO of 67 249 km$^2$ (Du Plessis, *et al*., 2015). White-bellied Bustard favour tall dense grassland and occasionally ecotones between savanna and fynbos (Du Plessis, *et al*., 2015). It has also been known to occur in cultivated grass pastures and recently harvested crop fields. In suitable habitat it has an estimated population density of 2-2.5 birds per km$^2$ (Du Plessis, *et al*., 2015). Suitable habitat is present in the study area, and it is therefore probable that White-bellied Bustard is present.

#### *6.2.2.9.Caspian Tern*

Caspian Tern is listed as Vulnerable on the regional bird Red List (Ortman, *et al*., 2015). The global population of Caspian Tern is estimated at 420 000 mature individuals; however, the regional population comprises only a small portion of this, with an estimated 300-316 breeding pairs (Ortman, *et al*., 2015). At inland locations, this species' breeding sites include large natural and man-made water bodies (dams) (Ortman, *et al*., 2015). Suitable habitat is present in the study area, and it is therefore probable that this species is present.

#### *6.2.2.10. African Marsh Harrier*

African Marsh Harrier is listed as Endangered on the regional bird Red List (Taylor, 2015) and the Mpumalanga Provincial Red List. The estimated South Africa population is between 3 500 and 4 500 mature individuals (Taylor, 2015). It is sparsely distributed across central, and east and southern Africa and has a AOO of 12 615.35 km$^2$ (SANBI, 2020). African Marsh Harrier occur in permanent wetland habitats and are known to forage over dry floodplains, grassland and crop fields (Taylor, 2015).

Suitable habitat is present in the study area, and it is therefore probable that African Marsh Harrier is present.

*Table 6: Bird species of conservation concern recorded / potentially occurring in the study area*

| Family | Scientific Name | Common Name | Regional Red List (2015) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Accipitridae | *Circus maurus* | Black Harrier | Endangered | - | Endangered | Riparian and wetland habitats. | Probable – suitable habitat present. |
| Accipitridae | *Circus ranivorus* | African Marsh Harrier | Endangered | Protected | Endangered | Wetlands and reedbeds. | Probable – suitable habitat present. |
| Accipitridae | *Circus macrourus* | Pallid Harrier | Near Threatened | - | Near Threatened | Grasslands, with open pans and floodplains, as well as crop fields. | Probable – suitable habitat present. |
| Alaudidae | *Spizocorys fringillaris* | Botha's Lark | Endangered | - | Endangered | Short dense and heavily grazed grasslands on plateaus and hill slopes | Probable – suitable habitat present. |
| Anatidae | *Oxyura maccoa* | Maccoa Duck | Near Threatened | - | Near Threatened | Deep water bodies with emergent vegetation. | Probable – suitable habitat present. |
| Ciconniidae | *Mycteria ibis* | Yellow-billed Stork | Endangered | - | Endangered | Seasonal and permanent wetland habitats | Recorded |
| Coraciidae | *Coracias garrulus* | European Roller | Near Threatened | - | Near Threatened | Open woodland. | Possible – limited suitable habitat present. |
| Falconidae | *Falco biarmicus* | Lanner Falcon | Vulnerable | - | Vulnerable | Range of habitats, including open grassland and savanna. | Probable – suitable habitat present. |
| Falconidae | *Falco vespertinus* | Red-footed Falcon | Near Threatened | - | - | Open semi-arid and arid grasslands and savanna | Probable – suitable habitat present. |
| Gruidae | *Grus paradisea* | Blue Crane | Near Threatened | Endangered | Vulnerable | Grassland and wetland habitats. | Recorded |
| Gruidae | *Grus carunculata* | Wattled Crane | Critically Endangered | Critically Endangered | Critically Endangered | Grassland and wetland habitats. | Probable – suitable habitat present. |

| Family | Scientific Name | Common Name | Regional Red List (2015) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Laridae | *Hydroprogne caspia* | Caspian Tern | Vulnerable | - | Endangered | Inland habitats include large natural and man-made water bodies. | Probable – suitable habitat present. |
| Otididae | *Eupodotis caerulescens* | Blue Korhaan | - | Vulnerable | Near Threatened | Range of habitats, including grassland. | Recorded |
| Otididae | *Eupodotis senegalensis* | White-bellied Bustard | Vulnerable | - | Vulnerable | Tall dense grassland and savanna. | Probable – suitable habitat present. |
| Phoenicopteridae | *Phoeniconaias minor* | Lesser Flamingo | Near Threatened | - | Near Threatened | Shallow wetland habitats and saltpans. | Recorded |
| Phoenicopteridae | *Phoenicopterus roseus* | Greater Flamingo | Near Threatened | - | Near Threatened | Shallow wetland habitats and saltpans. | Recorded |
| Rostratulidae | *Rostratula benghalensis* | Greater Painted-snipe | Near Threatened | - | Vulnerable | Wetland habitats, with exposed muddy flats. | Probable – suitable habitat present. |
| Sagittariidae | *Sagittarius serpentarius* | Secretarybird | Vulnerable | - | Vulnerable | Open grassland and scrub with scattered trees. | Probable – suitable habitat present. |
| Threskiornithidae | *Geronticus calvus* | Southern Bald Ibis | Vulnerable | Vulnerable | Vulnerable | Grassland and wetland habitats. | Recorded |
| Tytonidae | *Tyto capensis* | African Grass Owl | Vulnerable | Vulnerable | Vulnerable | Tall rank grassland and short dense grassland. | Probable – suitable habitat present. |
| *Source: Habitat preferences as per Roberts VII Multimedia App. | | | | | | | |

## 6.3. Herpetofauna

### 6.3.1. Herpetofauna Richness and Habitat Availability

Herpetofauna observed in the study area during the field survey include the Common River Frog (*Amieta delalandii*), Water Monitor (*Varanus niloticus*) and Rinkhals (*Hemachatus haemachatus*). Anecdotal evidence from a local farmer indicate that other common encountered species include the Mole Snake (*Pseudaspis cana*) and Red-lipped Snake (*Crotaphopeltis hotamboeia*). These are all common and widespread species.

Considering the availability of suitable habitat, it is expected that several herpetofauna taxa are likely to be present. Key habitat for amphibians includes streams and farm dams in areas of moist grassland, while all grassland- and rocky shrubland habitats will be utilised by reptiles. Based on known distribution ranges presented in Du Preez and Carruthers (2009) and Bates *et al*., (2014), up to 24 amphibian- and 65 reptile species are known from the region in which the study area is located (Appendix E). Of these, FrogMAP and ReptileMAP records indicate that 12 amphibian and 16 reptile species have previously been recorded in the 2629BD and 2629BC QDS (Fitzpatrick Institute of African Ornithology, 2023) (also listed in Appendix E). The documented taxa are common species, with widespread distributions.

### 6.3.2. Herpetofauna Species of Conservation Concern

Seven reptile and two amphibian SCC potentially occur in the study area. These are listed in Table 7 and Table 8, along with their conservation status, habitat preferences and a probability of occurrence. None of these taxa are listed as threatened on the regional Red Lists. They are however listed as threatened or Near Threatened or the Mpumalanga Red List, with the Giant Bullfrog (*Pyxicephalus adspersus*) also listed as Protected on the NEMBA ToPS List (2007).

*Table 7: Reptile species of conservation concern potentially occurring in the study area.*

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Colubridae | *Dasypeltis inornata* | Southern Brown Egg-eater | Least Concern | - | Near Threatened | Moist savanna in rocky areas. | Probable – suitable habitat present. |
| Cordylidae | *Chamaesaura aenea* | Coppery Grass Lizard | Least Concern | - | Near Threatened | Grassy slopes and plateau. | Probable – suitable habitat present. |
| Lamprophiidae | *Amplorhinus multimaculatus* | Many-spotted Snake | Least Concern | - | Near Threatened | Reed beds, wetlands and riparian vegetation in grasslands. | Probable – suitable habitat present. |
| Lamprophiidae | *Homoroselaps dorsalis* | Striped Harlequin Snake | Least Concern | - | Near Threatened | Semi-fossorial, favouring abandoned termitaria in grassland. | Probable – suitable habitat present. |
| Lamprophiidae | *Homoroselaps lacteus* | Spotted Harlequin Snake | Least Concern | - | Near Threatened | Semi-fossorial, favouring sandy soils, abandoned termitaria and rocky areas. | Probable – suitable habitat present. |
| Lamprophiidae | *Lamprophis fuscus* | Yellow-bellied Snake | - | - | Near Threatened | Fairly widespread, but rarely encountered species. Favours abandoned termitaria. | Possible – suitable habitat present. |
| Scincidae | *Acontias breviceps* | Short-headed Legless Skink | Least Concern | - | Vulnerable | Fossorial and found in montane grassland. | Probable – suitable habitat present. |

*Habitat preferences as per Branch (1998) and Bates *et al.,* (2014).

*Table 8: Amphibian species of conservation concern potentially occurring in the study area.*

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Hyperoliidae | *Hyperolius semidiscus* | Yellow-striped Reed Frog | - | - | Vulnerable | Favours savanna habitats, where it occurs in dense reeds along rivers and pans. | Unlikely –limited suitable habitat present. |

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Pyxicephalidae | *Pyxicephalus adspersus* | Giant Bullfrog | Least Concern | Protected | Vulnerable | Shallow pans, wetland and rained-filled depressions in savanna and grassland. | Possible – suitable habitat present. |
| *Habitat preferences as per Du Preez and Carruthers (2009) and www.speciesstatus.sanbi.org | | | | | | | |

## 6.4. Invertebrates of Conservation Concern

Limited data are available on the invertebrate diversity of the study area and surrounding landscape. The invertebrate profiles on the Virtual Museum database lists 18 butterfly, one dragonfly, one scorpion and one spider for the 2629BD and 2629BC QDS (Fitzpatrick Institute of African Ornithology, 2023). Of these, two are of conservation concern, namely the Marsh Sylph (*Metisella meninx*) and the Golden Star-dust Baboon Spider (*Harpactira hamiltoni*).

The national environmental screening tool highlighted the Potchefstroom Blue (*Lepidochrysops procera*) as a potentially sensitive feature for the study area. These three SCC are discussed in more detail in the subsections below:

### 6.4.1. Potchefstroom Blue

The Potchefstroom Blue is a butterfly species that is listed as Rare in South Africa, and is endemic to the country. It is a habitat specialist that is known from only a few locations across an EOO of 93 799 km$^2$ (Dobson & Dobson, 2018). This species favours rocky areas in grassland, where it is dependent on the presence of the larval host plant *Ocimum obovatum*, and potentially also a host ant, *viz., Camponotus* species (Dobson & Dobson, 2018). The Potchefstroom Blue thrives in grasslands subject to annual winter fires (Dobson & Dobson, 2018). The larval host plant *Ocimum obovatum* was recorded in the study area during the field survey, and it is therefore possible that the Potchefstroom Blue is present.

### 6.4.2. Marsh Sylph

The Marsh Sylph is listed as Near Threatened. This butterfly species favours pristine wetland habitats, where it feeds on the host grass *Leersia hexandra* (Henning, 2018). It has an EOO of 80 348 km$^2$, but only occurs in small areas of suitable habitat across its range (Henning, 2018). The total population size is approximately 12 000 mature individuals, but each subpopulation only numbers about 250 individuals (Henning, 2018). Considering the availability of suitable moist grassland habitat, it is probable that this species is present in the study area

### 6.4.3. Golden Star-dust Baboon Spider

The Golden Star-dust Baboon Spider is listed as protected at both a provincial level according to Mpumalanga Nature Conservation Act (Act No. 10 of 1998), and at a national level according to the NEMBA ToPS (2007) List. According to the distribution maps in Dippenaar-Schoeman (2014) is known from grassland habitats, and suitable habitat is present in the study area. It is therefore probable that this species is present in the study area.

# 7. Key Ecological Attributes and Processes

## 7.1. Habitat Corridors, Resources and Refugia

The study area is a multi-functional landscape that is characterised by large areas of cultivation (Cultivated Fields), but also large intact areas of natural dry grassland and moist grassland habitat. Various forms of linear infrastructure, such as formal roads, farm tracks, farm fences and an old railway line, and the presence of modified habitat patches, have caused habitat fragmentation. However, it is noted that the general level of habitat connectivity across the study area and to the broader landscape surrounding the study area remains high.

On-site natural habitat patches provide a large network of dispersal and movement corridors for fauna, and the topographically-linked ecological productivity gradients of dry upland sites and moist low-lying sites (i.e. wetland and watercourses) also provide important and functionally-adaptive foraging resources for fauna. This will sustain local metapopulation dynamics and a diverse fauna community that includes several species of conservation concern.

Within the grassland-dominated habitat matrix, the altitudinal variability, exposed rocks and abundance of indigenous woody flora that defines the Rocky Shrubland habitat unit, also creates diverse and unique micro-habitats that significantly increase broader-scale habitat heterogeneity. This will increase local flora and fauna diversity by providing niche habitats for, amongst others, obligate and facultative rupicolous[2] and shrubland-favouring species that are unlikely to be resident in adjacent open grassland.

Although Alien Tree Plantations are considered a modified habitat type, it is also noted that within the context of generally grassland-dominated habitat-matrix, these tall, densely wooded areas are likely to provide a form of refuge (or sheltering) habitat for several fauna species that are sensitive to disturbance and/or are persecuted. They are also likely to provide important roosting and nesting habitat for raptors, amongst other bird species.

The proposed Project will impact local habitat connectivity through habitat loss and fragmentation, and this may affect various ecological processes, such as the movement and dispersal of flora (propagules and pollinators) and fauna across the landscape.

## 7.2. Dynamic Ecological Processes and Drivers of Change

The following notes summarise the key ecological processes and drivers of change that are present in the landscape and their possible influence on terrestrial fauna and in particular SCC.

### 7.2.1. Wildfire – Grassland Burning

Fire is a natural, albeit often human initiated, disturbance agent in grassland ecosystems. Mesic Highveld Grasslands are considered fire-prone and fire-dependent landscapes, and fire is essential to the maintenance of biodiversity patterns and ecological processes (SANBI, 2013). Wildfire's have several key ecological effects with respects to fauna, including:

- Removal of moribund vegetation and increasing plant productivity and palatability, which improves grazing for wild herbivores;
- Controls the encroachment of both alien and indigenous woody plant species and weeds; and
- Increases overall habitat heterogeneity by creating a structural mosaic of tall- and short grassland.

Notwithstanding the positive ecological benefits of fire, wildfires that are too frequent, or too intense, can have negative consequences for fauna populations. These include the killing of fauna species (typically slow-moving taxa, or taxa trapped by fences), and the homogenisation of on-site habitat, which can limit the availability of key adaptive resources.

Fire is considered an important driver of change in the study area. It is anticipated that the proposed Project may result in altered wildfire patterns across the study area due to increased habitat fragmentation. It is also possible however, that the number of accidental fires initiated from proposed

[2] Flora and fauna species that are specifically adapted to rocky habitat.

on-site Project infrastructure may increase. Changes in local fire may impact vegetation productivity, which may affect the local fauna and flora diversity community, including SCC.

### 7.2.2. Herbivory - Livestock Grazing and Trampling

High levels of grazing (overgrazing) and trampling by herbivores is a common cause of dryland degradation (Scholes, 2009). Overgrazing occurs when herbivores (both wildlife and domestic) are kept at excessive stocking rates and/or are able to concentrate their grazing to a limited foraging area, without suitable rest periods. A common degradation syndrome that is linked to overgrazing, at least in part, is a change in plant species composition. In grassland habitats, this typically manifests as a reduction in palatable grass species and a reduction in grassland productivity (Scholes, 2009), which can negatively affect local fauna communities. Excessive cattle grazing and trampling can also cause soil erosion and gulley formation, and modify and homogenise vegetation structure, which can potentially impact sensitive fauna species that have specific life-cycle habitat requirements.

Cattle grazing (Figure 19) and trampling are considered important drivers of change in the study area. However, it is anticipated that the proposed Project is unlikely to alter livestock grazing patterns in the study area.

*Figure 19: Cattle grazing is common in the study area.*

### 7.2.3. Alien Invasive Species Colonisation

Several alien tree plantations (e.g., *Eucalyptus* trees) and wattle infestations (*Acacia mearnsii* and *Acacia dealbata*) are present in the study area, and many disturbed sites (e.g., cultivated fields) are encroached by herbaceous alien invasive species (e.g., *Verbena bonariensis*). If not actively controlled, species such as wattle may spread into adjacent natural habitats, where they will shade-out and competitively exclude many indigenous species. This will have several deleterious impacts on the integrity and function of these habitats, such as *inter alia*:

- A loss of natural habitat and floristic diversity, with the resulting habitat patches unable to support diverse fauna communities;
- A reduction in grass productivity for grazing herbivores (e.g., Mountain Reedbuck), and
- Increased exposed soil surfaces and incidences of erosion.

The spread of alien invasive vegetation is therefore considered a significant driver of change in the study area and surrounding landscape, and one capable of negatively impacting SCC.

### 7.2.4. Subsistence Bushmeat Hunting

Small- and medium-sized antelope were recorded in the study area, and these species, amongst others, are frequently the target of subsistence bushmeat hunting. Common subsistence hunting techniques include the use of snares (which is essentially indiscriminate) and hunting dogs (which is partly discriminate). Local subsistence hunters with hunting dogs were observed in the study area during the field survey.

An escalation of bush-meat hunting is likely to negatively affect local fauna communities, with species like the Mountain Reedbuck (Endangered) particularly at risk. Subsistence bushmeat hunting is therefore regarded as a potential driver of change in the study area, which could impact certain mammals SCC.

An increase in on-site construction workers and contractors linked with the proposed Project may result in a temporary increase in levels of subsistence bushmeat hunting in the study area, and this will need to be correctly managed during Project implementation.

# 8. Analysis of Site Ecological Importance

The ecological importance (SEI) of identified habitat units in the study area were assessed using the SANBI (2020) protocol (refer to Section 3.4 and Appendix B for the methodology). The results of the assessment are presented in Table 9, and shown in Figure 20.

*Table 9: Site Ecological Importance of habitat unit in the study area*

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| Mixed Dry Grassland | HIGH: Highly likely occurrence of CR, EN, VU species (=Mountain Reedbuck, EN).<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type.<br>Good habitat connectivity with potentially functional ecological corridors.<br>BUT<br>Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Rocky Shrubland | HIGH: Highly likely occurrence of CR, EN, VU species (=Mountain Reedbuck, EN).<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Large (> 5 ha but <100 ha) intact area for any conservation status. Good habitat connectivity with potentially functional ecological corridors.<br>Only minor current negative ecological impacts with limited signs of major past disturbance and good rehabilitation potential. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Moist Grassland | HIGH: Highly likely occurrence of CR, EN, VU species (=Yellow-billed Stork, EN & Southern Bald Ibis, VU).<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type.<br>Good habitat connectivity with potentially functional ecological corridors.<br>BUT | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| | Soweto Highveld Grassland, VU). | Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | | | |
| Old Lands | LOW: No confirmed or highly likely populations of SCC or range-restricted species. | MEDIUM/LOW: Narrow corridors of good connectivity. Mostly minor current negative ecological impacts, BUT with major past impacts (i.e., former cultivation). | LOW | HIGH: Habitat that can recover relatively quickly to restore >75% of the original species composition and functionality | VERY LOW |
| Cultivated Fields | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |
| Alien Tree Plantations | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |

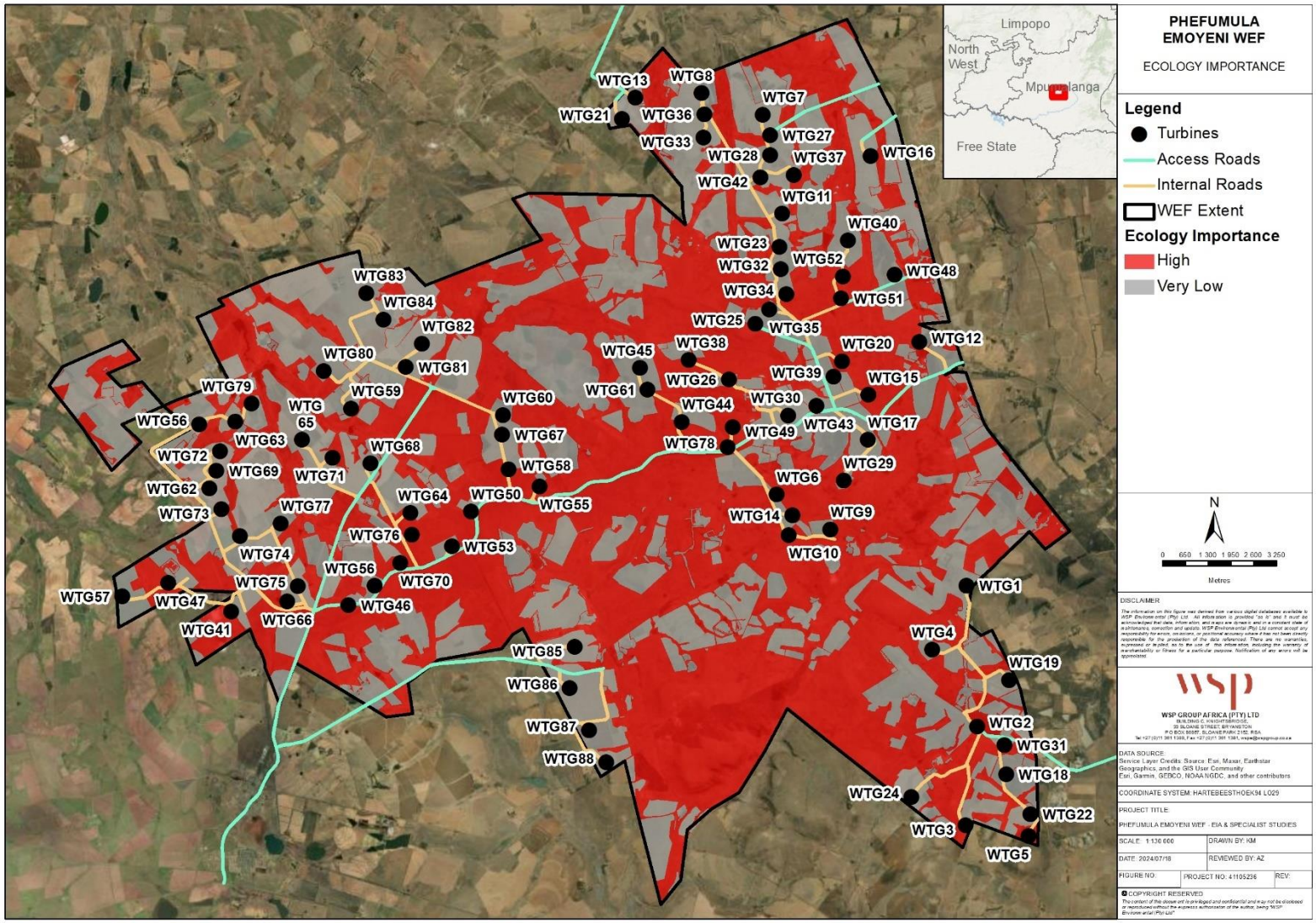



*Figure 20: Site Ecological Importance of the study area.*

# 9. Impact Assessment

## 9.1. Impact Assessment Methodology

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[3], indirect[4], secondary[5] as well as cumulative[6] impacts.

A standard risk assessment methodology is 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[7] presented in Table 10.

*Table 10: Impact Assessment Criteria and Scoring System*

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** 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 |
| **Impact Extent (E)** 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 |
| **Impact Reversibility (R)** 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 |

[3] Impacts that arise directly from activities that form an integral part of the Project.
[4] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[5] Secondary or induced impacts caused by a change in the Project environment.
[6] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects
[7] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Duration (D)** 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 |
| **Probability of Occurrence (P)** 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: | $[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | **4 to 15** | **16 to 30** | **31 to 60** | **61 to 80** | **81 to 100** |
| **Environmental Significance Rating (Negative (-))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |
| **Environmental Significance Rating (Positive (+))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |

## 9.2. 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 21 below.

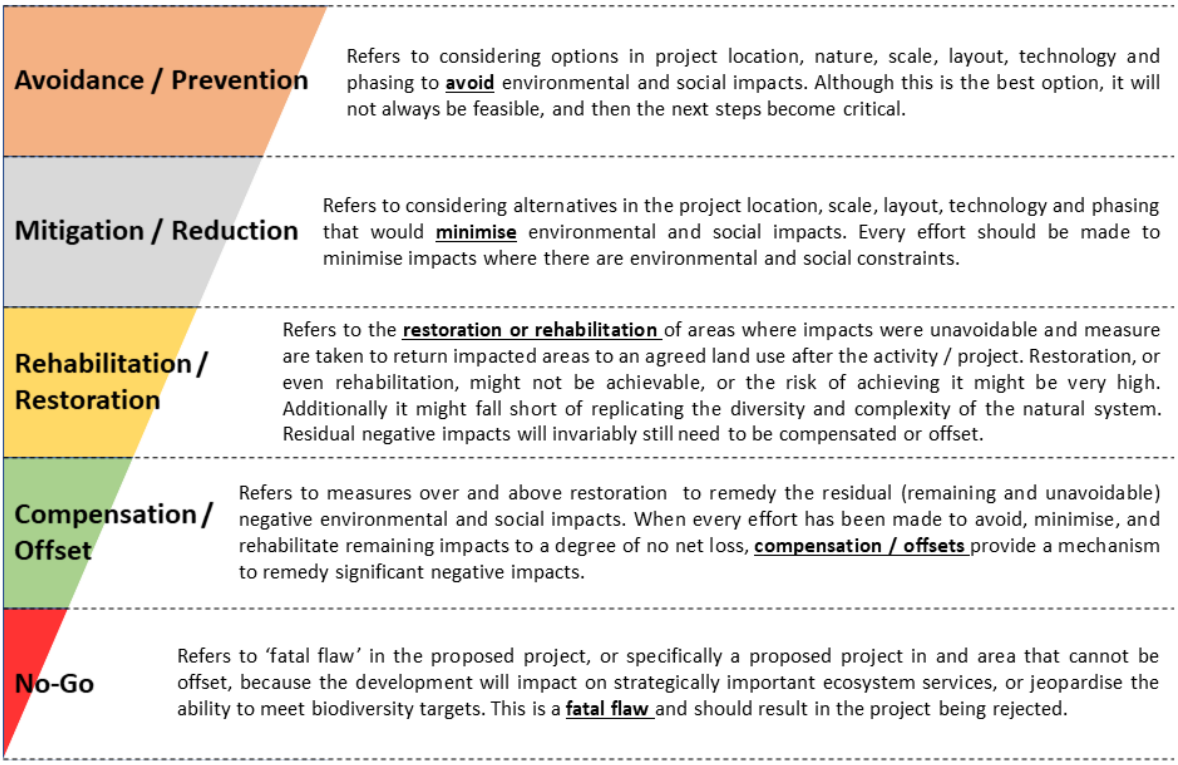



*Figure 21: Mitigation Sequence/Hierarchy*

A discussion on assessed impacts for each phase (i.e., Construction, Operational and Decommissioning) of the proposed Project is provided in the sections below, along with an analysis of anticipated cumulative impacts in Section 9.3.4. A summary table presented in Table 12.

## 9.3. Assessment of Impacts on Terrestrial Fauna

### 9.3.1. Construction Phase

#### *9.3.1.1.1. Direct loss and disturbance of natural habitat*

Habitat loss refers to the removal or complete degradation of natural habitat. In terrestrial ecosystems, this primarily occurs through vegetation clearing and bulk earth works during construction. Habitat disturbance refers to the modification of habitat to the extent that it loses important functionality. These impacts can negatively impact the viability of local fauna populations, including SCC.

Following the scoping phase identification of biodiversity sensitivities, the proposed Project layout was optimised to minimise impacts on identified sensitivities. This notwithstanding, the proposed Project will result in the clearing of natural vegetation for the installation of turbine infrastructure (hard standing footprint ˜75 m X 120 m) and the construction of the internal access roads (13 m width), amongst other planned infrastructure. An overlay of the current proposed Project layout (turbine footprints and access roads) on the habitat unit map is shown in Figure 22, with Table 11 presenting

an indication of the approximate infrastructure footprints spanning each habitat unit at the study area scale.

It is noted that 20 of the proposed 88 turbines are located fully or partly in areas of natural habitat, specifically Mixed Dry Grassland and Rocky Shrubland habitat. These comprise important habitats for fauna SCC. The remainder of the turbines are located in modified habitat (i.e., Cultivated Fields and Old Lands).

The impact prior to further mitigation is considered to be of very high magnitude. Duration of impact will be permanent, and habitat within and potentially adjacent to the development footprints (local) will be impacted. Probability is rated definite. This results in an impact of "high" significance.

Several management/mitigation measures can be taken to further minimise impact significance. These include: further repositioning turbines and internal roads where possible to avoid directly impacting Critical Biodiversity Areas[8]; in-field micro-siting of footprints to already disturbed sites; minimising disturbance footprints to the absolute necessary for construction and operational purposes; and, rehabilitating all disturbed areas after construction.

With the application of these, and other recommended mitigation measures, impact magnitude can be reduced to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to medium. This results in an after-mitigation impact of "Moderate" significance.

*Table 11: Indicative extent of possible impacts on the identified habitat units, based on the current proposed turbine and access road layout.*

| Habitat Unit | Approximate Extent of Possible Habitat Loss / Disturbance (Ha) |
|---|---|
| Alien Tree Plantations | 2.06 |
| Cultivated Fields | 128.27 |
| Mixed Dry Grassland | 104.91 |
| Moist Grassland | 5.93 |
| Old Lands | 18.67 |
| Rocky Shrubland | 1.22 |
| Transformed (e.g., farm houses and other built-infrastructure) | 0.62 |

[8] Refer to the Terrestrial Biodiversity Specialist Assessment report for further information of Critical Biodiversity Areas (CBA)

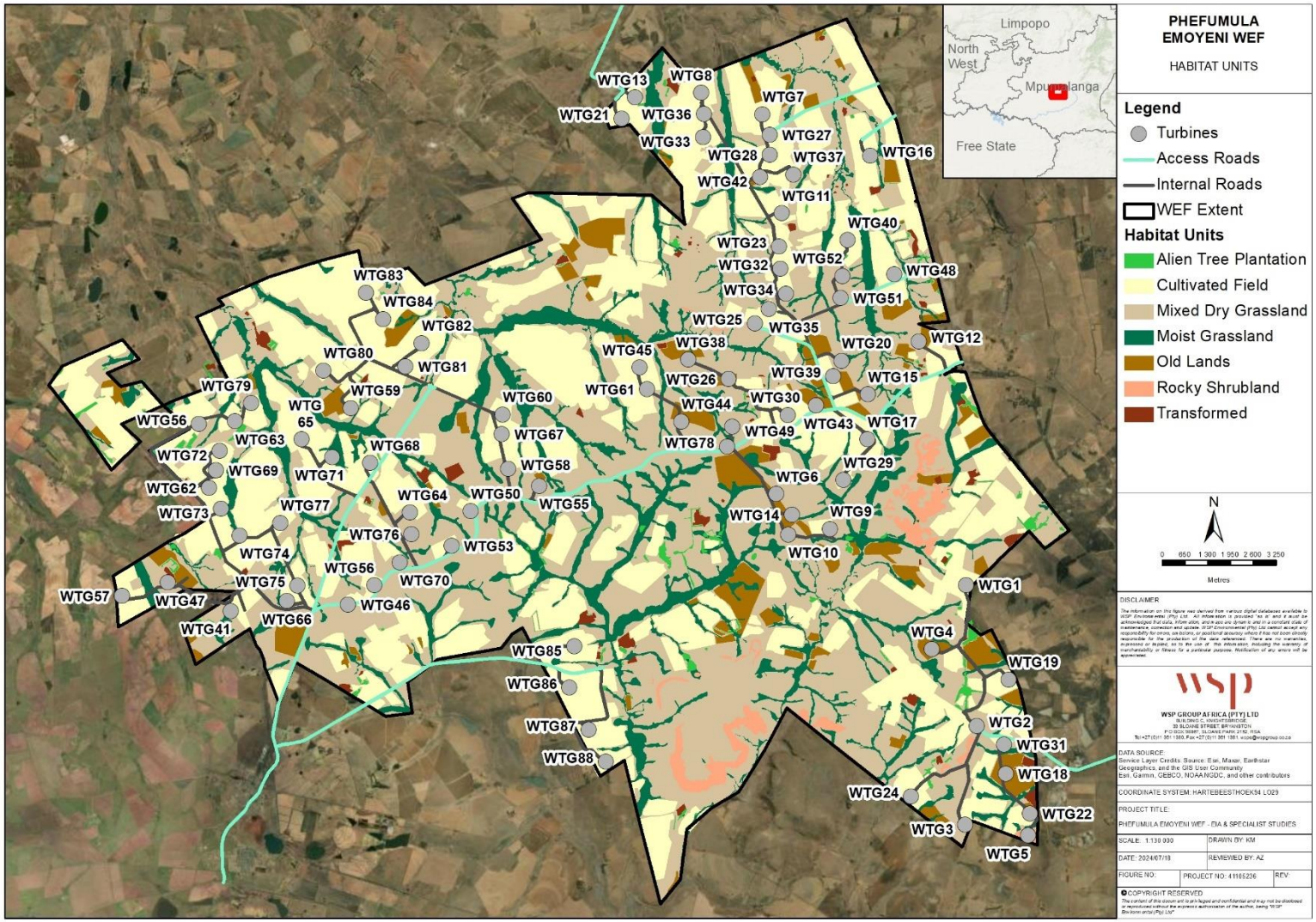



*Figure 22: Habitat units and the currently proposed infrastructure layout.*

#### *9.3.1.2. Fragmentation reducing natural habitat connectivity and integrity*

Habitat fragmentation is caused when vegetation clearing and/or the development of infrastructure (e.g., fences) result in the partitioning of habitat into smaller, discontinuous patches. This leads to altered habitat configuration that typically manifests as an increase in patch number and isolation, yet a decrease in overall patch size. These alterations change the ecological properties of remaining patches and can affect various ecological processes and metapopulation dynamics, such as fauna dispersal, movement and migration. This can, in turn, affect fauna species richness and population abundances.

The proposed internal access road network is likely to cause the fragmentation of areas of natural habitat within the study area, and this will have negative ecological impacts. During the planning stage, the internal access road layout was aligned with existing farm roads and tracks, and this will reduce possible fragmentation effects. However, fragmentation effects are likely to still occur as the new access roads will be more substantive than many of the existing farm roads and tracks.

Prior to mitigation, this impact is considered to be of very high magnitude, permanently affecting natural habitat within and potentially adjacent to the development footprint (local). It is also considered to have a definite probability, resulting in an impact of "High" significance.

With the application of mitigation measures, such as in-field micro-siting of internal access road footprints to already disturbed sites, and minimising the clearance footprint to the minimum area required for construction and operational purposes, and rehabilitating all disturbed footprints, impact magnitude can be reduced to medium. Duration can be reduced to the long-term, and probability to medium, but spatial scale will remain local. This results in a residual impact of "Moderate" significance.

#### *9.3.1.3.Injury, mortality and disturbance of fauna*

Large and mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes *inter alia*, burrowing mammals (e.g., rodents), reptiles and amphibians. Other common potential causes of fauna death, injury and disturbance during the construction phase may include:

- Vehicle collisions along construction and access roads;
- Hunting and snaring by construction workers;
- Trapping of fauna in excavations and trenches; and
- Excessive dust and noise from construction machinery may cause sensory disturbances.

The impact prior to mitigation is considered to be of high magnitude, and will affect fauna over the short term. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of "moderate" significance.

With mitigation, which includes *inter alia*, the active and correct management of all human-animal interactions, magnitude is reduced to low and probability of the impact can be reduced to low, and scale to the site only. This results in a residual impact of "Low" significance.

#### *9.3.1.4.Loss of fauna species of conservation concern*

Fauna SCC, such as Mountain Reedbuck and Serval, were observed on-site, and based on habitat suitability assessments, it is possible that several other SCC may be present. Proposed Project activities

may lead to the disturbance of fauna SCC through the loss of functional habitat or direct mortality (e.g., vehicle collisions, hunting and snaring).

The impact prior to mitigation is considered to be of very high magnitude, and will have a short-term impact on affect fauna SCC. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of "moderate" significance.

With mitigation, which includes a suite of measures to *inter alia*, limit habitat loss and disturbance and reduce direct mortality/disturbance, impact magnitude is reduced to high and probability of the impact can be reduced to low, and scale to the site only. This results in a residual impact of "Low" significance.

### 9.3.2. Operational Phase

Note: Impacts associated with fauna-wind turbine collisions will be assessed as part of separate avifauna and bat specialist studies.

#### *9.3.2.1.Injury, mortality and disturbance of fauna*

Potential causes of death, injury and disturbance to fauna during the operational phase include:

- Collision with maintenance vehicles along and access roads; and
- Hunting and snaring by maintenance workers.

The impact prior to mitigation is considered to be of high magnitude, and will have a medium-term effect since it could occur throughout the operational lifetime of the project. The spatial scale is local. It is also considered to have a medium probability, resulting in an impact of "moderate" significance. With mitigation, magnitude is reduced to low and probability of the impact can be reduced to low, and scale to the site only. This results in a residual impact of "Low" significance.

#### *9.3.2.2.Vibration from operating wind turbines disturbing fauna*

Ground vibrations caused by operating wind turbines is purported to potentially cause disturbances to ground-dwelling fauna, such as moles and the mole-rats, and this may reduce the extent of suitable habitat for these species. It is noted however, that the overall impact of vibrations on fauna remain poorly understood and additional research, focusing on the South African context, is required to develop a better understanding of the type and significance of potential impacts, identify particularly sensitive species, and identify effective mitigation measures.

Pursuant to the above, an adaptive approach is recommended with respects to the proposed Project, with the proponent committing to keep abreast with research and developments in this field, and revise and implement additional mitigation measures as they become available.

Before mitigation, impact magnitude is high, while duration is permanent and it has a medium probability. The spatial extent is local. Prior to mitigation, this is rated an impact of "moderate" significance.

With the adoption of adaptive management approach, this impact can be reduced to a low magnitude, with a medium-term duration. Spatial extent will remain local and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "Low" significance.

### 9.3.3. Decommissioning Phase

#### *9.3.3.1.Injury, mortality and disturbance of fauna*

The dismantling and removal of Project infrastructure during decommissioning may result in incidences of fauna death and injury. Common causes may include, *inter alia*:

- Vehicle and machinery collisions along access roads and at infrastructure sites where decommissioning activities are occurring; and
- Increased hunting and snaring by workers involved in decommissioning activities are occurring.

The impact prior to mitigation is considered to be of high magnitude, and will have a short-term effect. The spatial scale is local. It is also considered to have a medium probability, resulting in an impact of "medium" significance.

With mitigation, magnitude is reduced to medium and probability of the impact can be reduced to low, and scale to the site only. This results in a residual impact of "Low" significance.

*Table 12: Impact assessment scoring for terrestrial fauna species*

| CONSTRUCTION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** |
| **Impact 1:** | Fauna habitat | Direct loss and disturbance of natural habitat. | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 1 | 3 | 4 | 3 | **33** | **N2** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 2:** | Fauna habitat | Fragmentation reducing natural habitat connectivity and integrity. | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 2 | 3 | 4 | 3 | **36** | **N2** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 4:** | Fauna SCC | Injury, mortality and disturbance of fauna. | Construction | Negative | High | 4 | 2 | 3 | 2 | 4 | **44** | **N2** | 2 | 1 | 1 | 2 | 2 | **12** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 5:** | Fauna SCC | Loss of fauna species of conservation concern. | Construction | Negative | Low | 5 | 2 | 3 | 2 | 4 | **48** | **N2** | 4 | 1 | 1 | 2 | 2 | **16** | **N1** |
| | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **OPERATIONAL** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Fauna, incl. SCC | Injury and mortality of fauna, including SCC. | Operational | Negative | High | 4 | 2 | 3 | 3 | 3 | **36** | **N2** | 2 | 1 | 1 | 2 | 2 | **12** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Fauna, incl. SCC | Vibrations from operating wind turbines disturbing fauna. | Operational | Negative | Low | 4 | 2 | 3 | 5 | 3 | **42** | **N2** | 2 | 2 | 3 | 3 | 2 | **20** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **DECOMISSIONING** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Fauna, incl. SCC | Injury and mortality of fauna, including SCC . | Decommissioning | Negative | High | 4 | 2 | 3 | 2 | 3 | **33** | **N2** | 3 | 1 | 1 | 2 | 2 | **14** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **CUMULATIVE** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Fauna habitat & SCC | Cumulative impact on fauna SCC due to natural habitat loss, disturbance and fragmentation. | Construction | Negative | Moderate | 5 | 3 | 3 | 5 | 5 | **80** | **N3** | 3 | 3 | 3 | 4 | 2 | **26** | **N1** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Fauna SCC | Cumulative impact of fauna SCC due to Injury, mortality and disturbance of fauna. | Construction | Negative | All | 4 | 3 | 3 | 3 | 4 | **52** | **N2** | 2 | 3 | 3 | 3 | 2 | **22** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |

### 9.3.4. Cumulative Impacts

#### *9.3.4.1.Cumulative impact on fauna SCC due to natural habitat loss, disturbance and fragmentation.*

The landscape in which the study area is located is already modified and fragmented as a consequence of historic and current agriculture, and other land use activities such as mining. The current degree of existing habitat modification and fragmentation in the landscape places significant pressure on the functioning and integrity of remaining natural and semi-natural habitat patches, and their ability to support viable populations of SCC.

Although the proposed Project is not located within a promulgated Renewable Energy Development Zone (REDZ), several renewable energy developments are, or may be, taking place in the broader region surrounding the study area. Some of the main developments within a 55 km radius of the study area include *inter alia*; Halfgewonnen solar photovoltaic (PV) facilities, Forzando North Coal Mine Solar PV Facility, Eskom Arnot PV Facility, Haverfontein WEF, Camden I WEF, Camden I Solar, Camden II WEF, Hendrina North WEF, Hendrina South WEF and Ummbila Emyonei WEF.

Collectively, these projects will cause direct habitat loss, disturbance and fragmentation through vegetation clearing that is much greater in extent than that of a single constituent project, and this is a cumulative impact of concern with respects to fauna SCC and the proposed Project

Prior to any form of mitigation, the cumulative impact on fauna SCC resulting from habitat loss, disturbance and fragmentation is rated 'high'. The project contribution to cumulative impacts can be minimised by strictly implementing the required mitigation measures, and addressing any significant residual impacts via additional conservation actions, which could include offsets. The cumulative impact on fauna SCC can be thus reduced to 'Low' significance.

#### *9.3.4.2.Cumulative impact on fauna SCC due to direct injury, mortality and disturbance*

The cumulative development of the various renewable energy projects mentioned in Section 9.3.4.1, will result in a higher number of construction locations, construction workers, and higher levels of vehicle activity across the surrounding landscape. This is likely to increase the potential for, and number of, fauna SCC that may be killed, injured or disturbed.

Prior to any form of mitigation, the cumulative impact on fauna SCC from injury, mortality or disturbance is rated 'medium'. With the implementation of the management and mitigation measures presented in this report, the Project contribution to cumulative impacts on terrestrial fauna SCC can be reduced to 'Low' significance.

# 10. Assessment of the No Go Alternative

If the proposed Project does not proceed, it is anticipated that the current agricultural land use status quo will continue across most of the study area into the future. The tracts of grassland and wetland habitat in the study area will continue to be used for livestock (cattle) production and game farming, and the croplands will continue to be actively cultivated to produce maize and other crop types.

Certain portions of the study area are subject to heavy grazing and trampling by cattle, and it is possible that overtime, the condition of grassland and wetland habitat with respects to flora species diversity and ability to carry livestock (productivity) may deteriorate due to the effects of long-term overgrazing. This may compromise the agricultural profitability of on-site farming operations. With

respects to biodiversity, overgrazing is likely to drive the homogenisation of habitats and fauna diversity, including the persistence of SCC.

# 11. Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed in the preceding section.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following main Project phases:

- Construction, incl. Pre-Construction;
- Operational; and
- Decommissioning.

For each impact management action, the following information is provided:

- Category: The category within which the potential impact/risk occurs;
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning of the proposed Project;
- Description: Description of the possible impact management action;
- Prescribed standards or practices: Prescribed environmental standards or practices with which the impact management action must comply. Note that only key standards or practices have been listed;
- Mitigation type: The type of mitigation measure. This includes the following:
    - Avoidance;
    - Minimisation;
    - Rehabilitation or restoration;
    - Offsetting;
- Time period: The time period when the impact management actions must be implemented; and
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions.

Table 13**Error! Reference source not found.** presents a summary of the proposed impact mitigation actions during the pre-construction, construction, operational, and decommissioning phases of the proposed Project.

*Table 13: Recommended mitigation and management measures for terrestrial fauna*

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| **1. Pre-Construction and Construction Phase** | | | | | | | |
| 1.1 | Fauna Habitats | Direct loss and disturbance of natural habitat | <u>Avoidance</u><br>• As far as possible other proposed permanent Project infrastructure (e.g., O&M Office and Batching Plant) should be located in areas of modified habitat (i.e., Cultivated Fields, Old Lands);<br>• All temporary construction footprints, (e.g., construction camps, laydown areas), should <u>only</u> be located in areas of modified habitat;<br>• A pre-construction walkdown of the approved development footprints should be conducted during the wet/growing season to identify sensitive biodiversity and inform the micro-siting of Project infrastructure to already disturbed footprints and other relevant management measures.<br><br><u>Minimisation</u> | N/A | Avoidance, Minimisation and Rehabilitation | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • All vegetation clearing for the Project should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas;<br>• The footprints to be cleared of vegetation should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas;<br>• No heavy vehicles should travel beyond the marked works zone;<br>• Removed topsoil should be stockpiled and used to rehabilitate all disturbed areas.<br><br><u>Rehabilitation</u><br><br>A rehabilitation/ landscaping protocol should be developed and implemented to stabilise and revegetate all non-operational sites that have been disturbed by construction. The protocol should include:<br><br>• Stockpiling of topsoil that was cleared from development footprints during site preparation; | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment;<br>• Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and<br>• Grass species used during rehabilitation should be indigenous, locally-occurring perennial species. | | | | |
| 1.2 | Fauna, incl. SCC | Fragmentation reducing natural habitat connectivity and integrity | <u>Minimisation</u><br><br>See mitigation measures for *Direct loss and disturbance of natural habitat*, and<br><br>• Proposed access roads should be aligned, as far as possible, with existing farm roads and tracks and micro-sited to already disturbed sites.<br><br><u>Rehabilitation</u> | N/A | Minimisation and Rehabilitation | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | See mitigation measures for *Direct loss and disturbance of natural habitat* | | | | |
| 1.3 | Fauna, incl. SCC | Injury, mortality and disturbance of fauna. | <u>Avoidance and Minimisation</u><br>• An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions;<br>• As appropriate, temporary barriers should be erected around construction trenches and excavations to prevent fauna becoming trapped;<br>• Any fauna species trapped in construction areas, should be safely and correctly relocated to an adjacent area of natural habitat;<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• No fauna may be intentionally killed or injured by on-site contractors and workers. Handling, poisoning, snaring and killing of on-site fauna by | N/A | Avoidance and Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | contractors and workers must be strictly prohibited;<br>• General noise abatement equipment should be fitted to construction machinery and vehicles;<br>• Dust suppression using water bowsers should be undertaken on all roads and other sites where dust entrainment occurs;<br>• The rules and regulations concerning fauna should be communicated to contractors through on-site signage and awareness training; and<br>• An incidence register should be maintained throughout all phases of the Project detailing any fauna mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements.<br>• *Refer to the Avifauna Specialist Assessment for mitigation and management measures concerning birds.* | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| 1.4 | Fauna SCC | Loss of fauna of conservation concern | <u>Avoidance and Minimisation</u><br><br>See mitigation measures for *Direct loss and disturbance of natural habitat*, *Fragmentation reducing natural habitat connectivity and integrity*, and *Injury, mortality and disturbance of Fauna.* | N/A | Avoidance and Minimisation | During Construction Phase | Project Manager |
| **2. Operational phase** | | | | | | | |
| 2.1 | Fauna, incl. SCC | Injury, mortality disturbance of fauna, including SCC | <u>Avoidance and Minimisation</u><br><br>• No off-road driving is permitted for vehicles and mobile machinery used during operations and for maintenance purposes.<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• No fauna may be intentionally killed or injured by on-site contractors and workers. Handling, poisoning, snaring and killing of on-site fauna by contractors and workers must be strictly prohibited; | N/A | Avoidance and Minimisation | During Operational Phase | Facility Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training.<br>• *Refer to the Avifauna Specialist Assessment for mitigation and management measures concerning birds.* | | | | |
| 2.2 | Terrestrial Fauna, incl. SCC | Vibration from operating wind turbines disturbing fauna | <u>Minimisation</u><br>• The Project proponent must keep actively informed about new research in the field of vibration impacts on fauna and potential mitigation options;<br>• Based on the findings of new research, the biodiversity management plan for the proposed Project should be updated to include additional mitigation measures and these should be implemented on-site. | N/A | Minimisation | During Operational Phase | Facility Manager |
| **3. Decommissioning phase** | | | | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| 3.1 | Fauna incl. SCC | Injury, mortality disturbance of fauna, including SCC | <u>Avoidance and Minimisation</u><br>• No off-road driving is permitted for vehicles and mobile machinery used during decommissioning phases activities;<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• The handling, poisoning and killing of on-site fauna by on-site workers must be strictly prohibited;<br>• The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training. | N/A | Avoidance and Minimisation | During Decommissioning Phase | Facility Manager |

# 12. Monitoring Measures

With respects to terrestrial animal species, no additional monitoring measures are recommended.

# 13. Reasoned Opinion and Environmental Impact Statement

## 13.1. Summary of Main Findings

The study area is large and characterised by extensive tracts of natural dry- and moist grassland and shrubland habitat. Although various forms of linear infrastructure, such as formal roads, railway lines, farm tracks and farm fences, and the presence of modified habitat patches (e.g., Cultivated Fields and Alien Tree Plantations) have caused habitat fragmentation, the general level of habitat connectivity across the landscape remains high. Remaining areas of natural habitat within the study area therefore provide suitable habitat and a network of movement and dispersal corridor for many fauna species. The continued integrity and functioning of natural habitat in the study area is therefore important in maintaining the metapopulation dynamics of fauna, including SCC.

During the field survey, several fauna SCC were documented in the study area, including the following:

- Four mammal species of conservation concern:
    - Serval - Near Threatened;
    - Mountain Reedbuck - Endangered;
    - Cape Clawless Otter - Near Threatened;
    - Swamp Musk Shrew – Near Threatened;
- Six bird species of conservation concern:
    - Blue Crane - Near Threatened;
    - Lesser Flamingo - Near Threatened;
    - Greater Flamingo - Near Threatened;
    - Southern Bald Ibis - Vulnerable;
    - Yellow-billed Stork - Endangered; and
    - Blue Korhaan - Vulnerable (NEMBA ToPS, 2007).

The National Web Based Screening Tool rated the Animal Species Theme for the study area as 'High' Sensitivity on account of the potential presence of several threatened fauna species, of which, two species were confirmed in the study area during the field survey, namely Southern Bald Ibis and Yellow-billed Stork. Based on the findings of this study, the 'High' sensitivity rating for the study area is therefore confirmed.

The proposed Project will result in habitat loss, disturbance and fragmentation through vegetation clearing, and this will impact local fauna and metapopulation dynamics. Moreover, it is also likely that some fauna may be killed, injured or disturbed during the various Project phases through *inter alia*, vehicle collisions, hunting/snaring and sensory disturbances from noise, dust and turbine vibrations.

The loss, disturbance and fragmentation of natural fauna habitat can be mitigated by the implementation of the recommended management measures, which include *inter alia* 1) micro-siting as much of the proposed permanent and temporary Project infrastructure in areas of modified habitat (e.g., Cultivated Fields), 2) clearing only the minimum areas required for construction activities, and 3) actively rehabilitating all disturbance footprints. Direct impacts on individual fauna can also be mitigated through the appointment of an ECO on-site during the construction phase to manage any

human-fauna interactions, and through the implementation of several responsible operation and land use practices, such as *inter alia*, enforcing a speed limit for construction vehicles, banning hunting/snaring by on-site workers, and implementing dust suppression.

It is contended that the proactive implementation of the management measures outlined in this report, will provide effective mitigation and ensure minimal impacts on fauna SCC as a result of the proposed Project. It is therefore recommended that all mitigation measures are included in the proposed Project's environmental management plan (EMP).

### 13.2. Conditions to be Included in the Environmental Authorisation

No additional conditions are recommended for inclusion in the proposed Project's environmental authorisation.

### 13.3. Specialist Opinion

In accordance with the outcomes of the impact assessment, and taking cognisance of the baseline conditions presented herein, as well as the impact management measures, the proposed Project is not deemed to present significant negative ecological issues or impacts, and it should thus be authorised.

## 14. References


Anderson, M.D. (2015). *Phoenicopterus roseus*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Bates, M., Branch, W., Bauer, A., Burger, M., Marais, J., Alexander, G. and De Villiers, M. (Eds.) (2014) Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Pretoria: Suricata 1, South African Biodiversity Institute.

Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. (2016). The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

DEA (Department of Environmental Affairs) (2016). National Protected Areas Expansion Strategy for South Africa. Department of Environmental Affairs, Pretoria, South Africa.

Dippenaar-Schoeman, A. (2014). Field guide to the spiders of South Africa. LAPA Publishers. Pretoria.

Dobson, J. & Dobson, C. (2018). *Lepidochrysops procera*. Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/292/. Accessed on: 21 July 2023.

Du Preez, L and Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature. Cape Town.

Du Plessis, D., Taylor, M.R. and Peacock, F. (2015). *Eupodotis senegalensis*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Estes, R.D. (1991). The Behaviour Guide to African Mammals. Russel Friedman Books. Halfway House.

Edwards, D. (1983). A broad-scale structural classification of vegetation for practical purposes. Bothalia. 14, 3 & 4; 705-712.

Evans, S.W. (2015). *Mycteria ibis*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Fitzpatrick Institute of African Ornithology (2023). OdonataMAP, Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OdonataMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). FrogMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=FrogMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). LacewingMAP, Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=SpiderMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). LepiMAP, Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=SpiderMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). MammalMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). ReptileMAP, Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=ReptileMAP on 2023-09-21.

Fitzpatrick Institute of African Ornithology (2023). SpiderMAP, Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=SpiderMAP on 2023-09-21.

Henderson, K.L. (2015). *Geronticus calvus*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Henning, G. (2018). *Metisella meninx*. Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/283/. Accessed on: 15 August 2023.

Loock, D.J.E., Williams, S.T., Emsile, K.W., W.S. Matthews and Swanepoel, L.H. (2018). High carnivore population density highlights the conservation status of industrialised sites. Scientific Reports. Published Online.

Okes N, Ponsonby DW, Rowe-Rowe D, Avenant NL, Somers MJ. (2016). A conservation assessment of *Aonyx capensis*. 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.

Ortman, H.E., Hagen, C.T. and Peacock, F. (2015). *Sterna caspia*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Marnewick, M.D., Retief, E.F., Theron, N.T., Wright, D.R. and Anderson, T.A (2015). Important Bird and Biodiversity Areas of South Africa. Johannesburg: Birdlife South Africa.

Mpumalanga Nature Conservation Act (Act No. 10 of 1998).

McCulloch, M.D, Simmons, R.E. and Taylor, M.R. (2015). *Phoeniconaias minor*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - Lists of Critically Endangered, Endangered, Vulnerable and Protected Species. (2007) (NEMBA ToPS List, 2007). South Africa.

Ponsonby DW, Rowe-Rowe D, Power RJ, Somers MJ. (2016). A conservation assessment of *Hydrictis maculicollis*. 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.

Ramesh T, Downs CT, Power RJ, Laurence S, Matthews W, Child MF. (2016). A conservation assessment of *Leptailurus serval*. 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.

Retief, E.F. (2015). *Sagittarius serpentarius*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

SABAP2 (2023). Southern African Bird Atlas Project 2. Accessed at https://sabap2.birdmap.africa/ on 2023-09-21.

SANBI (2013) Grassland Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R., McCulloch, D. South African National Biodiversity Institute. Pretoria. 139 pages.

SANBI (2020). Species Environmental Assessment Guideline. Guideline 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. Version 1. 2020.

SANBI (2023). Red List of South African Species. South African National Biodiversity Institute. Available from: http://speciesstatus.sanbi.org [Accessed September 2023].

Scholes, R.J. (2009). Syndromes of dryland degradation in southern Africa. African Journal of Range and Forage Science. 26(3): 113-215.

Shaw, J.M. (2015). *Anthropoides paradiseus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Shrader AM, Little I, Coverdale B, Patel T. (2016). A conservation assessment of *Ourebia ourebi ourebi*. 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

Stuart, C. and Stuart, T. (2007) Field Guide to Mammals of Southern Africa. Fourth Edi. Cape Town: Struik Nature

Stuart, C. and Stuart, T. (2013) Field Guide to Tracks and Signs of Southern, Central and East African Wildlife. Fourth Edi. Cape Town: Struik Nature.

Taylor, M.R., Peacock, F. & Wanless, R.M. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Johannesburg: Birdlife South Africa.

Taylor, M.R. (2015). *Circus ranivorus*. In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Taylor A, Avenant N, Schulze E, Viljoen P, Child MF. (2016a) A conservation assessment of *Redunca fulvorufula fulvorufula.* 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.

Taylor PJ, Baxter R, Power RJ, Monadjem A, Harvey J, Child MF. (2016b). A conservation assessment of *Crocidura mariquensis*. 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.

Taylor PJ, Baxter R, Power RJ, Monadjem A, Child MF. (2016c). A conservation assessment of *Crocidura maquassiensis*. 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.

---

This report has been compiled by Andrew Zinn (Hawkhead Consulting).

Andrew Zinn (*Pr.Sci.Nat*.)

# Appendix A: Curriculum Vitae – Andrew Zinn

# Hawkhead Consulting

# Curriculum Vitae of Andrew Zinn (Pr.Sci.Nat.)

## Details

Andrew David Zinn
Terrestrial Ecologist
B.Sc. (Hons.), M.Sc., Pr.Sci.Nat.

Email: andrew@hawkhead.com
Mobile: +27 83 361 0373
Address: 58 Central Rd, Linden Ext., Johannesburg, 2195
South Africa
Date of birth: 14 July 1982
Nationality: South African

## Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and 15 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

## Education and Qualifications

- University of the Witwatersrand, M.Sc. Resource Conservation Biology (2013).
- University of KwaZulu-Natal, BSc. Hons. Ecology and Conservation Biology (2005).
- University of KwaZulu-Natal, BSc. Zoology and Grassland Science (2004).
- Bryanston High School, Johannesburg. Matric Exemption. (2000).

## Affiliations

- Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).
- Member of the South African Wildlife Management Association.
- Member of the South African Association of Botanists.

## Work Experience

1. **Independent Ecologist**

**Hawkhead Consulting, South Africa**
**September 2020 – Present**

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- Biodiversity study design and implementation;
- Biodiversity baseline and impact assessment reporting;
- Mitigation measure design and application;
- Vegetation surveys and vegetation community mapping;
- Fauna surveys for mammals, birds, reptiles and amphibians;
- Development of biodiversity management plans;
- Development of rehabilitation and revegetation plans; and
- Alien invasive species control and eradication plans.

**2. Ecologist**

**Golder Associates Africa, South Africa**
**June 2011 – September 2020**

Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa. Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's (IFC) Performance Standard 6 (PS6)

**3. Independent Ecologist**

**Subcontracted to KPMG, United Arab Emirates**
**March – April 2011**

Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

**4. Environmental Consultant**

**WSP Environment and Energy, South Africa**
**August 2008 – March 2011**

Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes,
conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

**5. Research Technician**

**Yale University, Kruger National Park, South Africa**
**October 2007 – May 2008**

Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

## Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.
- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

# Appendix B: Methodology Supplement

**Rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, as per (SANBI, 2020).**

The ecological sensitivity of habitats in the study area was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

SEI = BI + RR.

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

BI = CI + FI

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystems types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

**Table 1: Conservation Importance (CI) criteria.**

| Conservation Importance (CI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10km$^2$;<br>• Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type; and<br>• Globally significant populations of congregatory species (>10% of global population). |
| **High** | • Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of > 10km$^2$, IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining;<br>• Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type;<br>• Presence of Rare species;<br>• Globally significant populations of congregatory species (>1% but < 10% of global population). |
| **Medium** | • Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals;<br>• Any area of natural habitat of threatened ecosystem type with status of VU;<br>• Presence of range-restricted species; and<br>• >50% of receptor contains natural habitat to support SCC. |
| **Low** | • No confirmed or highly likely populations of SCC;<br>• No confirmed or highly likely populations of range-restricted species; and<br>• <50% of receptor contains natural habitat with limited potential to support SCC. |
| **Very Low** | • No confirmed and highly unlikely populations of SCC;<br>• No confirmed and highly unlikely populations of range-restricted species; and<br>• No natural habitat remaining. |

**Table 2: Functional Integrity (FI) criteria.**

| Functional Integrity (FI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type;<br>• High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches;<br>• No or minimal current negative ecological impacts with no signs of major disturbance (e.g., ploughing) |
| **High** | • Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types;<br>• Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches; and<br>• Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. |
| **Medium** | • Medium (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type or >20 ha for VU ecosystem type;<br>• Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches;<br>• Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. |
| **Low** | • Small (> 1 ha but <5ha) area;<br>• Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential; and<br>• Several minor and major current negative ecological impacts. |
| **Very Low** | • Very small (<1 ha) area;<br>• No habitat connectivity except for flying species or flora with wind-dispersed seeds;<br>• Several major current negative ecological impacts. |

**BI = CI + FI**

**Biodiversity Importance (BI) Rating Matrix**

| Biodiversity Importance (BI) | | Conservation Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Functional Integrity** | **Very High** | Very High | Very High | High | Medium | Low |
| | **High** | Very High | High | Medium | Medium | Low |
| | **Medium** | High | Medium | Medium | Low | Very Low |
| | **Low** | Medium | Medium | Low | Low | Very Low |
| | **Very Low** | Medium | Low | Very Low | Very Low | Very Low |

**Table 3: Receptor Resilience criteria (RR)**

| Resilience | Fulfilling Criteria |
|---|---|
| **Very High** | Habitat that can recover rapidly (˜less than 5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed. |
| **High** | Habitat that can recover relatively quickly (˜ 5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed. |
| **Medium** | Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed. |
| **Low** | Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed. |
| **Very Low** | Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed. |

**SEI = BI + RR**

**Site Ecological Importance (SEI) Rating Matrix**

| Site Ecological Importance | | Biodiversity Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Receptor Resilience** | **Very Low** | Very High | Very High | High | Medium | Low |
| | **Low** | Very High | Very High | High | Medium | Very Low |
| | **Medium** | Very High | High | Medium | Low | Very Low |
| | **High** | High | Medium | Low | Very Low | Very Low |
| | **Very High** | Medium | Low | Very Low | Very Low | Very Low |

# Appendix C: List of Mammal Species Potentially Occurring in the Study Area

Species highlighted in **bold** text have been recorded in the 2629BD and 2629BC QDS as per MammalMap (Fitzpatrick Institute of African Ornithology, 2023).

| Family | *Scientific Name* | Common Name | Red List – Regional Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| **Bathyergidae** | ***Cryptomys hottentotus*** | **Common Mole-rat** | **Least Concern** | - | **Data Deficient** |
| **Bathyergidae** | ***Georychus capensis*** | **Cape Mole-rat** | **Data Deficient** | - | - |
| Bovidae | *Connochaetes gnou* | Black Wildebeest | Least Concern | Protected | - |
| **Bovidae** | ***Damaliscus pygargus phillipsi*** | **Blesbok** | **Least Concern** | - | - |
| **Bovidae** | ***Ourebia ourebi ourebi*** | **Oribi** | **Endangered** | **Endangered** | **Endangered / Protected** |
| Bovidae | *Pelea capreolus* | Grey Rhebok | Near Threatened | - | Protected |
| **Bovidae** | ***Raphicerus campestris*** | **Steenbok** | **Least Concern** | - | **Protected** |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Least Concern | Protected | Protected |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Endangered | - | Protected |
| **Bovidae** | ***Sylvicapra grimmia*** | **Common Duiker** | **Least Concern** | - | - |
| **Canidae** | ***Canis mesomelas*** | **Black-backed Jackal** | **Least Concern** | - | - |
| Canidae | *Vulpes chama* | Cape Fox | Least Concern | Protected | Protected |
| Cercopithecidae | *Chlorocebus pygerythrus* | Vervet Monkey | Least Concern | - | - |
| Cercopithecidae | *Papio ursinus* | Chacma Baboon | Least Concern | - | - |
| Chrysochloridae | *Amblysomus septentrionalis* | Highveld Golden Mole | Near Threatened | - | Protected |
| Chrysochloridae | *Chrysospalax villosus* | Rough-haired Golden Mole | Vulnerable | Critically Endangered | Protected |
| **Erinaceidae** | ***Atelerix frontalis*** | **South African Hedgehog** | **Near Threatened** | **Protected** | - |
| Felidae | *Caracal caracal* | Caracal | Least Concern | - | - |
| Felidae | *Felis nigripes* | Black-footed Cat | Vulnerable | Protected | Near Threatened |
| Felidae | *Felis silvestris* | African Wildcat | Least Concern | - | - |
| **Felidae** | ***Leptailurus serval*** | **Serval** | **Near Threatened** | **Protected** | **Near Threatened** |
| Felidae | *Panthera pardus* | Leopard | Vulnerable | Vulnerable | Near Threatened |
| Gliridae | *Graphiurus murinus* | Woodland Dormouse | Least Concern | - | - |
| **Herpestidae** | ***Atilax paludinosus*** | **Water Mongoose** | **Least Concern** | - | - |
| **Herpestidae** | ***Cynictis penicillata*** | **Yellow Mongoose** | **Least Concern** | - | - |

| Family | *Scientific Name* | Common Name | Red List – Regional Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| **Herpestidae** | ***Herpestes sanguineus*** | **Slender Mongoose** | **Least Concern** | **-** | **-** |
| Herpestidae | *Ichneumia albicauda* | White-tailed Mongoose | Least Concern | **-** | **-** |
| **Herpestidae** | ***Suricata suricatta*** | **Suricate** | **Least Concern** | - | - |
| Hyaenidae | *Parahyaena brunnea* | Brown Hyaena | Near Threatened | Protected | Near Threatened / Protected |
| **Hyaenidae** | ***Proteles cristata*** | **Aardwolf** | **Least Concern** | - | **Protected** |
| Hystricidae | *Hystrix africaeaustralis* | Cape Porcupine | Least Concern | **-** | - |
| Leporidae | *Lepus saxatilis* | Scrub Hare | Least Concern | **-** | **-** |
| Leporidae | *Pronolagus crassicaudatus* | Natal Red Rock Rabbit | Least Concern | - | **-** |
| Leporidae | *Pronolagus rupestris* | Smith's Red Rock Rabbit | Least Concern | **-** | - |
| Macroscelididae | *Elephantulus myurus* | Eastern Rock Sengi | Least Concern | **-** | **-** |
| Muridae | *Aethomys chrysophilus* | Red Veld Rat | Least Concern | - | **-** |
| Muridae | *Dasymys incomtus* | African Marsh Rat | Near Threatened | **-** | Near Threatened |
| Muridae | *Gerbilliscus brantsii* | Highveld Gerbil | Least Concern | **-** | - |
| Muridae | *Lemniscomys rosalia* | Single-striped Mouse | Least Concern | **-** | **-** |
| Muridae | *Mastomys natalensis* | Natal Multimammate Mouse | Least Concern | **-** | **-** |
| Muridae | *Micaelamys namaquensis* | Namaqua Rock Mouse | Least Concern | - | - |
| Muridae | *Mus minutoides* | Pygmy Mouse | Least Concern | **-** | **-** |
| Muridae | *Otomys angoniensis* | Angoni Vlei Rat | Least Concern | **-** | **-** |
| **Muridae** | ***Otomys auratus*** | **Vlei Rat (Grassland type)** | **Near Threatened** | - | - |
| Muridae | *Otomys laminatus* | Laminate Vlei Rat | Near Threatened | **-** | **-** |
| **Muridae** | ***Rhabdomys pumilio*** | **Xeric Four-striped Mouse** | **Least Concern** | **-** | **-** |
| Muridae | *Thallomys paedulcus* | Tree Rat | Least Concern | - | - |
| Muridae | *Dendromus melanotis* | Grey Climbing Mouse | Least Concern | **-** | **-** |
| Muridae | *Dendromus mesomelas* | Brant's Climbing Mouse | Least Concern | **-** | **-** |
| Muridae | *Dendromus mystacalis* | Chestnut Climbing Mouse | Least Concern | - | - |
| Muridae | *Mystromys albicaudatus* | White-tailed Rat | Vulnerable | **-** | **-** |
| Muridae | *Steatomys pratensis* | Fat Mouse | Least Concern | - | - |

| Family | *Scientific Name* | Common Name | Red List – Regional Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| Mustelidae | *Aonyx capensis* | Cape Clawless Otter | Near Threatened | Protected | Protected |
| Mustelidae | *Hydrictis maculicollis* | Spotted-necked Otter | Vulnerable | Protected | Near Threatened / Protected |
| Mustelidae | *Ictonyx striatus* | Striped Polecat | Least Concern | - | - |
| Mustelidae | *Mellivora capensis* | Honey Badger | Least Concern | Protected | Near Threatened / Protected |
| Orycteropodidae | *Orycteropus afer* | Aardvark | Least Concern | - | Protected |
| **Pedetidae** | ***Pedetes capensis*** | **Springhare** | **Least Concern** | **-** | - |
| **Procaviidae** | ***Procavia capensis*** | **Rock Hyrax** | **Least Concern** | **-** | **-** |
| Soricidae | *Crocidura cyanea* | Reddish-grey Musk Shrew | Least Concern | - | **-** |
| **Soricidae** | ***Crocidura flavescens*** | **Greater Red Musk Shrew** | **Least Concern** | **-** | - |
| Soricidae | *Crocidura fuscomurina* | Tiny Musk Shrew | Least Concern | **-** | **-** |
| Soricidae | *Crocidura mariquensis* | Swamp Musk Shrew | Near Threatened | - | Near Threatened |
| Soricidae | *Myosorex cafer* | Dark-Footed Forest Shrew | Vulnerable | **-** | - |
| Soricidae | *Myosorex varius* | Forest Shrew | Least Concern | **-** | **-** |
| Soricidae | *Crocidura maquassiensis* | Maquassie Musk Shrew | Vulnerable | - | Vulnerable |
| Suidae | *Potamochoerus larvatus* | Bushpig | Least Concern | **-** | - |
| **Sciuridae** | ***Xerus inauris*** | **South African Ground Squirrel** | **Least Concern** | **-** | **-** |
| Viverridae | *Genetta maculata* | Rusty-spotted Genet | Least Concern | - | **-** |
| Source: Master list based on distribution maps in Stuart and Stuart (2007). | | | | | |

# Appendix D: List of Herpetofauna Species Recorded and Potentially Occurring in the Study Area

Reptiles

Species highlighted in **bold** text have been recorded in the 2629BD and 2629BC QDS, as per ReptileMap (Fitzpatrick Institute of African Ornithology, 2023)

| Family | Scientific Name | Common Name | Red List Status (2014) | NEMBA TOPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| **Agamidae** | ***Agama aculeata distanti*** | **Eastern Ground Agama** | **Least Concern** | **-** | **-** |
| **Agamidae** | ***Agama atra*** | **Southern Rock Agama** | **Least Concern** | **-** | **-** |
| Chamaeleonidae | *Chamaeleo dilepis* | Flap-neck Chameleon | Least Concern | - | - |
| **Colubridae** | ***Crotaphopeltis hotamboeia*** | **Red-lipped Snake** | **Least Concern** | **-** | **-** |
| Colubridae | *Dasypeltis inornata* | Southern Brown Egg-eater | Least Concern | - | Near Threatened |
| **Colubridae** | ***Dasypeltis scabra*** | **Rhombic Egg-eater** | **Least Concern** | **-** | **-** |
| Colubridae | *Dispholidus typus* | Boomslang | Least Concern | - | - |
| Colubridae | *Philothamnus hoplogaster* | Green Water Snake | Least Concern | - | - |
| Colubridae | *Philothamnus natalensis natalensis* | Eastern Natal Green Snake | Least Concern | - | - |
| Colubridae | *Philothamnus semivariegatus* | Spotted Bush Snake | Least Concern | - | - |
| Colubridae | *Thelotornis capensis capensis* | Southern Twig Snake | Least Concern | - | - |
| Cordylidae | *Chammaesaura aenea* | Coppery Grass Lizard | Near Threatened | - | Near Threatened |
| Cordylidae | *Chammaesaura anguina anguina* | Cape Grass Lizard | Least Concern | - | - |
| Cordylidae | *Cordylus vittifer* | Common Girdled Lizard | Least Concern | - | - |
| **Cordylidae** | ***Pseudocordylus melanotus melanotus*** | **Common Crag Lizard** | **Least Concern** | **-** | **-** |
| Cordylidae | *Pseudocordylus melanotus subviridis* | Drakensberg Crag Lizard | Least Concern | - | - |
| Cordylidae | *Smaug warren barbertonensis* | Barberton Dragon Lizard | Least Concern | - | - |
| Elapidae | *Elapsoidea boulengeri* | Boulenger's Garter Snake | Least Concern | - | - |
| Elapidae | *Elapsoidea sundevallii* | Sundevall's Garter Snake | Least Concern | - | - |
| **Elapidae** | ***Hemachatus heamachatus*** | **Rinkhals** | **Least Concern** | **-** | **-** |
| Elapidae | *Naja annulifera* | Snouted Cobra | Least Concern | - | - |
| Elapidae | *Naja mossambica* | Mozambique Spitting Cobra | Least Concern | - | - |
| Gekkonidae | *Homopholis wahbergii* | Wahlberg's Velvet Gecko | Least Concern | - | - |
| Gekkonidae | *Lygodactylus capensis capensis* | Common Dwarf Gecko | Least Concern | - | - |

| Family | Scientific Name | Common Name | Red List Status (2014) | NEMBA TOPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| Gekkonidae | *Lygodactylus ocellatus ocellatus* | Spotted Dwarf Gecko | Least Concern | - | - |
| Gekkonidae | *Pachydactylus vansoni* | Van Son's Gecko | Least Concern | - | - |
| Gerrhosauridae | *Gerrhosaurus flavigularis* | Yellow-throated Plated Lizard | Least Concern | - | - |
| Lacertidae | *Nucras lalandii* | Delalande's Sandveld Lizard | Least Concern | - | - |
| Lacertidae | *Pedioplanis burchelli* | Burchell's Sand Lizard | Least Concern | - | - |
| Lamprophiidae | *Amplorhinus multimaculatus* | Many-spotted Snake | Least Concern | - | - |
| **Lamprophiidae** | ***Aparallactus capensis*** | **Cape centipede-eater** | **Least Concern** | **-** | **-** |
| Lamprophiidae | *Atractaspis bibronii* | Bibron's Stiletto Snake | Least Concern | - | - |
| Lamprophiidae | *Boaedon capensis* | Common House Snake | Least Concern | - | - |
| **Lamprophiidae** | ***Duberria lutrix lutrix*** | **South African Slug Eater** | **Least Concern** | **-** | **-** |
| Lamprophiidae | *Homoroselaps dorsalis* | Striped Harlequin Snake | Near Threatened | - | Near Threatened |
| **Lamprophiidae** | ***Homoroselaps lacteus*** | **Spotted Harlequin Snake** | **Least Concern** | **-** | **Near Threatened** |
| Lamprophiidae | *Inyoka swazicus* | Swazi Rock Snake | Least Concern | - | - |
| Lamprophiidae | *Lamprophis aurora* | Aurora Snake | Least Concern | - | - |
| Lamprophiidae | *Lamprophis fuscus* | Yellow-bellied Snake | Least Concern | - | Near Threatened |
| Lamprophiidae | *Lamprophis guttatus* | Spotted Rock Snake | Least Concern | - | - |
| Lamprophiidae | *Lycodonomorphus inornatus* | Live Ground Snake | Least Concern | - | - |
| **Lamprophiidae** | ***Lycodonomorphus rufulus*** | **Brown Water Snake** | **Least Concern** | **-** | **-** |
| Lamprophiidae | *Lycophidion capense* | Cape Wolf Snake | Least Concern | - | - |
| Lamprophiidae | *Psammophis brevirostris* | Short-snouted Grass Snake | Least Concern | - | - |
| **Lamprophiidae** | ***Psammophis crucifer*** | **Montane Grass Snake** | **Least Concern** | **-** | **-** |
| Lamprophiidae | *Psammophylas tritaeniatus* | Striped Grass Snake | Least Concern | - | - |
| **Lamprophiidae** | ***Psammophylax rhombeatus rhombeatus*** | **Spotted Grass Snake** | **Least Concern** | **-** | **-** |
| **Lamprophiidae** | ***Pseudaspis cana*** | **Mole Snake** | **Least Concern** | **-** | **-** |
| **Leptotyphlopidae** | ***Leptotyphlops scutifrons*** | **Peter's Thread Snake** | **Least Concern** | **-** | **-** |
| Scincidae | *Acontias breviceps* | Short-headed Legless Skink | Least Concern | - | Vulnerable |
| Scincidae | *Acontias gracilicauda* | Thin-tailed Legless Skink | Least Concern | - | - |

| Family | Scientific Name | Common Name | Red List Status (2014) | NEMBA TOPS List (2007) | Mpumalanga Status |
|---|---|---|---|---|---|
| Scincidae | *Afroablepharus wahlbergii* | Wahlberg's Snake-eyed Skink | Least Concern | - | - |
| Scincidae | *Scelotes mirus* | Montane Dwarf Burrowing Skink | Least Concern | - | - |
| **Scincidae** | ***Trachylepis capensis capensis*** | **Cape Skink** | **Least Concern** | **-** | **-** |
| Scincidae | *Trachylepis homalocephala* | Red-sided Skink | Least Concern | - | - |
| Scincidae | *Trachylepis margaritifer* | Rainbow Skink | Least Concern | - | - |
| **Scincidae** | ***Trachylepis punctatissima*** | **Montane Rock Skink** | **Least Concern** | **-** | **-** |
| Scincidae | *Trachylepis varia* | Variable Skink | Least Concern | - | - |
| **Typhlopidae** | ***Afrotyphlops bibronii*** | **Bibron's Blind Snake** | **Least Concern** | **-** | **-** |
| Typhlopidae | *Rhinotyphlops lalandei* | Delalande's Beaked Blind Snake | Least Concern | - | - |
| Varanidae | *Varanus niloticus* | Water Monitor | Least Concern | - | - |
| Viperidae | *Bitis arietans arietans* | Puff Adder | Least Concern | - | - |
| Viperidae | *Bitis atropos* | Berg Adder | Least Concern | - | - |
| Viperidae | *Causus rhombeatus* | Rhombic Night Adder | Least Concern | - | - |
| Source: Master list based on Bates *et al.*, (2014) | | | | | |

**Amphibians**

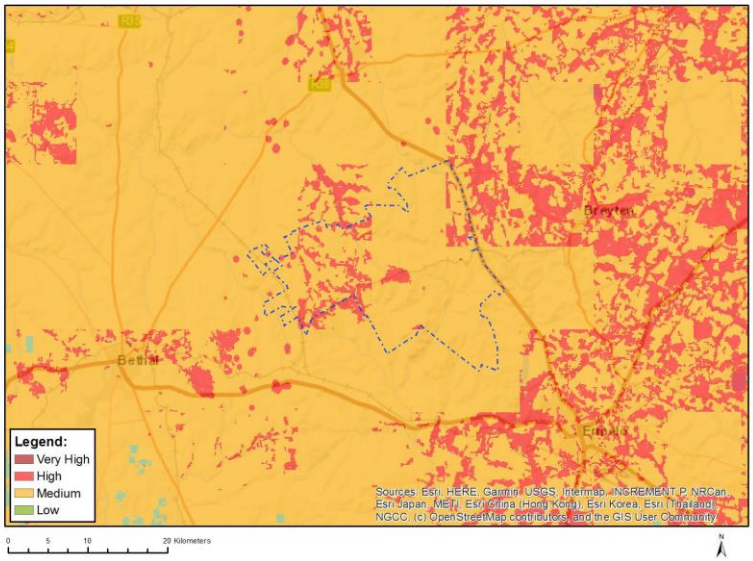
Species highlighted in **bold** text have been recorded in the 2629BD and 2629BC QDS, as per FrogMap (Fitzpatrick Institute of African Ornithology, 2023).

| Family | Scientific Name | Comon Name | Regional Red List | NEMBA 2007 | Mpumalanga Status |
|---|---|---|---|---|---|
| Breviceptidae | *Breviceps adspersus* | Bushveld Rain Frog | - | - | - |
| Breviceptidae | *Breviceps mossambicus* | Mozambique Rain Frog | - | - | - |
| **Bufonidae** | ***Amietophrynus gutturalis*** | **Guttural Toad** | - | - | - |
| Bufonidae | *Amietophrynus maculatus* | Flat-backed Toad | - | - | - |
| **Bufonidae** | ***Amietophrynus rangeri*** | **Raucous Toad** | - | - | - |
| Hyperoliidae | *Hyperolius marmoratus* | Painted Reed Frog | - | - | - |
| Hyperoliidae | *Hyperolius semidiscus* | Yellow-striped Reed Frog | - | - | Vulnerable |
| **Hyperoliidae** | ***Kassina senegalensis*** | **Bubbling Kassina** | - | - | - |
| **Hyperoliidae** | ***Semnodactylus wealii*** | **Rattling Frog** | - | - | - |
| Microhylidae | *Phrynomantis bifasciatus* | Banded Rubber Frog | - | - | - |
| Phrynobatrachidae | *Phrynobatrachus natalensis* | Snoring Puddle Frog | - | - | - |
| **Pipidae** | ***Xenopus laevis*** | **Common Platanna** | - | - | - |
| **Ptychadenidae** | ***Ptychadena porosissima*** | **Striped Grass Frog** | - | - | - |
| **Pyxicephalidae** | ***Amietia angolensis*** | **Common River Frog** | - | - | - |
| **Pyxicephalidae** | ***Amietia fuscigula*** | **Cape River Frog** | - | - | - |
| **Pyxicephalidae** | ***Cacosternum boettgeri*** | **Common Caco** | - | - | - |
| Pyxicephalidae | *Cacosternum nanum* | Bronze Caco | - | - | - |
| Pyxicephalidae | *Cacosternum parvum* | Mountain Caco | - | - | - |
| Pyxicephalidae | *Pyxicephalus adspersus* | Giant Bullfrog | Near Threatened | Protected | Vulnerable |
| **Pyxicephalidae** | ***Strongylopus fasciatus*** | **Striped Stream Frog** | - | - | - |
| Pyxicephalidae | *Strongylopus grayii* | Clicking Stream Frog | - | - | - |
| **Pyxicephalidae** | ***Tomopterna cryptotis*** | **Tremolo Sand Frog** | - | - | - |
| **Pyxicephalidae** | ***Tomopterna natalensis*** | **Natal Sand Frog** | - | - | - |
| Pyxicephalidae | *Tomopterna tandyi* | Tandy's Sand Frog | - | - | - |

# Appendix E: Summary and Comment on the Sensitivity Rating of the DFFE Screening Tool

## Sensitivity Rating of the National Web Based Screening Tool

The National Web-based Environmental Screening Tool rates the Animal Species Theme for the proposed Project as 'High' sensitivity on account of the potential presence of eight bird, one invertebrate, and three mammal species of conservation concern. These are listed in the table below. Also refer to the map showing the spatial sensitivity.




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | X | | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| High | Aves-Geronticus calvus |
| High | Aves-Polemaetus bellicosus |
| High | Aves-Sagittarius serpentarius |
| High | Aves-Mycteria ibis |
| Medium | Aves-Hydroprogne caspia |
| Medium | Aves-Geronticus calvus |
| Medium | Aves-Tyto capensis |
| Medium | Aves-Neotis denhami |
| Medium | Aves-Sagittarius serpentarius |
| Medium | Aves-Eupodotis senegalensis |
| Medium | Insecta-Lepidochrysops procera |
| Medium | Mammalia-Crocidura maquassiensis |
| Medium | Mammalia-Hydrictis maculicollis |
| Medium | Mammalia-Ourebia ourebi ourebi |

## Appraisal of the Sensitivity Rating

Two bird species highlighted by the Environmental Screening Tool were confirmed in the study area during the field survey, namely Southern Bald Ibis and Yellow-billed Stork. Field observations, coupled with habitat suitability assessments, also indicate that several other fauna SCC, including those highlighted by the screening report either occur, or are likely to occur, in the study area. Based on the findings of this study, the 'High' sensitivity rating for Animal Species for the study area is therefore confirmed.

# Appendix F: Compliance with Animal Species Protocol.

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity | Relevant Section in Report |
|---|---|
| **The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline7; and must;** | |
| 2.2.1 identify the SCC which were found, observed or are likely to occur within the study area; | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.2 provide evidence (photographs or sound recordings) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility, immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3); | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.3 identify the distribution, location, viability and provide a detailed description of population size of the SCC, identified within the study area; | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.4 identify the nature and the extent of the potential impact of the proposed development on the population of the SCC located within the study area; | Section 9.3 |
| 2.2.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases, including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases; | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area; | Section 9.3 |
| 2.2.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, include a motivation for the deviation; | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.8 identify any dynamic ecological processes occurring within the broader landscape that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems; | Section 8 |
| 2.2.9 identify any potential impact of ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long-term viability; | Section 7.1, Section 8 & Section 9.3 |
| 2.2.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; | N/A |
| 2.2.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 2.2.12 identify any alternative development footprints within the preferred site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification | Section 8 |
| 3.1 This report must include as a minimum the following information: | |

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity | Relevant Section in Report |
|---|---|
| 3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae; | Page 3 & Appendix A |
| 3.1.2 a signed statement of independence by the specialist; | Page 3 |
| 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; | Section 3.2 & Section 4 |
| 3.1.4 a description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant; | Section 3 & Section 9.1 |
| 3.1.5 a description of the mean density of observations/number of sample sites per unit area and the site inspection observations; | Section 3.2 |
| 3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data; | Section 4 |
| 3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported; | Section 6.1.2, Section 6.2.2, Section 6.3.2 & Section 6.4 |
| 3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area; | iNaturalist – Andrew Zinn profile |
| 3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant; | N/A |
| 3.1.10 a discussion on the cumulative impacts; | Section 9.3.4 |
| 3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr); | Section 11 & Section 12 |
| 3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; | Section 13 |
| 3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate; | N/A |
| 3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report. | EAP to incorporate |

# PLANT SPECIES SPECIALIST ASSESSMENT FOR THE PROPOSED PHEFUMULA EMOYENI ONE WIND ENERGY FACILITY PROJECT

WSP Group Africa Pty (Ltd)

September 2024

Submitted to:
Aisling Dower
WSP Africa Pty (Ltd)
Building 1, Maxwell Office Park
Waterfall City, Midrand
Gauteng
South Africa

Report Compiled By:
Andrew Zinn (*Pr.Sci.Nat.*)
Hawkhead Consulting

# Contents

# List of Figures



# List of Tables

# Acronyms and Abbreviations

| Abbreviation | Explanation |
|---|---|
| AIS | Alien Invasive Species |
| AOO | Area of Occupancy |
| BI | Biodiversity Importance |
| CA | Conservation Areas |
| CI | Conservation Importance |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Programme |
| EOO | Extent of Occurrence |
| FI | Functional Integrity |
| Ha | Hectare |
| IUCN | International Union for the Conservation of Nature |
| MAP | Mean Annual Precipitation |
| MPTA | Mpumalanga Parks and Tourism Agency |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management Biodiversity Act |
| QDS | Quarter Degree Square |
| RR | Receptor Resilience |
| SANBI | South African National Biodiversity Institute |
| SAS | Strategic Aquatic Services |
| SCC | Species of Conservation Concern |
| SEI | Site Ecological Importance |
| ToPS | Threatened or Protected Species |
| WEF | Wind Energy Facility |

# Details of the Expertise of the Specialist

| Specialist Information | |
|---|---|
| **Name** | Andrew D. Zinn<br>Pr.Sci.Nat. - Ecological Science (400687/15) |
| **Designation** | Report Author – Terrestrial Ecologist |
| **Cell Phone Number** | +27 83 361 0373 |
| **Email Address** | andrew@hawkhead.co.za |
| **Qualifications** | M.Sc. Resource Conservation Biology<br>B.Sc. Hons. Ecology and Conservation Biology<br>B.Sc. Zoology and Grassland Science |
| **Summary of Past Experience** | Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research, and is registered as a Professional Natural Scientist (*Pr.Sci.Nat.*) – Ecological Science, with the South African Council of Natural Scientific Professions (SACNASP). Andrew has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia. |
| Refer to Appendix A for a full Curriculum Vitae of Andrew Zinn. | |

# Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Phefumula Emoyeni One Wind Energy Facility Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

Andrew Zinn

# 1. Introduction

Hawkhead Consulting was appointed by WSP Group Africa Pty (Ltd), on behalf of Phefumula Emoyeni One (Pty) Ltd, to conduct the Plant Species Specialist Assessment for the proposed Phefumula Emoyeni One Wind Energy Facility (WEF) Project (hereafter referred to as the 'Project'), near Ermelo in Mpumalanga Province, South Africa.

## 1.1. Scope and Purposes of this Report

This specialist study focused on terrestrial plant species (flora), and was compiled in line with the '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 National Environmental Management Act, 1998, When Applying for Environmental Authorisation', and specifically:

- Protocol for the Specialist Assessment and Minimum Content Requirements for Environmental Impacts on Terrestrial Plant Species.

The primary scope of work included:

- Collating and reviewing information and data on terrestrial vegetation and flora species that occur or potentially occur on-site and in the surrounding landscape;
- Conducting a field programme to collect data on vegetation communities and flora species present on-site, and identify any botanical sensitivities;
- Assessing the suitability of the Proposed project and the potential negative impacts on terrestrial vegetation and flora that may result from proposed Project activities; and
- Recommending mitigation and management measures for inclusion in the proposed Project's Environmental Management Programme (EMP) and/or Biodiversity Management Plan (BMP).

In line with the above scope, the purpose of this report is to; 1) present a baseline description of terrestrial flora species occurring on-site, highlighting the presence/potential presence of species of conservation concern; 2) present the findings of an impact assessment for the proposed Project; 3) recommend applicable biodiversity mitigation and management measures; and 4) provide an impact statement on the appropriateness of the proposed Project with respects to terrestrial plant species conservation.

This report should be read in conjunction with the Terrestrial Biodiversity Specialist Assessment and Animal Species Specialist Assessment reports, as well as any other biodiversity-related reports.

## 1.2. Location and Delimits of the Study Area

The proposed Phefumula Emoyeni One WEF Project site is located approximately 16 km north of Ermelo in the Msukaligwa Local Municipality and Gert Sibande District Municipality, in Mpumalanga Province, South Africa (**Error! Reference source not found.**). The entire WEF site was regarded as the 'study area' for this specialist assessment.

## 1.3. Project Description

The proposed Phefumula Emoyeni One WEF will be developed within a project area of approximately 33 660 hectares (ha). The site will be accessed via the N11 and existing access roads. The proposed project description is outlined in Table 1.

*Table 1: Phefumula Emoyeni One WEF Technical Details*

| Details | Information |
|---|---|
| APPLICANT NAME: | PHEFUMULA EMOYENI ONE (PTY) LTD |
| Municipalities | Msukaligwa Local Municipality<br>Gert Sibande District Municipality |
| Extent | 33 660 ha |
| Buildable area | subject to finalization based on technical and environmental requirements |
| Export Capacity | Up to 550MW |
| Power system technology | Wind |
| Number of Turbines | 88 |
| Turbine capacity | Between 6 MW and 15 MW each |
| Rotor Diameter | Up to 200 m |
| Hub Height | Up to 200 m |
| Hard Standing Dimensions | Approximately 75 m x 120 m |
| Turbine Foundations | Diameter of up to 40 m per turbine – excavation up to 6 m deep, constructed of reinforced concrete to support the mounting ring. Once tower established, footprint of foundation is covered with soil. |
| Substation and internal powerlines | • 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.<br>• 3 x 33kV/132kV onsite collector substation (IPP Portion), each being up to 5 ha.<br>• Cabling between turbines, to be laid underground where practical |
| Construction camp and laydown area | • Construction compounds including site office (approximately 300 m x 300 m in total but split into 3 ha each of 150 m x 200 m):<br>• 3 x Batching plant of up to 4 ha to 7 ha.<br>• 3 x construction compound / laydown area, including site office of 3ha each (150 m x 200 m each).<br>• Laydown and crane hardstand areas (approximately 75 m x 120 m). |
| Internal Roads | • 12-13 m wide roads with 12 m radius turning circles, gravel surface |
| O&M Building | • 3 x O&M office of approximately 1. 5ha each adjacent to each collector Sub Station. |
| Batching Plant | • Up to 3 x Batching plants of up to 4 ha to 7 ha. |
| BESS | • Battery Energy Storage System (BESS) (200MW/800MWh).<br>• Type has not been confirmed at this stage. It is proposed that all impacts related to both types be assessed in the EIA.<br>• Export Capacity of up to 200MW<br>• Total storage capacity 800MWh<br>• Storage capacity of up to 6-8 hours<br>• The BESS will be housed in containers covering a total approximate footprint of up to 5ha.<br>• Battery types to be considered: Solid State Batteries as the preferred (Lithium Ion) and Redox Flow Batteries as the alternative (Vanadium Redox). |

## 1.4. Results of the Environmental Screening Tool

The proposed Project site was assessed at a desktop level using the National Web-based Environmental Screening Tool. According to the National Web Based Screening Tool, the Plant Species Theme for the proposed Project was rated 'Medium' sensitivity on account of the potential presence of nine threatened flora species. These species are listed below and discussed in more detail in Section 7.2.1 of this report:

- Sensitive species 1252;
- *Khadia carolinensis*;
- Sensitive species 1200;
- *Aspidoglossum xanthosphaerum;*
- *Miraglossum davyi;*
- Sensitive species 41;
- Sensitive species 691;
- *Pachycarpus suaveolens;* and
- Sensitive species 851.

Note: The names of specific taxa that are regarded as being susceptible to overexploitation have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number', *a*s per the species assessment guidelines (SANBI, 2020).

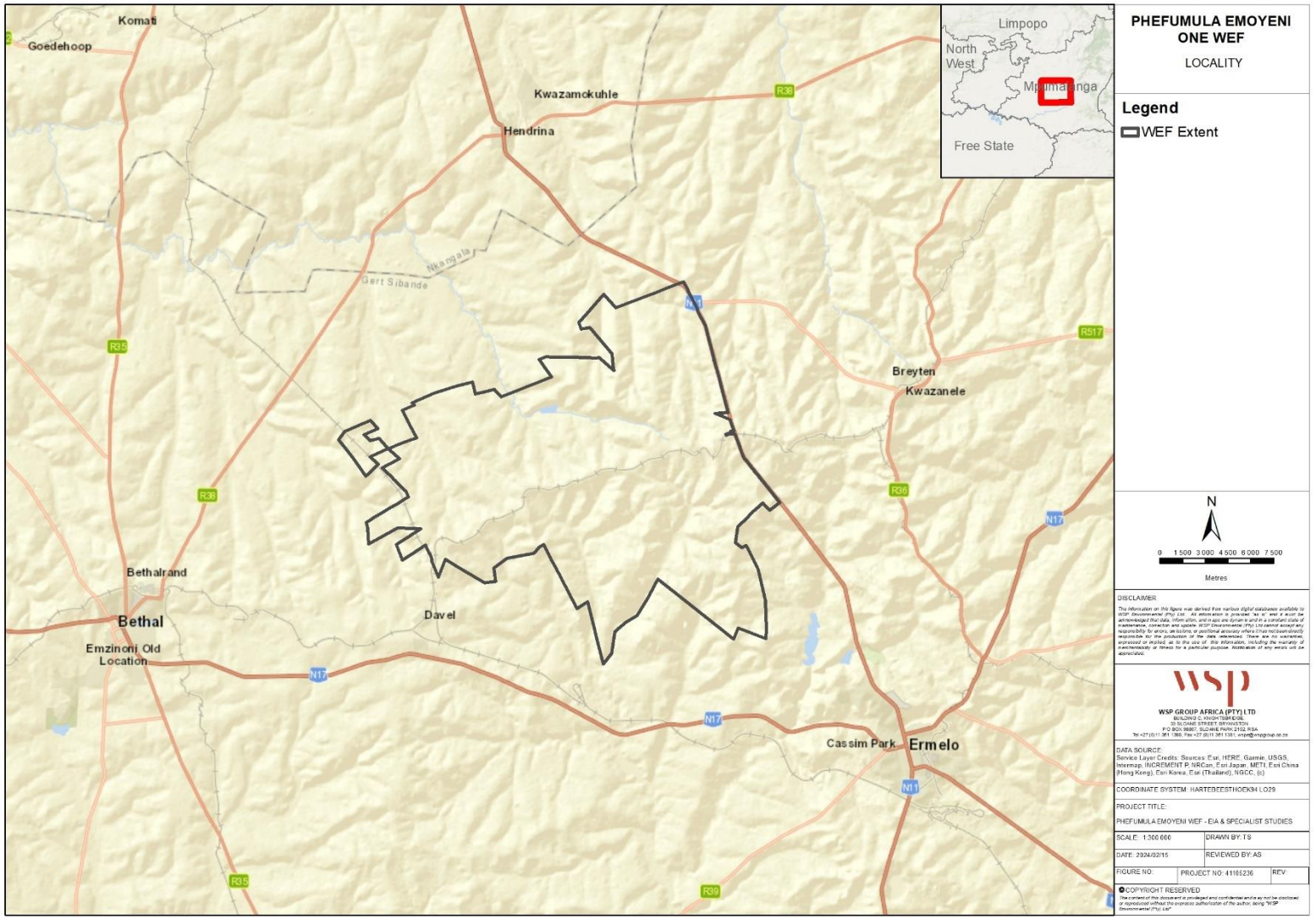



*Figure 1: Map showing the regional location of the proposed Project.*

# 2. Relevant Legislation and Guidelines

Relevant international, national and provincial legislation, associated guidelines and policies that are relevant to the environment and biodiversity, and which were used to guide the Plant Species Specialist Assessment are listed in Table 2.

*Table 2: Relevant environmental and biodiversity legislation and guidelines.*

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| National Environmental Management Act, 1998 (Act No 107 of 1998) – NEMA | Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management, and laid down in Chapter 5 of the NEMA. In terms of section 24(1), the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the NEMA with granting of the relevant environmental authorisation. In terms of section 24F (1) of the NEMA no person may commence an activity listed or specified in terms of section 24(2)(a) or (b) unless the competent authority has granted an environmental authorisation for the activity.<br><br>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, the following is relevant to this study:<br><br>• Protocol for the specialist assessment and report content requirements for environmental impacts on terrestrial plants. |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) | The NEMBA is administered by the Department of Forestry, Fisheries and the Environment (DFFE) and provides the framework under the NEMA for the:<br><br>• Management and conservation of South Africa's biodiversity;<br>• The protection of species and ecosystems that warrant protection;<br>• The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; and<br>• The establishment and functions of a South African National Biodiversity Institute (SANBI).<br><br>Amongst other components, the NEMBA includes:<br>• Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (February 2007), with associated amendments (December 2007 and 3 June 2020) (ToPS), published under Section 56(10 of NEMBA;<br>• Threatened or Protected Species Regulations (February 2007); and |

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| | • National list of threatened terrestrial ecosystems for South Africa (2011, and 2021 revision), published under Section 51(1)(a) of NEMBA.<br>• National Biodiversity Offset Guideline (2023), which provides guidance on the need to develop biodiversity offsets.<br><br>The purpose of ToPS lists and regulations are to regulate the permit system concerning restricted activities involving specimens of listed threatened or protected species. The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by identifying 'witness' sites' of exceptionally high conservation value and enabling and facilitating proactive management of these ecosystems.<br><br>Chapter 5 of NEMBA also provides a list of regulations and guidance concerning alien invasive species, including:<br>• A guideline for Monitoring, Control and Eradication Plans (September 2015);<br>• 2020 Alien and Invasive Species Regulations (September 2020); and<br>• 2016 and 2020 Alien and Invasive Species Lists (March 2021). |
| National Environmental Management: Protected Areas Act (2003) | • The NEMPA provides the framework under the NEMA for the protection and conservation of South Africa's biodiversity through the establishment of a system of protected areas that represent the country's diverse ecosystems, landscapes, and seascapes; and<br>• The NEMPA sets out mechanisms and processes for declaring and managing protected areas, including protected environments, with an emphasis on intergovernmental cooperation and public involvement. |
| Mpumalanga Nature Conservation Act (Act No. 10 of 1998) | Amongst other provisions, the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) provides lists of specially protected and protected flora and fauna. Of particular relevance to this specialist study are species of game/wild animals and flora that are listed under:<br>• Schedule 11 and 12: Protected and Specialist Protected Plants. |
| Other Relevant national and Provincial Policies, Plans and Guidelines | Other relevant policies, plans and guidelines that were considered during this study include:<br>• Mpumalanga Biodiversity Sector Plan (2022);<br>• Species Environmental Assessment Guideline (SANBI, 2020);<br>• National Protected Area Expansion Strategy (2019); and<br>• Mpumalanga Protected Area Expansion Strategy – 20-year Plan. |

# 3. Study Methodology

The methodology used for this study included a desktop literature review component and a field programme. The various tasks associated with these components are discussed below:

## 3.1. Desktop Data Collation and Literature Review

The aim of the desktop literature review component was to collate and review data and information pertaining to terrestrial flora species that may occur in the study area and surrounding landscape, based on historic distribution ranges or recent records. Literature and data that were reviewed were obtained from a variety of online and literature sources. These are discussed below:

### 3.1.1. Regional Ecosystems and Vegetation Types

General habitat descriptions relevant to the study area and the surrounding landscape were obtained from SANBI (2018) and Mucina and Rutherford (2011).

### 3.1.2. Vegetation and Flora Species Richness

- A list of flora species that have previously been recorded in the broader region, and that potentially occur in the study area, was obtained from the SANBI's online Botanical Database of Southern Africa (BODATSA); and
- Lists of flora species of conservation concern (SCC) sourced from the Mpumalanga Parks and Tourism Agency (MPTA) for the 2629BD and 2629DC Quarter Degree Squares (QDS) and flora SCC highlighted by the online environmental sensitivity screening tool.

## 3.2. Field Programme

The field programme comprised a wet-season field survey, conducted from the 22$^{nd}$-26$^{th}$ January 2024. This period coincides with the peak vegetation growing period (November to April) for grassland ecosystems in summer rainfall areas and is therefore an optimal time to assess flora. The sampling methodologies used during the field survey were based, in part, on those recommended in SANBI (2020), and included the following:

- Vegetation was sampled using meander search transects at representative sites in each of the main natural habitat units that were identified across the study area at a desktop level using aerial imagery prior to the field survey. Twenty-nine transects were surveyed across the study area;
- Data collected during flora surveys included habitat character and condition, flora species composition, evidence of current and past disturbances, presence of flora species of conservation concern, and declared alien invasive species;
- Flora nomenclature is based on species names presented on SANBI's Red List of South African Plants website;
- Field data were used to compile a species list for the study area, develop habitat unit descriptions, and provide the basis for habitat suitability assessments for flora species of conservation concern; and
- Vegetation structural classification was based on Edwards (1983).

## 3.3. Delineation and Mapping of Habitat Units

Mapping of habitat units was conducted using a review and analysis of composite Google Earth aerial imagery, coupled with data and observations obtained during the field survey, and using the wetland delineations developed by Strategic Aquatic Services (SAS).

## 3.4. Assessment of Species of Conservation Concern

### 3.4.1. Threatened, Near Threatened and/or Protected Species Status

Species of conservation concern (SCC) were based on the national and provincial Red Lists of threatened/near threatened flora species. Also included in the discussion of flora SCC are species listed as Protected, as per national and provincial legislation. Relevant lists and legislation consulted include:

- Red List of South African Plans (Version 2020), presented by SANBI;
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998); and
- Mpumalanga Red List of Threatened Flora.

### 3.4.2. Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of SCC potentially present on-site, a 'probability of occurrence' of a species in the study area was determined by conducting habitat suitability assessments. The following parameters were used in the assessments:

- Habitat requirements: Most threatened species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of SCC.

Probability of occurrence is presented in the following categories:

- Recorded: Any SCC observed/documented in or close to the study area;
- Probable: the species is likely to occur in the study area due to suitable habitat and resources being present;
- Possible: The species may occur in the study area due to potential habitat and/or resources; and
- Unlikely: the species will not likely occur in the study area due to lack of suitable habitat and resources, or significant differences in its Area of Occupancy (AOO) compared to its Extent of Occurrence (EOO).

## 3.5. Alien Invasive Species

Owing to their potential to spread, outcompete and exclude indigenous vegetation, special emphasis was placed on declared alien invasive flora species occurring in the study area. These were categorised

according to the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - 2020 listing of declared alien and invasive species.

## 3.6. Flora Species of Medicinal Value

Many common and widespread flora species have medical or cultural utility to humans, and as such have value to local communities. Flora of medicinal value recorded in the study area were therefore identified and their purported uses described based on Van Wyk, *et al*., (2009).

## 3.7. Assessment of Site Ecological Importance

The ecological importance (sensitivity) of habitat units was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of International Union for Conservation of Nature (IUCN) threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

For tables detailing the rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, refer to Appendix B. Table 3 presents a guideline for interpreting the SEI (SANBI, 2020).

*Table 3: Guidelines for interpreting SEI in the context of the proposed development activities*

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat |

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| | impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |
| Source: SANBI (2020). | |

# 4. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions, uncertainties and gaps in knowledge are highlighted for the Plant Species Specialist Assessment:

- The field survey was conducted in January 2024. The timing of the field survey thus coincided with the peak vegetation growing period (November to April) for grassland ecosystems in summer rainfall areas. It was noted that sufficient rain had fallen prior to the field survey, and vegetation was actively growing and flowering. Conditions at this time were therefore optimal to assess vegetation condition and flora species composition. Seasonality was therefore not considered a study limitation;
- Notwithstanding the above, it is possible that certain herbaceous taxa (e.g., annuals and geophytes) that are most readily visible or distinguishable at other periods during the wet/growing season, may not have been detected during the field survey; and
- Mapping of habitat units was conducted manually at a desktop-level, using available aerial imagery, coupled with field observations and supplementary spatial datasets. Agricultural landscapes are dynamic and subject to ongoing farming activities. It is thus possible that the character of individual habitat patches may change over time.

# 5. Regional Description of Baseline Vegetation

The study area is located in the Grassland Biome, and according to SANBI's regional mapping of South Africa's vegetation types (2018), Eastern Highveld Grassland and Soweto Highveld Grassland are the dominant vegetation type across the study area (Figure 2). The general characteristics of the Grassland Biome and these vegetation types, are discussed in more detail below:

## 5.1. Grassland Biome

The regional study area is located in the Grassland Biome, which covers approximately 28% of South Africa and is the dominant biome of the central plateau and inland areas of the eastern subcontinent (SANBI, 2013). Grasslands are typically situated in moist, summer rainfall regions that experience between 400 mm and 2000 mm of rainfall per year. Vegetation consists of a dominant field-layer comprising grasses and herbaceous perennials, with little- to no woody plants present.

South Africa's grassland ecosystems are parsed into five groups, with the study area located in the Mesic Highveld Grasslands group (SANBI 2013). Mesic Highveld Grasslands occur at mid-altitudes and

experience warm, wet summers (MAP 700-1200 mm) and cold winters. They are typically highly productive sourveld grasslands that are dominated by long-lived perennial grasses (SANBI, 2013).

Fire is common in Mesic Highveld Grasslands and maintains these ecosystems in a relatively treeless form (SANBI, 2013). Apart from their importance as rich stores of biodiversity, grasslands are critically important water production landscapes, constituting about half of South Africa's Strategic Water Source Areas (SANBI, 2013).

## 5.2. Eastern Highveld Grassland

Eastern Highveld Grasslands extend from Johannesburg in the east through to Bethel, Ermelo and Piet Retief in the west. This vegetation type is found on slightly- to moderately undulating plains, low hills and wetland depressions. Grasses are typical Highveld species from the genera *Aristida, Digitaria, Eragrostis* and *Tristachya*. Indigenous woody species are mainly restricted to rocky areas and include *Celtis africana, Protea caffra, Protea welwitschii, Diospyros lycioides, Searsia magalismontana* and *Senegalia caffra* (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) note the following species, amongst several others, as important taxa in Eastern Highveld Grassland:

**Shrubs**: *Anthospermum rigidum* and *Seriphium plumosum*.

**Graminoide**s: *Aristida aequiglumis, Aristida congesta, Aristida junciformis, Cynodon dactylon, Digitaria monodactyla, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Eragrostis racemosa, Heteropogon contortus, Loudetia simplex, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Alloteropsis semialata* and *Monocymbium ceresiiforme*.

**Herbs**: *Berkheya setifera, Haplocarpha scaposa, Euryops gilfillanii, Euryops transvaalensis, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Kohautia amatymbica, Lactuca inermis, Gladiolus crassifolius, Haemanthus humilis* and *Selago densiflora*.

**Endemic Taxa**: The geophytic herbs *Agapanthus inapertus, Eucomis vandermerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

## 5.3. Soweto Highveld Grassland

Soweto Highveld Grassland extends in a broad band between Johannesburg and Ermelo in the north, and Perdekop and the Vaal River in the south (Mucina & Rutherford, 2011). Vegetation is characterised by short to medium-high density tufted grassland occurring on gently to moderately undulating plains (Mucina & Rutherford, 2011). Grasslands are typically dominated by *Themeda triandra* along with several other co-dominant species. These grasslands are interrupted by small wetlands and rocky ridges and outcrops (Mucina & Rutherford, 2011).

The mean annual precipitation (MAP) of the region is 662 mm. Rainfall occurs in the summer, with winters being typically cold and dry (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) list the following flora species as being important or characteristic taxa in the Soweto Highveld Grassland vegetation type, amongst others:

**Graminoids**: *Themeda triandra, Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Heteropogon contortus, Hyparrhenia hirta, Setaria sphacelata, Aristida junciformis, Aristida congesta, Aristida bipartita* and *Paspalum dilatatum*.

**Herbs**: *Hermannia depressa, Euryops gilfillanii, Geigeria aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum rugulosum, Helichrysum nudifolium, Lippia scaberrima, Senecio coronatus, Vernonia oligocephala* and *Wahlenbergia undulata.*

**Shrubs**: *Anthospermum hispidulum, Anthospermum rigidum, Berkheya annectens, Felicia muricata* and *Ziziphus zeyheriana*.

## 5.4. Threat Status of Eastern Highveld Grassland and Soweto Highveld Grassland

Both Eastern Highveld Grassland and Soweto Highveld Grasslands are listed as threatened, as per NEMBA Threatened Ecosystems (2021).

Eastern Highveld Grassland is listed as Endangered and is subject to high rates of habitat loss as a result of cultivation, forestry, mines, urbanisation and the building of dams (Mucina & Rutherford, 2011). Estimates suggest that up to approximately 70% of the original extent of Eastern Highveld Grassland has been transformed. Only a very small fraction is conserved in statutory reserves (e.g., Nooitgedacht Dam and Jericho Dam Nature Reserves) (Mucina & Rutherford, 2011). The mapped remaining extent of Eastern Highveld Grassland, as per SANBI (2021) spatial data, is shown in Figure 3 below.

Cultivation, urbanisation, road infrastructure and mining have similarly resulted in the transformation of more than half of the original extent of Soweto Highveld Grasslands (Mucina & Rutherford, 2011). Only a few patches are conserved in formal protected areas, such as Waldrift Nature Reserve, Krugersdorp Nature Reserve, Leeuwkuil Nature Reserve and Suikerbosrand Nature Reserve. This vegetation type is therefore listed as Vulnerable, according to the NEMBA Threatened Ecosystems (2021) (remaining extent also shown in Figure 3).

The study area is characterised by large areas of intact grassland habitat comprising both Eastern Highveld Grassland and Soweto Highveld Grassland. Considering the conservation status of these vegetation types, potential loss of natural grassland associated with the proposed Project is a concern and needs to be carefully managed.

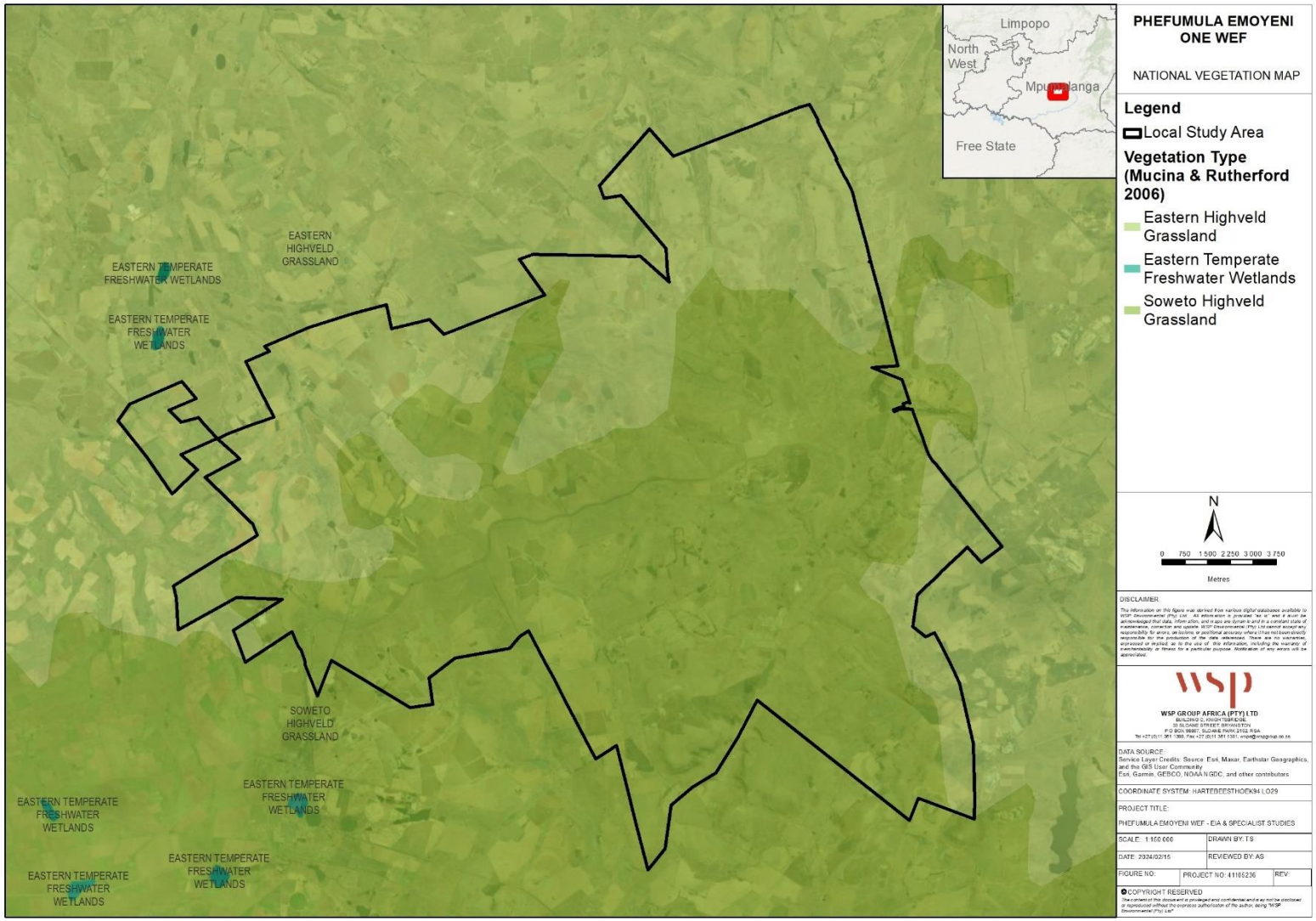



*Figure 2: Study area in relation to the SANBI (2018) vegetation types.*

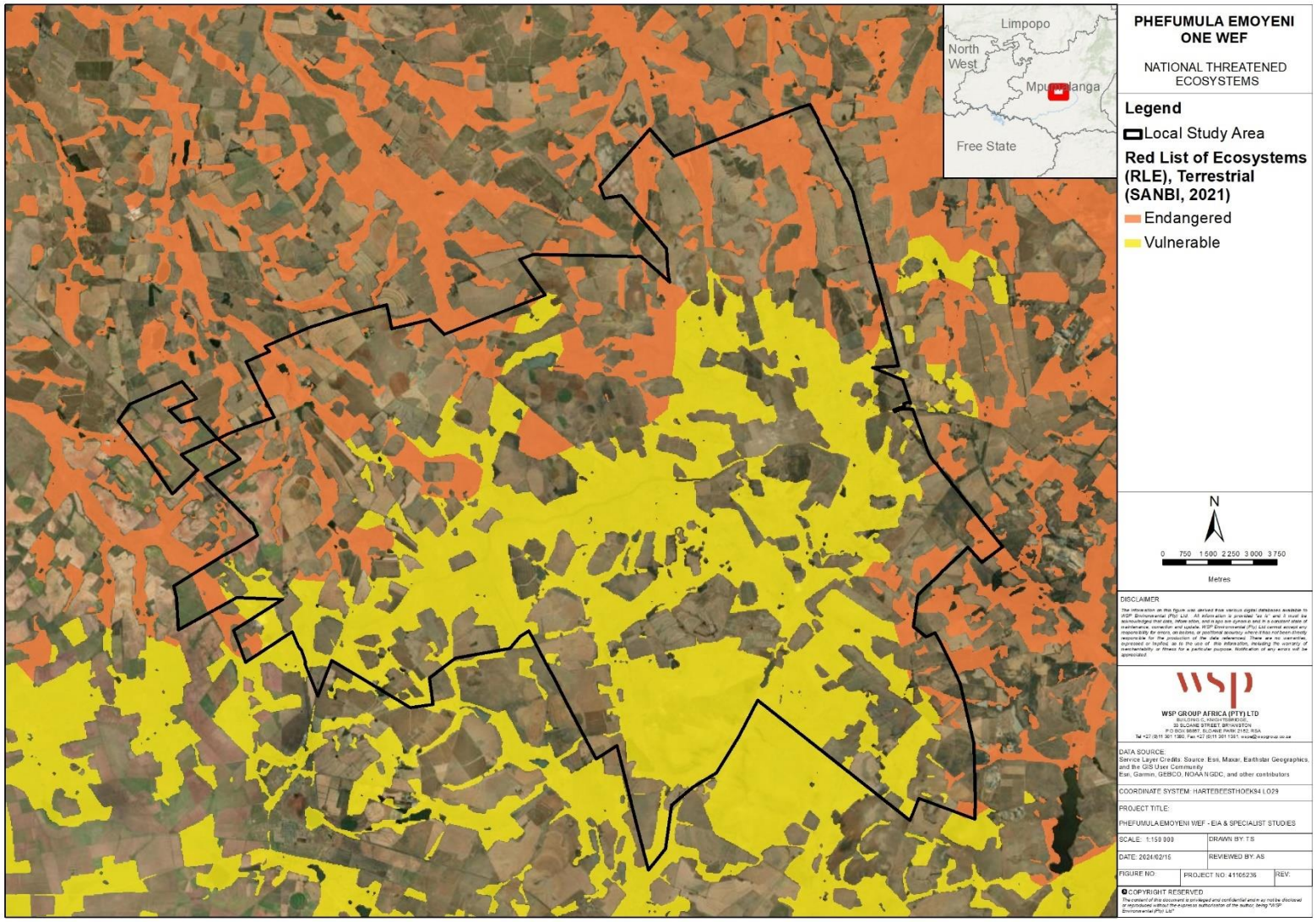



*Figure 3: Study area in relation to delineations of the National Red List of Terrestrial Ecosystems.*

# 6. Landscape Context and Existing Impacts on Flora

The study area is large and defined as a multi-functional rural-agricultural landscape, that is characterised by areas of both modified- and natural habitat. The following notes describe the general landscape context and major existing impacts (anthropogenic activities and infrastructure) that were observed in and around the study area during the 2024 field survey:

- Farming is the dominant land use within the study area, as well as across the surrounding landscape. Irrigated and dry-land cultivation, coupled with livestock production (mostly cattle, but also sheep) are the primary farming activities. These activities over the long term have caused varying degrees of spatial habitat modification and disturbance;
- Mining operations are present in the south-east of the study and to the immediate north of the study area. Mined areas were noted to be completely transformed, with typically little- to no natural habitat remaining;
- Various forms of linear infrastructure are present in the study area and across the broader landscape. These include major national tarred roads (N11 and N17), several gravel district roads, farms roads, informal vehicle tracks, a defunct railway line, and enumerable farm fences. These linear features have caused to varying degrees, and in conjunction with transformative land uses activities (e.g., mining and cultivation), habitat fragmentation across the study area and surrounding landscape. Be that as it may, a large network of natural habitat patches and corridors is still present;
- Alien invasive species (AIS) are not overly abundant in the study area compared to other locations in Mpumalanga Province. However, localised stands of alien trees are present, with aggressive invaders such as wattle (e.g., *Acacia dealbata* and *Acacia mearnsii*) and *Populus x canescens* noted. The edges of many cultivated field and other degraded locations are also encroached by various herbaceous AIS, such as *Verbena bonariensis*; and
- Other anthropogenic activities and infrastructure in the study area that have resulted in small-scale and localised habitat transformation include *inter alia*, farm residences, rural school buildings, and various agriculture structures (barns).

# 7. Vegetation and Flora Assessment

## 7.1. Habitat Units

Based on data collected during the field survey, six primary habitat units were identified in the study area. These include three units regarded as natural habitat, and three units regarded as modified habitats:

**Natural Habitats**

- Mixed Dry Grassland;
- Rocky Shrubland;
- Moist Grassland;

**Modified Habitats**

- Old Lands;
- Cultivated Fields; and

- Alien Tree Plantations.

Habitat units are described, with accompanying photographs, in Section 7.1.1 through to Section 7.1.6**Error! Reference source not found.Error! Reference source not found.**. A habitat unit map for the study area is shown in Figure 4. It must be noted that the study area is an active agricultural landscape, and subject to ongoing farming activity/disturbances. The temporal and spatial character of Cultivated Fields and Old Lands, is thus often changing.

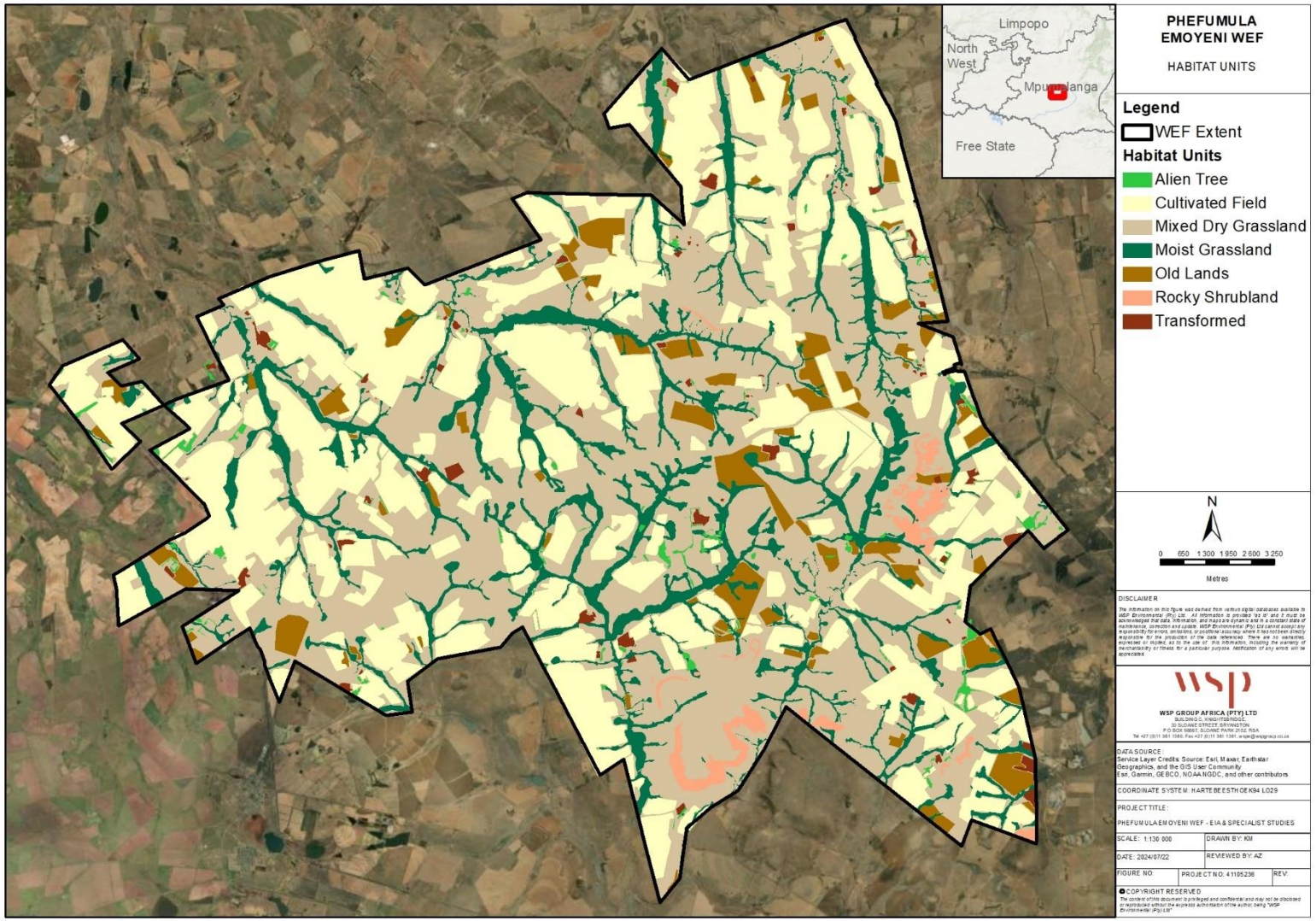



*Figure 4: Habitat unit map of the study area.*

### 7.1.1. *Mixed Dry Grassland*

Mixed Dry Grassland is a variable habitat unit that characterises the large intact grasslands of the study area. Based on contemporary and former farming activities disturbance levels in areas of Mixed Dry Grassland vary.

As per Edwards (1983) structural classification system, the vegetation structure of this unit is defined a low- closed grassland. Compositionally, areas of Mixed Dry Grassland are characterised by a diverse flora assemblage, that is typically grass dominated and forb rich, and with woody species generally occurring as scattered individual trees and shrubs.

Predicated on past livestock grazing levels and wildfire patterns, the grass species composition of these grasslands varies. Areas that have likely experienced high-levels of past selective grazing and/or too frequent wildfires tend to be dominated by early-seral grass species, such as *Eragrostis plana* and *Eragrostis chloromelas* (Figure 5), whereas in areas that have been less intensely grazed, other species are more common, such as the often-dominant *Themeda triandra,* as well as *Brachiaria serrata, Cymbopogon pospischilii, Eragrostis racemosa, Harpochloa falx, Setaria* species and *Tristachya leucothrix* (Figure 6).

Common herbs/forbs recorded in the Mixed Dry Grassland unit include *inter alia*; *Berkheya pinnatifida ingrata, Berkheya radula, Berkheya setifera, Berkheya speciosa, Haplocarpha scaposa, Hermannia transvaalensis, Hilliardiella aristata,* various *Helichrysum* and *Hypoxis* species and *Nidorella podocephala.*

Woody species generally occur at low abundances in areas of Mixed Dry Grassland and typically include scattered *Diospyros lycioides* and *Seriphium plumosum* shrubs. Higher abundances of *Seriphium plumosum* were noted at certain locations and are likely a result of historic localised overgrazing by livestock. In terms of declared alien invasive species, several species were observed including *inter alia*; *Cirsium vulgare, Solanum elaeagnifolium, Solanum sisymbriifolium, Verbena bonariensis* and *Verbena rigida*. For a list of flora species recorded in this habitat unit during the field survey refer to Appendix C.

**Sensitivity Aspects**

This habitat unit characterises large portions of the study area. In conjunction with adjacent Moist Grassland habitat, areas of Mixed Dry Grassland are crucial resource and refuge habitat for flora and fauna. They also act as important ecological corridors, increasing local habitat connectivity and facilitating various ecological processes such as, *inter alia*, flora and fauna movement and dispersal.

In terms of flora SCC, *Kniphofia ensifolia* subsp*. ensifolia* (NT, MP) and several protected flora species were recorded in this habitat unit during the field survey. Habitat suitability assessments also indicate that several other flora SCC are likely to be present in areas of Mixed Dry Grassland (refer to Section 7.2.1 for further discussion on flora SCC). Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 5: Eragrostis dominated Mixed Dry Grassland.*

*Figure 6: Themeda triandra dominated Mixed Dry Grassland.*

### 7.1.2. Rocky Shrubland

Rocky Shrubland is a relatively small habitat unit that occurs along rocky hillside and ridges in the study area. Unlike adjacent areas of open grassland, this habitat unit is characterised by a notably higher abundance of indigenous woody vegetation, coupled with the presence of numerous large protruding rocks.

In line with Edwards (1983) structural classification, this habitat unit is defined as low- to short sparse shrubland, with woody vegetation growing as small trees and shrubs (typically < 3m in height). These typically grow in either dense, but spatially discrete aggregations around exposed rocks, or as scattered individuals within the broader grassland matrix – see Figure 7 and Figure 8.

Compositionally, the *Diospyros lycioides* is the most abundant woody species. Other common larger woody taxa recorded in this unit include *Asparagus laricinus*, *Euclea crispa, Gymnosporia buxifolia, Kiggelaria africana, Rabdosiella calycina, Searsia dentata, Searsia discolor* and *Searsia pyroides* var. *gracilis.*

The herbaceous layer shares many of the same species as adjacent areas of Mixed Dry Grassland, as well as several additional taxa. Commonly recorded grasses include *Cymbopogon pospischilii, Eragrostis chloromelas, Eragrostis plana, Eragrostis pseudosclerantha, Eragrostis racemosa, Hyparrhenia dregeana, Hyparrhenia hirta, Melinis nerviglumis, Themeda triandra* and *Tristachya leucothrix.*

Various forbs, geophytes and small shrublets are also common in the herbaceous layer including *inter alia; Berkheya radula, Haemanthus humilis, Hilliardiella aristata, Haplocarpha scaposa, Helichrysum rugulosum, Phylica paniculata, Ledebouria ovatifolia* and *Leonotis dysophylla.* Ferns recorded in this unit include *Blechnum cf. australe, Cheilanthes hirta* var. *hirta, Pellaea calomelanos* var. *calomelanos* and *Selaginella dregei*. For a list of flora species recorded in this habitat unit during the field survey refer to Appendix C.

**Sensitivity Aspects**

The combination of indigenous woody vegetation and exposed rocks creates a distinctive rocky shrubland habitat that is relatively uncommon within the study area's typical open grassland

dominated land cover. Accordingly, areas of Rocky Shrubland increase landscape-scale heterogeneity, and provide important niche habitat for a variety of flora and fauna, including species of conservation concern that have an affinity for more wooded and/or rocky areas. The provincially protected *Haemanthus humilis* was recorded in this habitat unit, and habitat suitability assessments suggest that several other flora SCC are likely to be present. Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 7: Hillside characterised by exposed rocks and indigenous woody vegetation.*

*Figure 8: Pockets of woody trees and shrubs are typically dominated by Diospyros lycioides.*

### 7.1.3. *Moist Grassland*

Moist Grassland habitat characterises wetland and riparian systems across the study area. Vegetation structure ranges from low- to tall closed grassland (*sensu*. Edwards 1983), and although not widespread or abundant in most areas of Moist Grassland, alien woody vegetation is present and well-established at certain locations (Figure 9 and Figure 10).

Common flora species recorded include a range of grasses and sedges such as*, inter alia*; *Agrostis lachnantha, Andropogon appendiculatus, Arundinella nepalensis, Aristida junciformis, Cyperus congesta, Cyperus denudatus, Cyperus fastigiatus, Cyperus marginatus, Cynodon dactylon, Eleocharis limosa, Eragrostis gummiflua, Eragrostis heteromera, Eragrostis plana, Imperata cylindrica, Juncus dregeanus, Kyllinga erecta, Leersia hexandra* and *Paspalum dilatatum*.* The tall reed *Phragmites australis,* the bulrush *Typha capensis* and *Schoenoplectus brachyceras* are also present in more permanently damp areas (*denotes alien taxa).

Common forbs recorded in this habitat unit include *inter alia*; *Berkheya pinnatifida ingrata, Berkheya radula, Berkheya setifera, Centella asiatica, Helichrysum aureonitens, Helichrysum nudifolium* var. *pilosellum*, *Lobelia flaccida, Monopsis decipiens, Nidorella podocephala, Pelargonium luridum, Pimpinella transvaalensis, Scabiosa columbaria* and *Trifolium repens.*

Several alien woody taxa recorded in this habitat unit include *Eucalyptus sp., Quercus ruber, Populus x canescens, Pyracantha angustifolia* and *Salix babylonica* (Figure 10). For a list of flora species recorded in this habitat unit during the field survey refer to Appendix C.

**Sensitivity Aspects**

Moist Grasslands play a crucial in maintaining the hydrological functioning (e.g., filtration and flood attenuation), ecological processes, and terrestrial biodiversity of the landscape. In conjunction with

adjacent Mixed Dry Grasslands, these habitats significantly increase landscape-scale habitat connectivity, and thus provide important ecological corridors. Several protected flora species, such as *Crinum bulbispermum* and various *Gladiolus* species, were recorded in Moist Grasslands in the study area, and habitat suitability assessments suggest that several other flora SCC are likely to be present. Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 9: Typical area of open Moist Grassland in the study area.*

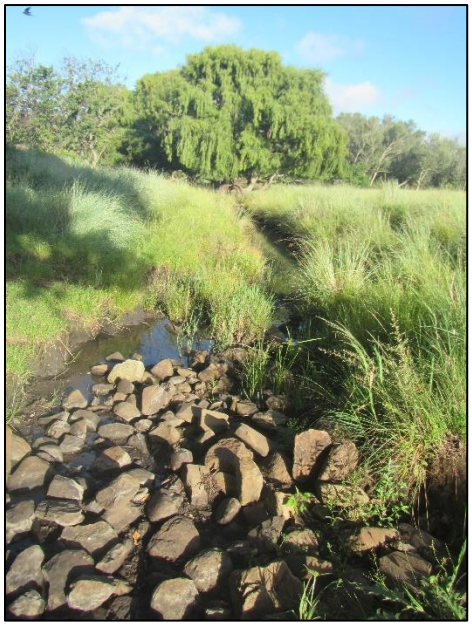


*Figure 10: Small stream encroached by large alien trees including Salix babylonica and Populus x canescens.*

### 7.1.4. *Old Lands*

As the name suggests, this habitat unit characterises old cultivated fields that have been left fallow for several years, and as a result have subsequently regenerated to a secondary grassland community. As such, this is considered a modified habitat unit.

Vegetation structure is low closed grassland (*sensu*. Edwards, 1983). Compositionally, compared to natural grasslands, Old Lands are depleted of nutrients and thus floristically depauperate. Dominant grass species recorded in this unit during the field survey include the tall, robust thatching grasses *Hyparrhenia dregeana* and *Hyparrhenia hirta,* and relict-pioneer and early-seral taxa such as *Eragrostis chloromelas, Eragrostis curvula* and *Eragrostis plana* (see Figure 11).

Forbs recorded Old Lands include a mixture or indigenous and alien ruderal and weedy species, such as *Bidens pilosa, Conyza bonariensis, Pseudognaphalium luteo-album, Senecio consanguineus, Rumex acetosella, Selago densiflora, Tagetes minuta, Verbena rigida* and *Wahlenbergia undulata.* The only woody species recorded in this habitat unit was *Seriphium plumosum.* For a list of flora species recorded during the field survey refer to Appendix C.

**Sensitivity Aspects**

Despite past disturbances and a secondary vegetation community, Old Lands can retain some of the functional attributes of natural grasslands. They are also very stable and able to persist for extensive periods. This notwithstanding, no flora and fauna species of conservation were recorded in this habitat

unit, and it is considered unlikely that Old Lands constitute important life-cycle habitat for any SCC. Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 11: Old Land dominated by Hyparrhenia grass species.*

### 7.1.5. *Cultivated Fields*

Large portions of the study area are dominated by cultivated agricultural fields, which is considered a modified habitat type. Cultivated Fields include both pivot-irrigated crop fields and dry-land crop fields. These are typically under maize production, and are regularly disturbed through ploughing and harvesting (Figure 12).

This habitat unit also includes open fields that are actively-managed as grass pastures. Unlike areas of natural grassland, grass pastures are often fertilised, and regularly mown and baled to provide reserve forage for livestock during the dry season (shown Figure 13).

**Sensitivity Aspects**

Actively Cultivated Fields are denuded of indigenous vegetation, and are subject to regular anthropogenic disturbance. When not dominated by a monoculture of food crop species, these areas are typically colonised by a variety of alien invasive and weedy species.

No flora SCC were recorded in Cultivated Fields during the field survey, and no flora SCC are likely to be present in these areas. Although certain fauna species may move through or periodically forage in Cultivated Fields, due to the high-level of ongoing disturbance and modification, they are not considered important fauna life-cycle habitats. Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 12: Dry-land Cultivated Field, under maize production.*

*Figure 13: Recently mown and baled grass pasture. Note prevalence of the declared weed Verbena bonariensis in foreground.*

### 7.1.6. Alien Tree Plantations

Alien Tree Plantations is a broad-term to describe the numerous and localised stands of alien woody vegetation in the study area. These stands range from narrow wind-rows (typically associated with farms residences and farm roads) to defined plantation-type stands and informal thickets (Figure 14 and Figure 15). Alien Tree Plantations are a modified habitat type.

Vegetation structure is defined as short- to tall closed woodland (*sensu*. Edwards, 1983). Dominant alien tree species include alien *Eucalyptus* species*, Acacia* dealbata and *Acacia mearnsii* (wattles), and *Populus x canescen*s. Little indigenous vegetation is present in dense, well-established Alien Tree Plantations, with herbaceous flora typically supressed or in most cases, largely absent.

**Sensitivity Aspects**

Alien Tree Plantations are characterised by an almost complete dominance of one or two non-indigenous tree species. No flora SCC were observed in these areas during the field survey, and no flora SCC are likely to be present in these habitats.

From a fauna perspective, Alien Tree Plantations may be used as refuge habitats by fauna that are sensitive to hunting and other forms of anthropogenic disturbance. They may also be used as roosting/nesting habitat by *inter alia* raptors. Refer to Section 9 for discussion of the Site Ecological Importance of this habitat unit.

*Figure 14: Small stand of Acacia dealbata trees in the study area.*

*Figure 15: Stand of Populus x canescens trees growing in a hillside seep.*

## 7.2. Floristics Analysis

### 7.2.1. Flora Species of Conservation Concern

In line with the internationally endorsed IUCN Red List Categories and Criteria, the Red List of South African Plants recognises three categories of threatened species, namely Critically Endangered (CR), Endangered (EN) and Vulnerable (VU), and five 'other categories of conservation concern' that are recognised as having high conservation importance, namely Near Threatened (NT), Critically Rare, Rare, Declining, and Data Deficient – Insufficient Information (DDD).

As they are subject to national and/or provincial environmental legislation and require specific conservation management, flora species listed on the NEMBA ToPS List (2007) and Mpumalanga Nature Conservation Act (Act No. 10 of 1998) are also included as flora species of conservation concern and discussed in this section.

No flora species listed as threatened or Near Threatened on the national Red List were recorded in the study area during the field survey. However, *Kniphofia ensifolia* subsp*. ensifolia,* which is listed as Near Threatened on the Mpumalanga Red List, was recorded in the study area (coordinates S26 19.732 E29 46.738) (Figure 16). Based on reviewed literature and data sources, 11 flora species that occur, or potentially occur in the study area are listed as threatened or Near Threatened on the national and/or provincial Red Lists. These are listed in Table 4, along with the conservation statuses, habitat preferences and a probability of occurrence, based on habitat suitability.

Several flora species that are listed as protected at a provincial level according to Mpumalanga Nature Conservation Act (Act No. 10 of 1998) were recorded in the study area during the field survey, including *Aloe ecklonis, Boophone disticha* (Figure 17)*, Crinum bulbispermum* (Figure 18)*, Gladiolus crassifolius, Gladiolus longicollis subsp. platypetalus, Gladiolus sericeovillosus* subsp. *calvatus* and *Haemanthus humilis* (Figure 19).

No flora species listed on the NEMBA ToPS (2007) List were recorded or potentially occur in the study area.

*Figure 16: Kniphofia ensifolia subsp. ensifolia*

*Figure 17: Boophone disticha*

*Figure 18: Crinum bulbispermum*

*Figure 19: Haemanthus humilis*

*Table 4: Regionally or provincially threatened and Near Threatened flora species that occur or potentially occurring in the study area.*

| Family | Scientific Name[#] | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Habitat Preferences | Probability of Occurrence |
|---|---|---|---|---|---|---|
| Aizoaceae | *Khadia carolinensis* | Vulnerable | Vulnerable | - | Range-restricted species, occurring in Highveld grasslands between 1700m. AOO is estimated at 28.34 km2 (SANBI, 2020). Favours on well-drained sandy loam soils amongst rock outcrops, or along the edges of sandstone sheets (Lötter *et al*., 2007a) | Probable – suitable habitat present. |
| Apocynaceae | *Aspidoglossum xanthosphaerum* | Vulnerable | Vulnerable | - | Favours marshy habitats in montane grasslands around 1800 m. Only known from four locations, within an EOO of < 500 km2 (Nickolas & Victor, 2006), and an AOO estimated at 15.90 km2 (SANBI, 2020). Recorded at Breyten to the west of the town of Ermelo. | Possible - suitable habitat present. |
| Apocynaceae | *Miraglossum davyi* | Vulnerable | Vulnerable | - | Found on sloping grasslands in heavy black loam soils at high altitudes. Known from only five locations, with an EOO of <15 000km2 (Lötter et al., 2005) and a AOO estimated at 10.78 km2 (SANBI, 2020). | Possible - suitable habitat present. |
| Apocynaceae | *Pachycarpus suaveolens* | Vulnerable | Vulnerable | - | Favours short, annually burnt grassland between 1400-2000 m. Known from eight locations with an EOO of 19 900 km2 (Lötter *et al*., 2007b). | Probable – suitable habitat present. |
| Hyacinthaceae | *Eucomis autumnalis* | Least Concern | Declining | Protected | Favours damp open places (Williams, *et al.,* 2016b). | Probable – suitable present. |
| Orchidaceae | *Eulophia cooperi* | Least Concern | Rare | Protected | Widespread species. Found on rocky quartzite ridges between 1000 and 1800 m. | Probable – suitable habitat present. |
| Asphodelaceae | *Kniphofia ensifolia* subsp. *ensifolia* | Least Concern | Near Threatened | Protected | Generally occurs on heavy clay soils, along streams in grassland habitats. | Recorded (S26 19.732 E29 46.738) |

| Family | Scientific Name[#] | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Habitat Preferences | Probability of Occurrence |
|---|---|---|---|---|---|---|
| - | Sensitive species 1252 | Vulnerable | Vulnerable | Protected | Moist bushveld habitats, including wooded mountain kloofs. AOO estimated at 73.01 $km^2$ (SANBI, 2020). | Unlikely/ Possible – limited suitable habitat present. |
| - | Sensitive species 41 | Vulnerable | Vulnerable | Protected | Widespread but rare species, with a EEO of <19 940 $km^2$ and a AOO of <2000 $km^2$. Favours high altitude wetlands that remain damp throughout the year. | Probable – suitable habitat present. |
| - | Sensitive species 691 | Vulnerable | Near Threatened | - | EOO is between 455 and 11 158 $km^2$, and thought to occur at less than 10 locations, with an AOO estimated at 3.06 $km^2$ (SANBI, 2020). Prefers moist areas in undulating grassland. | Probable – suitable habitat present. |
| - | Sensitive species 851 | Vulnerable | - | - | Uncertainty surrounding distribution due to taxonomic confusion. EOO is estimated at 6244 $km^2$, but it could be as large as 22 664 $km^2$. Known from only 10 locations. Occurs in shallow wetlands and marshes in high altitude montane grassland. Population known from the close-by Bethal area. | Probable – suitable habitat present. |
| - | Sensitive species 1200 | Endangered | Endangered | - | The range of this species is between Breyton, Lothair, Middelburg and Stoffberg. Its EOO has reduced by more than 50% due to agriculture. Habitat preferences are poorly understood, but thought to favour edges of pans. | Unlikely – limited suitable habitat present. |
| [#]The names of specific taxa that are regarded as being susceptible to overexploitation have been redacted and are not presented in this report. These species are referred to by their assigned 'sensitive species number', *a*s per the species assessment guidelines (SANBI, 2020). | | | | | | |
| Source: List based on data from MPTA, BODATSA and Environmental Screening Report Output. | | | | | | |

### 7.2.2. Declared Alien Invasive Species

Based on the findings of the field survey, 20 NEMBA declared alien invasive plant species were recorded in the study area. These are listed in Table 5, along with their growth form and NEMBA Category.

*Table 5: Declared alien invasive species recorded in the study area.*

| Scientific Name | Common Name | Growth Form | NEMBA Category |
|---|---|---|---|
| *Acacia mearnsii* | Black Wattle | Tree | 2 |
| *Acacia dealbata* | Silber Wattle | Tree | 2 |
| *Cirsium vulgare* | Spear Thistle | Herbaceous forb | 1b |
| *Cortaderia selloana* | Pampas Grass | Graminoid | 1b |
| *Datura stramonium* | Common Thorn Apple | Herbaceous forb | 1b |
| *Eucalyptus* species | Gum | Tree | 1b or 2 |
| *Opuntia ficus-indica* | Sweet Prickly Pear | Succulent Tree | 1b |
| *Pennisetum clandestinum* | Kikuyu | Graminoid | 1b |
| *Pinus patula* | Patula pine | Tree | 2 |
| *Populus x canescens* | Grey Poplar | Tree | 2 |
| *Pyracantha angustifolia* | Yellow Fire-thorn | Tree | 1b |
| *Robinia pseudoacacia* | Black Locust | Tree | 1b |
| *Salix babylonica* | Weeping Willow | Tree | - |
| *Solanum elaeagnifolium* | Potato Creeper | Herbaceous forb | 1b |
| *Solanum sisymbriifolium* | Wild Tomato | Herbaceous forb | 1b |
| *Sorghum halepense* | Johnson Grass | Graminoid | 2 |
| *Verbena brasiliensis* | Wild Verbena | Herbaceous forb | 1b |
| *Verbena bonariensis* | Wild Verbena | Herbaceous forb | 1b |
| *Verbena rigida* | Veined Verbena | Herbaceous forb | 1b |
| *Xanthium strumarium* | Large Cocklebur | Herbaceous forb | 1b |

### 7.2.3. Flora of Medicinal Value

Several flora species recorded in the study area have recognised medicinal value. These are listed in Table 6, accompanied by a description of their purported use, as per Van Wyk *et al*., (2009).

*Table 6: Flora species recorded in the study area that have recognised medicinal value.*

| Scientific Name | Medicinal Use* |
|---|---|
| *Asparagus laricinus* | Used in the treatment of tuberculosis, kidney ailments and rheumatism. |
| *Berula erecta* | Used to treat toothache. |
| *Boophone disticha* | Bulbs scales are used to treat boils and septic wounds, as well as alleviate pains. |
| *Centella asiatica* | Used to treat a variety of infirmities including leprosy, wounds, cancer, fever and syphilis. |
| *Datura stramonium* | Relieves asthma and acts to reduce pain. Weak infusions are used as an aphrodisiac. |
| *Gomphocarpus fruticosus* | Ground leaves are used as snuff, and to treat headaches, tuberculosis and as an emetic. |

| Scientific Name | Medicinal Use* |
|---|---|
| *Helichrysum* species | Treats a variety of afflictions, including coughs, colds, fever, headaches and infections. |
| *Hilliardiella aristata* | Infusions taken to treat stomach ailments, rheumatism, dysentery and diabetes. |
| *Hypoxis* species | Infusions of the corm are used to treat dizziness, bladder disorders and insanity. |
| *Mentha longifolia* | Treats various respiratory ailments including coughs, colds and asthma. |
| *Pelargonium luridum* | Taken orally to treat diarrhoea and dysentery. |
| *Pellaea calomelanos var. calomelanos* | Used to treat boils and abscesses and for internal parasites |
| *Pentanisia prunelloides* | Decoctions are used to treat burns, swellings, sore joints and rheumatism. |
| *Rumex crispus* | Used as a remedy for internal parasites, as well as vascular diseases and internal bleeding. |
| *Scabiosa columbaria* | Used to treat colic and heartburn. |
| *Typha capensis* | Decoctions used to treat venereal disease, as well as diarrhoea, dysentery and enhance male libido. |
| *Xysmalobium undulatum* | Remedy for diarrhoea and colic. |
| *Medicinal use, as per Van Wyk, *et al*. (2009). | |

# 8. Key Ecological Attributes and Processes

## 8.1. Habitat Corridors, Resources and Refugia

The study area is a multi-functional landscape that is characterised by large areas of cultivation (Cultivated Fields), but also large intact areas of natural dry grassland and moist grassland habitat. Various forms of linear infrastructure, such as formal roads, farm tracks, farm fences and an old railway line, and the presence of modified habitat patches, have caused habitat fragmentation. However, it is noted that the general level of habitat connectivity across the study area and to the broader landscape surrounding the study area remains high. On-site natural habitat patches provide a large network of dispersal and movement corridors for flora pollinators and propagules.

Within the grassland-dominated habitat matrix, the altitudinal variability, exposed rocks and abundance of indigenous woody flora that defines the Rocky Shrubland habitat unit, also creates diverse and unique micro-habitats that significantly increase broader-scale habitat heterogeneity. This will increase local flora and fauna diversity by providing niche habitats for, amongst others, obligate and facultative rupicolous[1] and shrubland-favouring species that are unlikely to be resident in adjacent open grassland.

Amongst other impacts, the proposed Project will impact local habitat connectivity through habitat loss and fragmentation, and this may affect the movement and dispersal of flora propagules and pollinators.

[1] Flora and fauna species that are specifically adapted to rocky habitat.

## 8.2. Dynamic Ecological Processes and Drivers of Change

The following notes summarise the key ecological processes and drivers of change that are present in the landscape and their possible influence on the character of terrestrial vegetation and flora in the study area.

### 8.2.1. Wildfire – Grassland Burning

Fire is a natural, albeit often human initiated, disturbance agent in grassland ecosystems. Mesic Highveld Grasslands are considered fire-prone and fire-dependent landscapes, and fire is essential to the maintenance of biodiversity patterns and ecological processes (SANBI, 2013). Wildfire's have several key ecological effects with respects to fauna, including:

- Removal of moribund vegetation and increasing plant productivity and palatability, which improves grazing for wild herbivores;
- Controls the encroachment of both alien and indigenous woody plant species and weeds; and
- Increases overall habitat heterogeneity by creating a structural mosaic of tall- and short grassland.

Notwithstanding the positive ecological benefits of fire, wildfires that are too frequent, or too intense, can have negative consequences for fauna populations. These include the killing of fauna species (typically slow-moving taxa, or taxa trapped by fences), and the homogenisation of on-site habitat, which can limit the availability of key adaptive resources.

Fire is considered an important driver of change in the study area. It is anticipated that the proposed Project may result in altered wildfire patterns across the study area due to increased habitat fragmentation. It is also possible however, that the number of accidental fires initiated from proposed on-site Project infrastructure may increase. Changes in local fire may impact vegetation productivity, which may affect the local fauna and flora diversity community, including SCC.

### 8.2.2. Herbivory - Livestock Grazing and Trampling

High levels of grazing (overgrazing) and trampling by herbivores is a common cause of dryland degradation (Scholes, 2009). Overgrazing occurs when herbivores (both wildlife and domestic) are kept at excessive stocking rates and/or are able to concentrate their grazing to a limited foraging area, without suitable rest periods. A common degradation syndrome that is linked to overgrazing, at least in part, is a change in plant species composition. In grassland habitats, this typically manifests as a reduction in palatable grass species and a reduction in grassland productivity (Scholes, 2009). Excessive cattle grazing and trampling can also cause soil erosion and gulley formation, and modify and homogenise vegetation structure.

Cattle grazing (Figure 20) and trampling are considered important drivers of change in the study area. However, it is anticipated that the proposed Project is unlikely to alter livestock grazing patterns in the study area.

*Figure 20: Cattle grazing is common in the study area.*

### 8.2.3. Alien Invasive Species Colonisation

Several alien tree plantations (e.g., *Eucalyptus* trees) and wattle infestations (*Acacia mearnsii* and *Acacia dealbata*) are present in the study area, and many disturbed sites (e.g., cultivated fields) are encroached by herbaceous alien invasive species (e.g., *Verbena bonariensis*). If not actively controlled, species such as wattle may spread into adjacent natural habitats, where they will shade-out and competitively exclude many indigenous species. This will have several deleterious impacts on the integrity and function of these habitats, such as *inter alia*:

- A loss of natural habitat and floristic diversity, with the resulting habitat patches unable to support diverse fauna communities;
- A reduction in grass productivity for grazing herbivores (e.g., Mountain Reedbuck), and
- Increased exposed soil surfaces and incidences of erosion.

The spread of alien invasive vegetation is therefore considered a significant driver of change in the study area and surrounding landscape, and one capable of negatively impacting terrestrial biodiversity.

# 9. Analysis of Site Ecological Importance

The ecological importance (SEI) of identified habitat units in the study area were assessed using the SANBI (2020) protocol (refer to Section 3.7 and Appendix B for the methodology). The results of the assessment are presented in Table 7 and shown in Figure 21.

*Table 7: Site Ecological Importance of habitat unit in the study area*

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| Mixed Dry Grassland | HIGH: Highly likely occurrence of CR, EN, VU species.<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type.<br>Good habitat connectivity with potentially functional ecological corridors.<br>BUT<br>Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Rocky Shrubland | HIGH: Highly likely occurrence of CR, EN, VU species.<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Large (> 5 ha but <100 ha) intact area for any conservation status. Good habitat connectivity with potentially functional ecological corridors.<br>Only minor current negative ecological impacts with limited signs of major past disturbance and good rehabilitation potential. | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |
| Moist Grassland | HIGH: Highly likely occurrence of CR, EN, VU species.<br>Small area of natural habitat of EN ecosystem (=Eastern Highveld Grassland, EN & Soweto Highveld Grassland, VU). | HIGH: Very large (>100 ha) intact area for any conservation status of ecosystem type.<br>Good habitat connectivity with potentially functional ecological corridors.<br>BUT | HIGH | MEDIUM: Habitat that can recover slowly to restore >75% of the original species composition and functionality | HIGH |

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| | | Mostly minor current negative ecological impacts, with some major impacts and a few signs of past disturbance. | | | |
| Old Lands | LOW: No confirmed or highly likely populations of SCC or range-restricted species. | MEDIUM/LOW: Narrow corridors of good connectivity. Mostly minor current negative ecological impacts, BUT with major past impacts (i.e., former cultivation). | LOW | HIGH: Habitat that can recover relatively quickly to restore >75% of the original species composition and functionality | VERY LOW |
| Cultivated Fields | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |
| Alien Tree Plantations | VERY LOW: No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining. | VERY LOW: Several major current negative ecological impacts. | VERY LOW | VERY HIGH: Habitat that can recover rapidly to restore >75% of the original species composition and functionality. | VERY LOW |

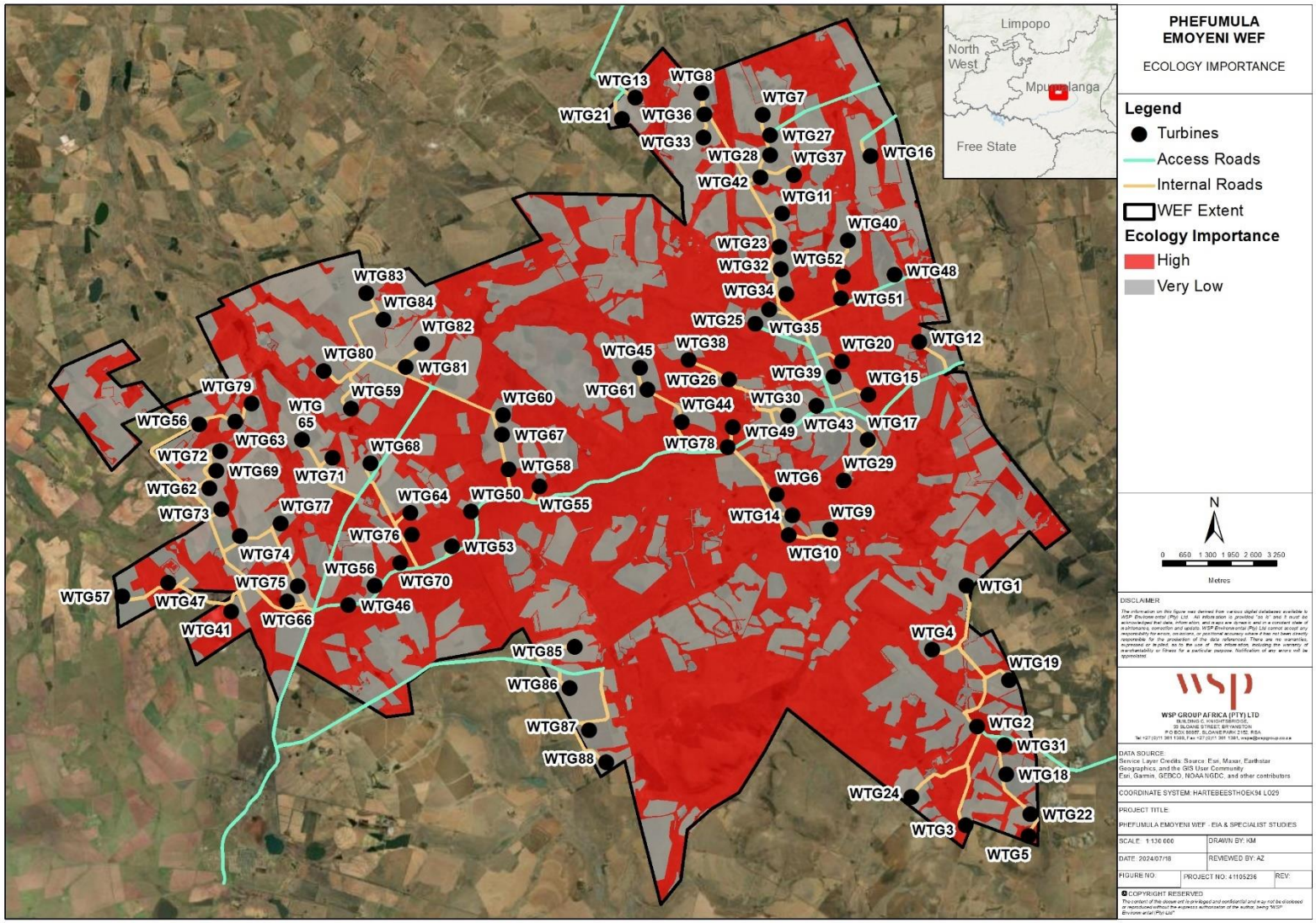



*Figure 21: Site Ecological Importance of the study area, showing current proposed layout of the Project infrastructure.*

# 10. Impact Assessment

## 10.1. Impact Assessment Methodology

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[2], indirect[3], secondary[4] as well as cumulative[5] impacts.

A standard risk assessment methodology is 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[6] presented in Table 8.

*Table 8: Impact Assessment Criteria and Scoring System*

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** 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 |
| **Impact Extent (E)** 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 |
| **Impact Reversibility (R)** 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 |

[2] Impacts that arise directly from activities that form an integral part of the Project.
[3] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[4] Secondary or induced impacts caused by a change in the Project environment.
[5] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects
[6] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Duration (D)** 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 |
| **Probability of Occurrence (P)** 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: | $[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | **4 to 15** | **16 to 30** | **31 to 60** | **61 to 80** | **81 to 100** |
| **Environmental Significance Rating (Negative (-))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |
| **Environmental Significance Rating (Positive (+))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |

## 10.2. 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 22 below.

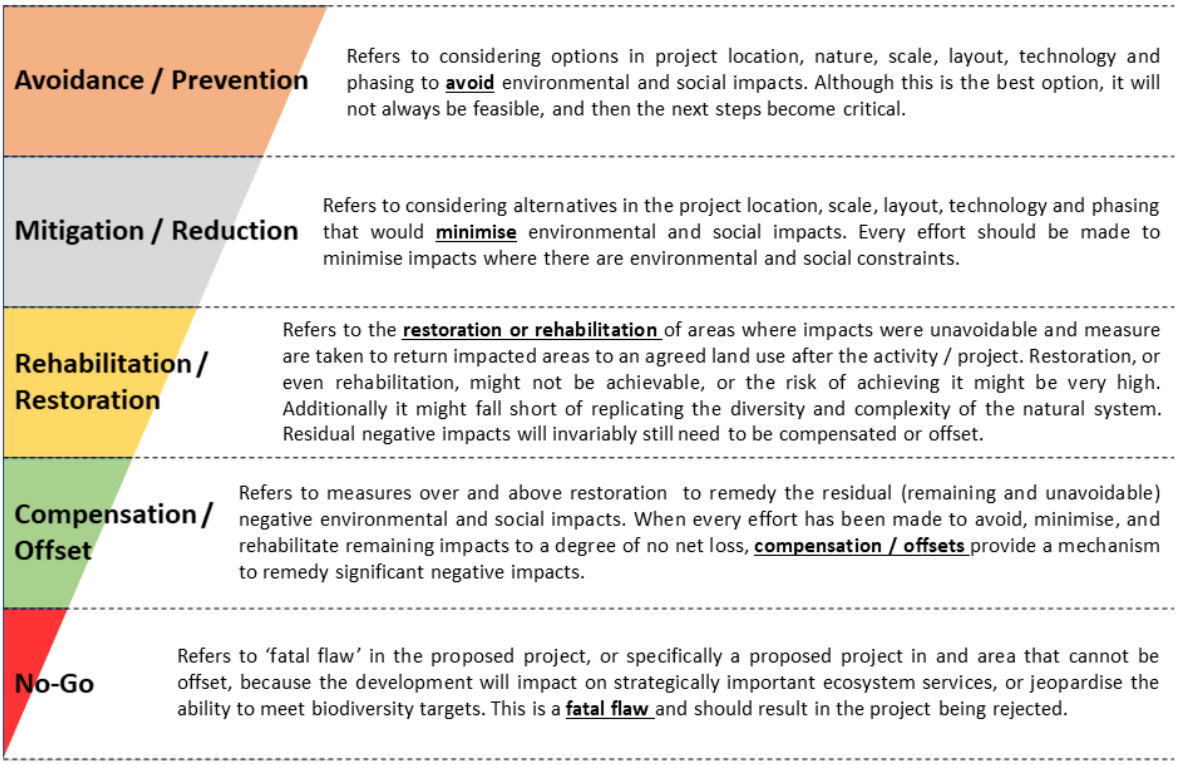



*Figure 22: Mitigation Sequence/Hierarchy*

A discussion on assessed impacts for each phase (i.e., Construction Operational and Decommissioning) of the proposed Project is provided in the sections below, along with an analysis of anticipated cumulative impact in Section 10.3.4. A summary table presented in Table 10.

## 10.3. Assessment of Impacts on Terrestrial Flora

### 10.3.1. Construction Phase

#### *10.3.1.1. Direct loss and disturbance of natural habitat*

Habitat loss refers to the removal or complete degradation of natural habitat. In terrestrial ecosystems, this primarily occurs through vegetation clearing and bulk earth works during construction. Habitat disturbance refers to the modification of habitat to the extent that it loses important functionality. These impacts can negatively impact the viability of flora occurring in the study area, including SCC.

Following the scoping phase identification of biodiversity sensitivities, the proposed Project layout was optimised to minimise impacts on identified sensitivities, such as designated CBA's. This notwithstanding, the proposed Project will result in the clearing of natural vegetation for the installation of turbine infrastructure (hard standing footprint ˜75 m X 120 m) and the construction of the internal access roads (13 m width). An overlay of the current proposed Project layout (turbine footprints and access roads) on the habitat unit map is shown in Figure 23, with Table 9 presenting an

indication of the approximate infrastructure footprints spanning each habitat unit at the study area scale.

It is noted that 20 of the proposed 88 turbines are located fully or partly in areas of natural habitat, specifically Mixed Dry Grassland and Rocky Shrubland habitat. The remainder of the turbines are located in modified habitat (i.e., Cultivated Fields and Old Lands).

The impact prior to further mitigation is considered to be of very high magnitude. Duration of impact will be permanent, and habitat within and potentially adjacent to the development footprints (local) will be impacted. Probability is rated definite. This results in an impact of "high" significance.

Several management/mitigation measures can be taken to further minimise impact significance. These include: further repositioning turbines and internal roads where possible to avoid directly impacting CBA[7]; in-field micro-siting of footprints to already disturbed sites; minimising disturbance footprints to the absolute necessary for construction and operational purposes; and, rehabilitating all disturbed areas after construction.

With the application of these, and other recommended mitigation measures, impact magnitude can be reduced to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to medium. This results in an after-mitigation impact of "Moderate" significance.

*Table 9: Indicative extent of possible impacts on the identified habitat units, based on the current proposed turbine and access road layout.*

| Habitat Unit | Approximate Extent of Possible Habitat Loss / Disturbance (Ha) |
|---|---|
| Alien Tree Plantations | 2.06 |
| Cultivated Fields | 128.27 |
| Mixed Dry Grassland | 104.91 |
| Moist Grassland | 5.93 |
| Old Lands | 18.67 |
| Rocky Shrubland | 1.22 |
| Transformed (e.g., farm houses and other built-infrastructure) | 0.62 |

[7] Refer to the Terrestrial Biodiversity Specialist Assessment report for further information of Critical Biodiversity Areas (CBA)

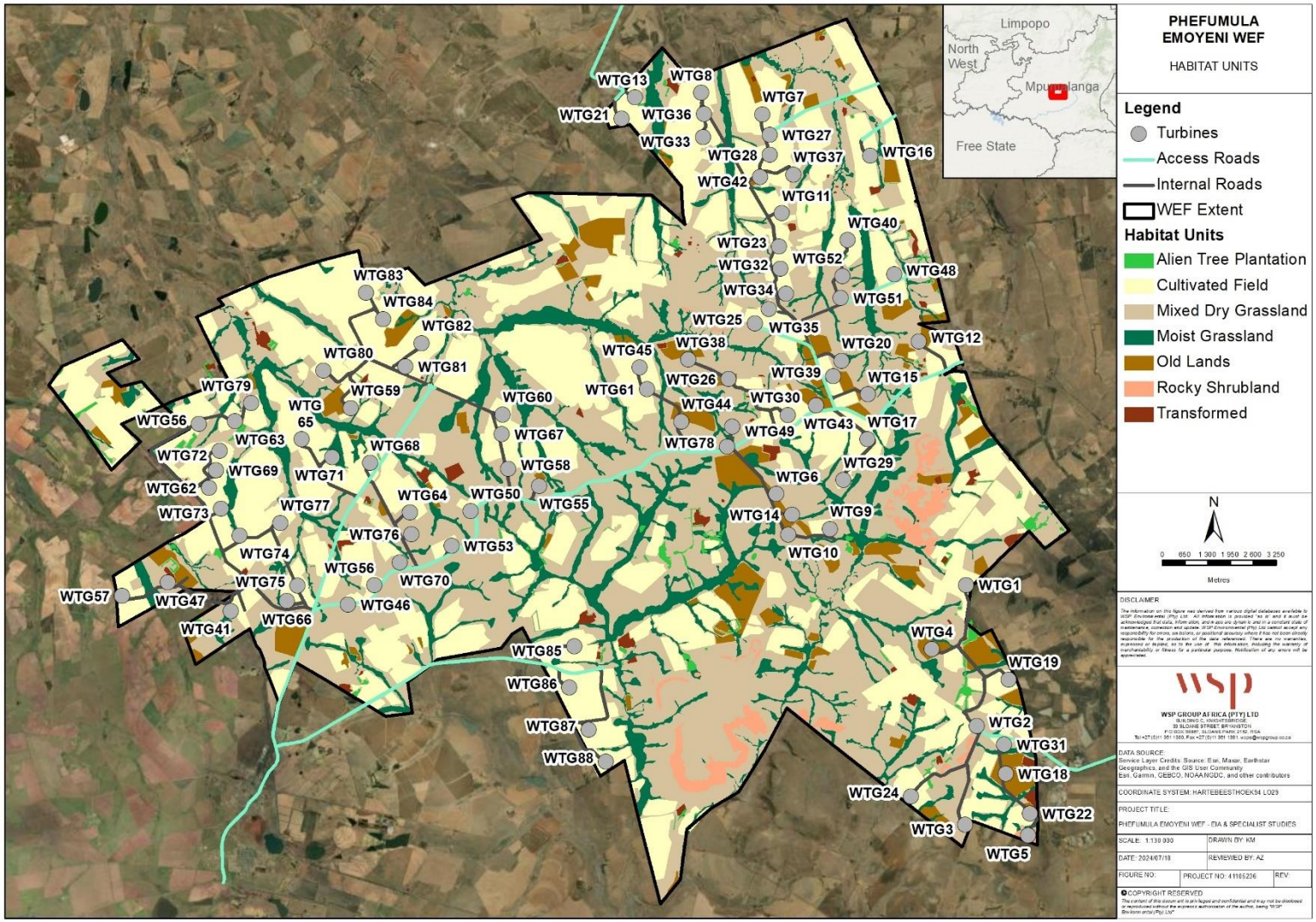



*Figure 23: Habitat units and the currently proposed infrastructure layout*

#### *10.3.1.2. Fragmentation reducing natural habitat connectivity and integrity*

Habitat fragmentation is caused when vegetation clearing and/or the development of infrastructure (e.g., roads and fences) result in the partitioning of habitat into smaller, discontinuous patches. This leads to altered habitat configuration that typically manifests as an increase in patch number and isolation, yet a decrease in overall patch size. These alterations change the ecological properties of remaining patches (edge effects) and can affect various ecological processes (e.g. fire patterns) and metapopulation dynamics, such as flora pollination and propagule dispersal. This can, in turn, affect flora species richness and population stability.

The proposed internal access road network is likely to cause the fragmentation of areas of natural habitat within the study area, and this will have negative ecological impacts. During the planning stage, the internal access road layout was aligned with existing farm roads and tracks, and this will reduce possible fragmentation effects. However, fragmentation effects are likely to still occur as the new access roads will be more substantive than many of the existing farm roads and tracks.

Prior to mitigation, this impact is considered to be of very high magnitude, permanently affecting natural habitat within and potentially adjacent to the development footprint (local). It is also considered to have a definite probability, resulting in an impact of "High" significance.

With the application of mitigation measures, such as in-field micro-siting of internal access road footprints to already disturbed sites, and minimising the clearance footprint to the minimum area required for construction and operational purposes, and rehabilitating all disturbed footprints, impact magnitude can be reduced to medium. Duration can be reduced to the long-term, and probability to medium, but spatial scale will remain local. This results in a residual impact of "Moderate" significance.

#### *10.3.1.3. Loss of flora species of conservation concern*

Several protected flora species were recorded in the study area during the field survey and it is probable that a number of Red List flora species may be present. It is possible that some of these will occur within the proposed infrastructure footprints, and therefore may be lost/damaged during construction phase vegetation clearing and earth works.

Before mitigation, impact magnitude is very high, while duration is immediate. It has a high probability of occurrence. The spatial extent of the impact is at the local scale. Prior to mitigation, this impact is rated of "moderate" significance.

This impact can be effectively mitigated through the successful completion of micro-siting and, if required, a rescue and relocation operation. With the application of mitigation, this impact can be reduced to a medium magnitude, while duration will remain of immediate. Spatial extent will be reduced to the site only, but probability will be reduced to low. After mitigation, this impact is rated to be of "Low" significance.

#### *10.3.1.4. Establishment and spread of alien invasive species*

Habitat disturbances caused by vegetation clearing and earth works during construction can facilitate the establishment and spread of AIS. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may impact ecological integrity and functioning and terrestrial biodiversity. Twenty NEMBA listed AIS have been recorded in the study area. Construction activities will cause the physical disturbance of vegetation and soils which will facilitate the spread of AIS.

Before mitigation, impact magnitude is high, while the duration is long term, and the impact has a high probability of occurrence. The spatial extent of AIS spread is local. Prior to mitigation, the establishment and spread of AIS is rated an impact of "moderate" significance.

This impact is relatively easy to mitigate though the implementation of an AIS control programme during the construction phase. This impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "Low" significance.

### 10.3.2. Operational Phase

#### *10.3.2.1. Establishment and spread of alien invasive species*

The potential establishment and spread of AIS in the study area will continue to be an impact of concern during the operational phase.

Before mitigation, impact magnitude is high, while duration is long term and the impact has a medium probability of occurring as predicted. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance.

With the continued implementation of an active alien species control programme during the operational phase this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and probability at low. After mitigation, this impact is rated to be of "Low" significance.

### 10.3.3. Decommissioning Phase

#### *10.3.3.1. Establishment and spread of alien invasive species*

As Project infrastructure is dismantled and removed from site during the decommissioning phase, the associated disturbances are likely to facilitate alien invasive species colonisation in, and immediately adjacent to, the study area.

Before mitigation, impact magnitude is high, while duration is long term and the impact has a high probability of occurring as predicted. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance.

With the continued implementation of an active alien species control programme during decommissioning and for a defined period thereafter, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring would be low. After mitigation, this impact is rated to be of "Low" significance.

*Table 10: Impact assessment scoring for terrestrial flora species*

| CONSTRUCTION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** |
| **Impact 1:** | Flora habitat | Direct loss and disturbance of natural habitat | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 1 | 3 | 4 | 3 | **33** | **N2** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 2:** | Flora habitat | Fragmentation reducing natural habitat connectivity and integrity | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 3 | 2 | 3 | 4 | 3 | **36** | **N2** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 3:** | Flora SCC | Loss of flora of conservation concern | Construction | Negative | High | 5 | 2 | 5 | 1 | 4 | **52** | **N2** | 3 | 1 | 3 | 1 | 2 | **16** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 4:** | Flora habitat | Establishment and spread of alien invasive species | Construction | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **OPERATIONAL** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Flora habitat | Establishment and spread of alien invasive species | Operational | Negative | High | 4 | 2 | 3 | 4 | 3 | **39** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **DECOMISSIONING** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Flora habitat | Establishment and spread of alien invasive species | Decommissioning | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **CUMULATIVE** | | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Flora habitat & SCC | Cumulative loss of flora SCC due to natural habitat loss, disturbance and fragmentation | Construction | Negative | Moderate | 5 | 3 | 3 | 5 | 5 | **80** | **N3** | 2 | 3 | 3 | 4 | 2 | **24** | **N1** |
| **Significance** | | | | | | **N3 - High** | | | | | | | **N1 - Low** | | | | | | |

### 10.3.4. Cumulative Impacts

#### *10.3.4.1. Cumulative loss of flora SCC due to natural habitat loss, disturbance and fragmentation.*

The landscape in which the study area is located is already modified and fragmented as a consequence of historic and current agriculture, and other land use activities such as mining. The current degree of existing habitat modification and fragmentation in the landscape places significant pressure on the functioning and integrity of remaining natural and semi-natural habitat patches, and their ability to support viable populations of SCC.

Although the proposed Project is not located within a promulgated Renewable Energy Development Zone (REDZ), several renewable energy developments are, or may be, taking place in the broader region surrounding the study area. Some of the main developments within a 55 km radius of the study area include *inter alia*; Halfgewonnen solar photovoltaic (PV) facilities, Forzando North Coal Mine Solar PV Facility, Eskom Arnot PV Facility, Haverfontein WEF, Camden I WEF, Camden I Solar, Camden II WEF, Hendrina North WEF, Hendrina South WEF and Ummbila Emyonei WEF.

Collectively, these projects will cause direct habitat loss, disturbance and fragmentation through vegetation clearing that is much greater in extent than that of a single constituent project, and this is a cumulative impact of concern with respects to flora SCC and the proposed Project

Prior to any form of mitigation, the cumulative impact on flora SCC from vegetation clearing is rated 'high'. The proposed Project's contribution to cumulative impacts can be minimised by strictly implementing the required mitigation measures, and addressing any significant residual impacts via additional conservation actions. The cumulative impacts on terrestrial flora SCC can therefore be reduced to 'Low' significance.

# 11. Assessment of the No Go Alternative

If the proposed Project does not proceed, it is anticipated that the current agricultural land use status quo will continue across most of the study area into the future. The tracts of grassland and wetland habitat in the study area will continue to be used for livestock (cattle) production and game farming, and the croplands will continue to be actively cultivated to produce maize and other crop types.

Certain portions of the study area are subject to heavy grazing and trampling by cattle, and it is possible that overtime, the condition of grassland and wetland habitat with respects to flora species diversity and ability to carry livestock (productivity) may deteriorate due to the effects of long-term overgrazing. This may compromise the agricultural profitability of on-site farming operations. With respects to biodiversity, overgrazing is likely to drive the homogenisation of habitats and flora diversity, including the persistence of SCC.

# 12. Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed in the preceding section.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following main Project phases:

- Construction (incl. Pre-Construction);
- Operational; and
- Decommissioning

For each impact management action, the following information is provided:

- Category: The category within which the potential impact/risk occurs;
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning of the proposed Project;
- Description: Description of the possible impact management action;
- Prescribed standards or practices: Prescribed environmental standards or practices with which the impact management action must comply. Note that only key standards or practices have been listed;
- Mitigation type: The type of mitigation measure. This includes the following:
    - Avoidance;
    - Minimisation;
    - Rehabilitation or restoration;
    - Offsetting;
- Time period: The time period when the impact management actions must be implemented; and
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions.

Table 11**Error! Reference source not found.** presents a summary of the proposed impact mitigation actions during the pre-construction, construction, operational, and decommissioning phases of the proposed Project.

*Table 11: Recommended mitigation measures.*

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| **1. Pre-Construction and Construction Phase** | | | | | | | |
| 1.1 | Terrestrial Flora | Direct loss and disturbance of flora habitat | <u>Avoidance</u><br>• As far as possible other proposed permanent Project infrastructure (e.g., O&M Office and Batching Plant) should be located in areas of modified habitat (i.e., Cultivated Fields, Old Lands);<br>• All temporary construction footprints, (e.g., construction camps, laydown areas), should <u>only</u> be located in areas of modified habitat;<br>• A pre-construction walkdown of the approved development footprints should be conducted during the wet/growing season to identify sensitive biodiversity and inform the micro-siting of Project infrastructure to already disturbed footprints and other relevant management measures.<br><br><u>Minimisation</u> | N/A | Avoidance, Minimisation and Rehabilitation | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • All vegetation clearing for the Project should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas;<br>• The footprints to be cleared of vegetation should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas;<br>• No heavy vehicles should travel beyond the marked works zone;<br>• Removed topsoil should be stockpiled and used to rehabilitate all disturbed areas.<br><br><u>Rehabilitation</u><br><br>A rehabilitation/ landscaping protocol should be developed and implemented to stabilise and revegetate all non-operational sites that have been disturbed by construction. The protocol should include:<br><br>• Stockpiling of topsoil that was cleared from development footprints during site preparation; | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • Post-construction, the land form should be correctly contoured to limit potential erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment;<br>• Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and<br>• Grass species used during rehabilitation should be indigenous, locally-occurring perennial species. | | | | |
| 1.2 | Terrestrial Flora | Fragmentation reducing natural habitat connectivity and integrity | <u>Avoidance and Minimisation</u><br><br>See mitigation measures for *Direct loss and disturbance of natural habitat*, and<br><br>• Proposed access roads should be aligned, as far as possible, with existing farm roads and tracks and micro-sited to already disturbed sites.<br><br><u>Rehabilitation</u> | N/A | Avoidance, Minimisation and Rehabilitation | During Pre-Construction and Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | See rehabilitation measures for *Direct loss and disturbance of natural habitat* | | | | |
| 1.3 | Terrestrial Flora SCC | Loss of Flora Species of Conservation Concern | <u>Avoidance and Minimisation</u><br>• A pre-construction walkdown/survey of the proposed development footprints should be conducted during the wet/growing season to determine the identity and number of potentially impacted flora SCC;<br>• Data from the survey/walkdown should then be to inform:<br>  ○ The micro-siting of proposed Project infrastructure; and.<br>  ○ The scope of a Flora SCC Management strategy with respects to obtaining permits should from the relevant authority to rescue and relocate impacted plants. | N/A | Avoidance & Minimisation | During Construction Phase | Project Manager |
| 1.4 | Terrestrial Flora | Establish and spread of alien invasive species | An AIS control and eradication plan must be developed for the Project that focuses on | Guidelines for Monitoring, | Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | controlling and eradicating AIS occurring at sites disturbed by project activities in the study area. The plan must include:<br>• Identification of AIS management units<br>• Prioritisation of sites and species requiring control;<br>• Targets and indicators of success;<br>• Scheduling of AIS control;<br>• Species-specific control methods, using a combined approach of both chemical and mechanical control methods; and<br>• Provision for follow-up treatments, as informed by regular AIS monitoring. | Control and Eradication of AIS (DEA, 2015) | | | |
| **2. Operational Phase** | | | | | | | |
| 2.1 | Terrestrial Biodiversity | Establish and spread of alien invasive species | • Active alien invasive species control should continue throughout the operational phase, as per the approved AIS control and eradication programme. | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | During Operational Phase | Facility Manager |
| **3. Decommissioning Phase** | | | | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| 3.1 | Terrestrial Biodiversity | Establish and spread of alien invasive species | • Active alien invasive species control should continue during the decommissioning phase and annual follow up control should be carried out for a five- year period following decommissioning. | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | Annually during decommissioning and annually for a five-year period after decommissioning | Facility Manager |
| 3.2 | Terrestrial Biodiversity | General habitat restoration | • To limit the potential for AIS encroachment, soil erosion and dust generation, all Project footprints and sites that were disturbed during decommissioning, should be actively rehabilitated using local-occurring perennial indigenous flora species. | N/A | Rehabilitation | During the Decommissioning Phase | Facility Manager |

# 13. Monitoring Measures

The following section presents the proposed monitoring actions for monitoring and reporting on the implementation of the impact mitigation actions presented in the preceding Section **Error! Reference source not found.**.

The content of this section is largely based on the monitoring requirements outlined in Appendix 4 of the EIA Regulations, 2014.

For each monitoring action, the following information is provided:

- Category: The category within which the potential impact and/or risk occurs
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and closure of the proposed Project
- Method for monitoring : The method for monitoring the implementation of the recommended mitigation measures
- Time period: The time period over which the monitoring actions must be implemented
- Frequency of monitoring: The frequency of monitoring the implementation of the recommended mitigation measures
- Mechanism for monitoring compliance: The mechanism for monitoring compliance with the impact management actions
- Responsible persons: The persons who will be responsible for the implementation of the monitoring actions

As with the impact management actions, the proposed monitoring actions have been arranged according to the following project phases:

- Pre-construction;
- Construction;
- Operational; and
- Decommissioning

Table 12 presents a summary of the proposed monitoring actions during the construction, operational and decommissioning phases

*Table 12: Recommended monitoring measures*

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| **1. Construction and Operational phase** | | | | | | |
| 1.1 | Alien invasive species | • Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:<br>  ○ All sites disturbed during the construction phase;<br>  ○ Wetland areas adjacent to construction sites; and<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | Wet/growing season | Annual | Annual Monitoring Report | Project Manager |
| **2. Decommissioning phase** | | | | | | |
| 2.1 | Alien invasive species | • Alien invasive species monitoring should be conducted on an annual basis during decommissioning and annually for a five-year period following decommissioning. Monitoring should focus on:<br>  ○ All sites disturbed during decommissioning; | Wet/growing season | Annually during decommissioning and for a five-year period after decommissioning | Annual Monitoring Report | Facility Manager |

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| | | ○ Wetland areas adjacent to former development sites; and<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | | | | |

# 14. Reasoned Opinion and Environmental Impact Statement

## 14.1. Summary of Main Findings

The study area is located within the Eastern Highveld Grassland and Soweto Highveld Grassland vegetation types, which according to the NEMBA Threatened Ecosystems (2021), are listed as Endangered and Vulnerable, respectively.

Six habitat units have been identified in the study area. These comprise both natural habitats and modified habitats. Modified habitats (i.e., Cultivated Fields, Alien Tree Plantations and Old Lands), are of little conservation value and have Site Ecological Importance ratings of 'Very Low'. The natural habitat units (i.e., Mixed Dry Grassland, Moist Grassland and Rocky Shrubland) provide important habitat for flora, and they contribute to broader habitat connectivity, which is an important component of maintaining landscape-scale ecological processes and terrestrial biodiversity. These have Site Ecological Importance ratings of 'High'.

No flora species listed as Near Threatened or threatened on the national Red List were recorded in the study area during the field survey, although one species that is listed as Near Threatened on the Mpumalanga Red List was recorded, viz. *Kniphofia ensifolia* subsp. *ensifolia*. Habitat suitability assessments however, suggest that it is likely that a number of nationally threatened taxa may be present in the study area.

Several flora species that are listed as protected at a provincial level, as per the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), were recorded in the study area. It is likely that some of these will occur within the proposed infrastructure footprints, and therefore may be lost/damaged during the construction phase vegetation clearing and associated earth works.

The National Web Based Screening Tool rated the Plant Species Theme for the study area as 'Medium' sensitivity, based on the potential presence of several flora SCC. The findings of this current study confirm this sensitivity rating.

Key mitigation and management measures that are recommended for the proposed Project with respects to minimising impacts on potential flora SCC, include *inter alia*,1) micro-siting as much of the proposed Project infrastructure as possible in areas that have already been completely transformed (i.e., Cultivated Fields, Alien Tree Plantations) or disturbed areas of grassland (i.e., Old Lands), 2) conducting a wet/growing season survey of the study area to identify and locate any flora SCC and inform micro-siting options and the SCC rescue and relocation requirements, and 3) implementing an alien invasive species control programme for the duration of the Project.

The successful implementation of the management measures presented in this report can effectively mitigate the identified impacts, resulting in 'Low' residual impact scores. It is recommended that all mitigation and management measures should be incorporated into the proposed Project's environmental management plan (EMP).

## 14.2. Conditions to be Included in the Environmental Authorisation

No additional conditions are recommended for inclusion in the proposed Project's environmental authorisation.

## 14.3. Specialist Opinion

In accordance with the outcomes of the impact assessment, and taking cognisance of the baseline conditions presented herein, as well as the impact management measures, the proposed Project is not deemed to present significant negative ecological issues or impacts on terrestrial plant species, and it should thus be authorised.

# 15. References

BODATSA (2023). Botanical Database of Sothern Africa (New POSA platform), South African National Biodiversity Institute. Accessed at http://newposa.sanbi.org/. [Accessed 21 September 2023].

DEA (Department of Environmental Affairs) (2016). National Protected Areas Expansion Strategy for South Africa. Department of Environmental Affairs, Pretoria, South Africa.

Edwards, D. (1983). A broad-scale structural classification of vegetation for practical purposes. Bothalia. 14, 3 & 4; 705-712.

Johnson, S., Bytebier, B. and Starker, H. (2015). Orchids of South Africa – A Field Guide. Struik Nature. Cape Town.

Lötter, M., Burrows, J.E., Nicholas, A. & Victor, J.E. (2005). *Miraglossum davyi* (N.E.Br.) Kupicha. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2023/07/10.

Lötter, M., Burrows, J.E., Burgoyne, P.M. & von Staden, L. (2007a). *Khadia carolinensis* (L.Bolus) L.Bolus. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2022/08/15.

Lötter, M., Nicholas, A. & von Staden, L. (2007b). *Pachycarpus suaveolens* (Schltr.) Nicholas & Goyder. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2023/07/10.

MPTA (2014). Mpumalanga Biodiversity Sector Plan Handbook. Compiled by Lotter, M.C., Cadman, M.J. and Lechmere-Oertel, R.G. Mpumalanga Parks and Tourism Agency. Mbombela.

Mpumalanga Nature Conservation Act (Act No. 10 of 1998)

Mucina, L. and Rutherford, M.C. (eds) (Reprint 2011) The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute (SANBI), Pretoria.

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004). Alien and Invasive Species Lists, 2016 and 2020.

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - Lists of Critically Endangered, Endangered, Vulnerable and Protected Species. (2007) (NEMBA ToPS List, 2007). South Africa.

Nicholas, A. & Victor, J.E. 2006. *Aspidoglossum xanthosphaerum* Hilliard. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2023/07/10

SANBI (2013). Grassland Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and McCulloch, D. South African National Biodiversity Institute, Pretoria.

SANBI (2018). 2018 National Vegetation Map. South African National Biodiversity Institute, Pretoria.

SANBI (2020). Species Environmental Assessment Guideline. Guideline 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. Version 1. 2020.

SANBI (2024) Red List of South African Plants. South African National Biodiversity Institute. Available from: http://redlist.sanbi.org/.

Scholes, R. (2009) Syndromes of dryland degradation in southern Africa, African Journal of Range and Forage Science, 26 (3), pp. 113–125.

Van Wyk, B., Van Oudtshoorn, B. and Gericke, N. (2009) Medicinal Plants of South Africa. Second Edi. Pretoria: Briza Publications.

Williams, V.L., Raimondo, D., Brueton, V.J., Crouch, N.R., Cunningham, A.B., Scott-Shaw, C.R., Lötter, M. & Ngwenya, A.M. (2016a). *Boophone disticha* (L.f.) Herb. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2022/08/22.

Williams, V.L., Raimondo, D., Crouch, N.R., Cunningham, A.B., Scott-Shaw, C.R., Lötter, M. & Ngwenya, A.M. (2016b). *Eucomis autumnalis* (Mill.) Chitt. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2022/08/22.

---

This report has been compiled by Andrew Zinn (Hawkhead Consulting).

Andrew Zinn (*Pr.Sci.Nat*.)

# Appendix A: Curriculum Vitae – Andrew Zinn

# Hawkhead Consulting

# Curriculum Vitae of Andrew Zinn (Pr.Sci.Nat.)

## Details

Andrew David Zinn
Terrestrial Ecologist
B.Sc. (Hons.), M.Sc., Pr.Sci.Nat.

Email: andrew@hawkhead.com
Mobile: +27 83 361 0373
Address: 58 Central Rd, Linden Ext., Johannesburg, 2195
South Africa
Date of birth: 14 July 1982
Nationality: South African

## Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and 15 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

## Education and Qualifications

- University of the Witwatersrand, M.Sc. Resource Conservation Biology (2013).
- University of KwaZulu-Natal, BSc. Hons. Ecology and Conservation Biology (2005).
- University of KwaZulu-Natal, BSc. Zoology and Grassland Science (2004).
- Bryanston High School, Johannesburg. Matric Exemption. (2000).

## Affiliations

- Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).
- Member of the South African Wildlife Management Association.
- Member of the South African Association of Botanists.

## Work Experience

1. **Independent Ecologist**

**Hawkhead Consulting, South Africa**
**September 2020 – Present**

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- Biodiversity study design and implementation;
- Biodiversity baseline and impact assessment reporting;
- Mitigation measure design and application;
- Vegetation surveys and vegetation community mapping;
- Fauna surveys for mammals, birds, reptiles and amphibians;
- Development of biodiversity management plans;
- Development of rehabilitation and revegetation plans; and
- Alien invasive species control and eradication plans.

**2. Ecologist**

**Golder Associates Africa, South Africa**
**June 2011 – September 2020**

Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa. Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's (IFC) Performance Standard 6 (PS6)

**3. Independent Ecologist**

**Subcontracted to KPMG, United Arab Emirates**
**March – April 2011**

Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

**4. Environmental Consultant**

**WSP Environment and Energy, South Africa**
**August 2008 – March 2011**

Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes,
conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

**5. Research Technician**

**Yale University, Kruger National Park, South Africa**
**October 2007 – May 2008**

Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

## Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.
- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

# Appendix B: Methodology Supplement

**Rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, as per (SANBI, 2020).**

The ecological sensitivity of habitats in the study area was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

SEI = BI + RR.

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

BI = CI + FI

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystems types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

**Table 1: Conservation Importance (CI) criteria.**

| Conservation Importance (CI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10km$^2$;<br>• Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type; and<br>• Globally significant populations of congregatory species (>10% of global population). |
| **High** | • Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of > 10km$^2$, IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining;<br>• Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type;<br>• Presence of Rare species;<br>• Globally significant populations of congregatory species (>1% but < 10% of global population). |
| **Medium** | • Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals;<br>• Any area of natural habitat of threatened ecosystem type with status of VU;<br>• Presence of range-restricted species; and<br>• >50% of receptor contains natural habitat to support SCC. |
| **Low** | • No confirmed or highly likely populations of SCC;<br>• No confirmed or highly likely populations of range-restricted species; and<br>• <50% of receptor contains natural habitat with limited potential to support SCC. |
| **Very Low** | • No confirmed and highly unlikely populations of SCC;<br>• No confirmed and highly unlikely populations of range-restricted species; and<br>• No natural habitat remaining. |

**Table 2: Functional Integrity (FI) criteria.**

| Functional Integrity (FI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type;<br>• High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches;<br>• No or minimal current negative ecological impacts with no signs of major disturbance (e.g., ploughing) |
| **High** | • Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types;<br>• Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches; and<br>• Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. |
| **Medium** | • Medium (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type or >20 ha for VU ecosystem type;<br>• Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches;<br>• Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. |
| **Low** | • Small (> 1 ha but <5ha) area;<br>• Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential; and<br>• Several minor and major current negative ecological impacts. |
| **Very Low** | • Very small (<1 ha) area;<br>• No habitat connectivity except for flying species or flora with wind-dispersed seeds;<br>• Several major current negative ecological impacts. |

**BI = CI + FI**

**Biodiversity Importance (BI) Rating Matrix**

| Biodiversity Importance (BI) | | Conservation Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Functional Integrity** | **Very High** | Very High | Very High | High | Medium | Low |
| | **High** | Very High | High | Medium | Medium | Low |
| | **Medium** | High | Medium | Medium | Low | Very Low |
| | **Low** | Medium | Medium | Low | Low | Very Low |
| | **Very Low** | Medium | Low | Very Low | Very Low | Very Low |

**Table 3: Receptor Resilience criteria (RR)**

| Resilience | Fulfilling Criteria |
|---|---|
| **Very High** | Habitat that can recover rapidly (˜less than 5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed. |
| **High** | Habitat that can recover relatively quickly (˜ 5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed. |
| **Medium** | Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed. |
| **Low** | Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed. |
| **Very Low** | Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed. |

**SEI = BI + RR**

**Site Ecological Importance (SEI) Rating Matrix**

| Site Ecological Importance | | Biodiversity Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Receptor Resilience** | **Very Low** | Very High | Very High | High | Medium | Low |
| | **Low** | Very High | Very High | High | Medium | Very Low |
| | **Medium** | Very High | High | Medium | Low | Very Low |
| | **High** | High | Medium | Low | Very Low | Very Low |
| | **Very High** | Medium | Low | Very Low | Very Low | Very Low |

**Table 4: Guidelines for interpreting SEI in the context of the proposed development activities.**

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |

## Appendix C: Flora species recorded in the study area during the field survey.

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Acanthaceae | *Blepharis* species | Herb | Indigenous | LC | - | - | x | | | | |
| Achariaceae | *Kiggelaria africana* | Tree | Indigenous | LC | - | - | | x | | | |
| Agavaceae | *Agave americana** | Succulent | Alien | NE | - | - | | | | | x |
| Agavaceae | *Chlorophytum cooperi* | Herb | Indigenous | LC | - | - | | x | | | |
| Aizoaceae | *Delosperma sutherlandii* | Succulent | Indigenous | LC | - | - | | | x | | |
| Aizoaceae | *Mossia intervallaris* | Succulent | Indigenous | LC | - | - | | x | | | |
| Amaranthaceae | *Achyranthes aspera* subsp. *aspera** | Herb | Alien | NE | - | - | | x | | | |
| Amaranthaceae | *Amaranthus hybridus** | Herb | Alien | NE | - | - | | | | | x |
| Amaranthaceae | *Chenopodium album** | Herb | Alien | NE | - | - | | | | | x |
| Amaranthaceae | *Gomphrena celosioides** | Herb | Alien | NE | - | - | x | x | | | |
| Amaranthaceae | *Guilleminea densa** | Herb | Alien | NE | - | - | | | | | x |
| Amaryllidaceae | *Boophone disticha* | Geophytic Herb | Indigenous | LC | - | Protected | x | x | | | |
| Amaryllidaceae | *Crinum bulbispermum* | Geophyte | Indigenous | LC | - | Protected | | | x | | |
| Amaryllidaceae | *Haemanthus humilis* | Geophyte | Indigenous | LC | - | Protected | | x | | | |
| Amaryllidaceae | *Nerine krigei* | Geophyte | Indigenous | LC | - | - | | | x | | |
| Anacardiaceae | *Searsia dentata* | Dwarf Shrub | Indigenous | LC | - | - | | x | | | |
| Anacardiaceae | *Searsia discolor* | Dwarf Shrub | Indigenous | LC | - | - | | x | | | |
| Anacardiaceae | *Searsia pyroides* var. *gracilis* | Tree | Indigenous | LC | - | - | | x | | | |
| Apiaceae | *Berula erecta* | Herb | Indigenous | LC | - | - | | | x | | |
| Apiaceae | *Centella asiatica** | Herb | Alien | NE | - | - | x | | x | | |
| Apiaceae | *Heteromorpha arborescens* var. *abyssinica* | Tree | Indigenous | LC | - | - | | x | | | |
| Apiaceae | *Pimpinella transvaalensis* | Herb | Indigenous | LC | - | - | x | x | x | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Apocynaceae | *Acokanthera rotundata* | Shrub | Indigenous | LC | - | - | | x | | | |
| Apocynaceae | *Asclepias stellifera* | Herb | Indigenous | LC | - | - | | | x | | |
| Apocynaceae | *Gomphocarpus fruticosus* | Shrub | Indigenous | LC | - | - | x | | x | | |
| Apocynaceae | *Xysmalobium undulatum* | Herb | Indigenous | LC | - | - | | | x | | |
| Asparagaceae | *Asparagus* cf. *virgatus* | Shrub | Indigenous | LC | - | - | | x | | | |
| Asparagaceae | *Asparagus laricinus* | Shrub | Indigenous | LC | - | - | x | x | | | |
| Asphodelaceae | *Aloe ecklonis* | Succulent | Indigenous | LC | - | Protected | | x | | | |
| Asphodelaceae | *Aloe* species (maculata) | Succulent | Indigenous | - | - | Protected | | x | | | |
| Asphodelaceae | *Kniphofia ensifolia* subsp. *ensifolia* | Herb | Indigenous | LC | NT | Protected | x | | | | |
| Asteraceae | *Berkheya pinnatifida ingrata* | Herb | Indigenous | LC | - | - | x | x | x | x | |
| Asteraceae | *Berkheya radula* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Asteraceae | *Berkheya setifera* | Herb | Indigenous | LC | - | - | x | x | x | x | |
| Asteraceae | *Berkheya speciosa* | Herb | Indigenous | LC | - | - | x | | x | | |
| Asteraceae | *Bidens pilosa** | Herb | Alien | NE | - | - | x | x | | x | |
| Asteraceae | *Campuloclinium macrocephalum** | Herb | Alien | NE | - | - | | | | | x |
| Asteraceae | *Cirsium vulgare** | Herb | Alien (NEMBA Category 1b) | NE | - | - | x | x | x | x | x |
| Asteraceae | *Conyza bonariensis** | Herb | Alien | NE | - | - | x | | x | x | |
| Asteraceae | *Conyza canadensis** | Herb | Alien | NE | - | - | x | | | x | |
| Asteraceae | *Cosmos bipinnatus** | Herb | Alien | NE | - | - | | | | | x |
| Asteraceae | *Felicia* cf. *pleiocephalus* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Felicia filifolia* | Shrub | Indigenous | LC | - | - | x | x | | | |
| Asteraceae | *Gazania* species | Herb | Indigenous | LC | - | - | | | x | | |
| Asteraceae | *Gerbera piloselloides* | Geophytic herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Geigeria burkei* | Herb | Indigenous | LC | - | - | | | x | | |
| Asteraceae | *Haplocarpha lyrata* | Herb | Indigenous | LC | - | - | x | | x | | |
| Asteraceae | *Haplocarpha scaposa* | Herb | Indigenous | LC | - | - | x | x | x | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Asteraceae | *Helichrysum acutatum* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Helichrysum aureonitens* | Herb | Indigenous | LC | - | - | x | | x | | |
| Asteraceae | *Helichrysum callicomum* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Helichrysum cephaloideum* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Helichrysum caespititium* | Herb | Indigenous | LC | - | - | x | x | | | |
| Asteraceae | *Helichrysum mundtii* | Herb | Indigenous | LC | - | - | | | x | | |
| Asteraceae | *Helichrysum nudifolium* var. *nudifolium* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Helichrysum nudifolium var. pilosellum* | Herb | Indigenous | LC | - | - | x | | x | | |
| Asteraceae | *Helichrysum oreophilum* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Helichrysum rugulosum* | Herb | Indigenous | LC | - | - | x | x | x | x | |
| Asteraceae | *Hilliardiella aristata* | Herb | Indigenous | LC | - | - | x | x | | x | |
| Asteraceae | *Hilliardiella elaeagnoides* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Hypochaeris radicata** | Herb | Alien | NE | - | - | x | x | | | |
| Asteraceae | *Nidorella podocephala* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Asteraceae | *Nidorella sp.* | Herb | Indigenous | LC | - | - | x | | | x | |
| Asteraceae | *Pseudognaphalium luteo-album** | Herb | Alien | NE | - | - | | | x | x | |
| Asteraceae | *Schistostephium crataegifolium* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Schkuhria pinnata** | Herb | Alien | NE | - | - | | | | x | |
| Asteraceae | *Senecio consanguineus* | Herb | Indigenous | LC | - | - | x | | x | x | |
| Asteraceae | *Senecio coronatus* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Senecio erubescens* | Herb | Indigenous | LC | - | - | | | x | | |
| Asteraceae | *Senecio gerrardii* | Herb | Indigenous | LC | - | - | x | | x | | |
| Asteraceae | *Senecio inornatus* | Herb | Indigenous | LC | - | - | x | x | x | x | |
| Asteraceae | *Senecio othonniflorus* | Herb | Indigenous | LC | - | - | x | | | | |
| Asteraceae | *Seriphium plumosum* | Shrub | Indigenous | LC | - | - | x | | | x | |
| Asteraceae | *Sonchus cf. oleraceus** | Herb | Alien | NE | - | - | | | | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Asteraceae | *Tagetes minuta** | Herb | Alien | NE | - | - | | | | x | |
| Asteraceae | *Xanthium strumarium** | Herb | Alien (NEMBA Category 1b) | NE | - | - | | | | | x |
| Blechnaceae | *Blechnum cf. australe* | Fern | Indigenous | LC | - | - | | x | | | |
| Cactaceae | *Opuntia ficus-indica** | Succulent | Alien (NEMBA Category 1b) | NE | - | - | | | | | x |
| Campanulaceae | *Wahlenbergia undulata* | Herb | Indigenous | LC | - | - | x | x | | x | |
| Caryophyllaceae | *Pollichia campestris* | Shrub | Indigenous | LC | - | - | x | x | | | |
| Celastraceae | *Gymnosporia buxifolia* | Tree | Indigenous | LC | - | - | | x | | | |
| Convolvulaceae | *Ipomoea ommaneyi* | Herb | Indigenous | LC | - | - | x | | | | |
| Convolvulaceae | *Ipomoea transvaalensis* | Herb | Indigenous | LC | - | - | x | | | | |
| Crassulaceae | *Crassula* cf. *peploides* | Succulent | Indigenous | LC | - | - | | x | | | |
| Crassulaceae | *Crassula lanceolata* subsp. *lanceolata* | Succulent | Indigenous | LC | - | - | | x | | | |
| Crassulaceae | *Crassula setulosa* | Succulent | Indigenous | LC | - | - | | x | | | |
| Crassulaceae | *Crassula* species | Succulent | Indigenous | - | - | - | | x | | | |
| Cyperaceae | *Cyperus congesta* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Cyperus denudatus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Cyperus esculentus** | Graminoid | Alien | NE | - | - | x | | | | |
| Cyperaceae | *Cyperus fastigiatus* | Graminoid | Indigenous | - | - | - | | | x | | |
| Cyperaceae | *Cyperus marginatus* | Graminoid | Indigenous | - | - | - | | | x | | |
| Cyperaceae | *Eleocharis limosa* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Fuirena pubescens* | Herb | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Fuirena* species | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Kyllinga erecta* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Cyperaceae | *Pycreus mundii* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Pycreus nitidus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Schoenoplectus brachyceras* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Cyperaceae | *Scirpoides burkei* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Cyperaceae | *Scirpoides* species | Graminoid | Indigenous | - | - | - | | | x | | |
| Cyperaceae | *Scleria* species | Graminoid | Indigenous | LC | - | - | | | x | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Dipsacaceae | *Scabiosa columbaria* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Ebenaceae | *Diospyros austro-africana* | Tree | Indigenous | LC | - | - | | x | | | |
| Ebenaceae | *Diospyros lycioides* | Tree | Indigenous | LC | - | - | x | x | | x | |
| Ebenaceae | *Euclea crispa* | Tree | Indigenous | LC | - | - | | x | | | |
| Euphorbiaceae | *Acalypha angustata* | Herb | Indigenous | LC | - | - | x | | | | |
| Euphorbiaceae | *Euphorbia striata* | Herb | Indigenous | LC | - | - | x | | | | |
| Fabaceae | *Acacia dealbata** | Tree | Alien (NEMBA Category 2) | NE | - | - | x | x | | | x |
| Fabaceae | *Acacia mearnsii** | Tree | Alien (NEMBA Category 2) | NE | - | - | | x | | | x |
| Fabaceae | *Commelina africana* | Herb | Indigenous | LC | - | - | | x | | x | |
| Fabaceae | *Erythrina zeyheri* | Tree | Indigenous | LC | - | - | x | | | | |
| Fabaceae | *Indigofera daleoides* | Herb | Indigenous | LC | - | - | x | | | | |
| Fabaceae | *Indigofera hedyantha* | Herb | Indigenous | LC | - | - | x | | x | | |
| Fabaceae | *Lespedeza cuneata** | Shrub | Alien | NE | - | - | x | | x | | |
| Fabaceae | *Melilotus albus** | Herb | Alien | NE | - | - | | | | | x |
| Fabaceae | *Robinia pseudoacacia** | Tree | Alien (NEMBA Category 1b) | NE | - | - | | | | | x |
| Fabaceae | *Tephrosia capensis* | Herb | Indigenous | LC | - | - | | | x | | |
| Fabaceae | *Trifolium repens** | Herb | Alien | NE | - | - | | | x | | |
| Fabaceae | *Vigna vexillata* | Herb | Indigenous | LC | - | - | x | | | | |
| Fabaceae | *Zornia linearis* | Herb | Indigenous | LC | - | - | | | x | | |
| Fagaceae | *Quercus ruber** | Tree | Alien | NE | - | - | | | x | | |
| Gentianaceae | *Chironia purpurascens* | Herb | Indigenous | LC | - | - | | | x | | |
| Geraniaceae | *Pelargonium* cf. *dolomiticum* | Herb | Indigenous | LC | - | - | | | x | | |
| Geraniaceae | *Pelargonium luridum* | Herb | Indigenous | LC | - | - | x | | x | | |
| Hyacinthaceae | *Dipcadi marlothii* | Herb | Indigenous | LC | - | - | x | | | | |
| Hyacinthaceae | *Dipcadi viride* | Herb | Indigenous | LC | - | - | x | | | | |
| Hyacinthaceae | *Ledebouria cooperi* | Herb | Indigenous | LC | - | - | | | | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Hyacinthaceae | *Ledebouria ovatifolia* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Hyacinthaceae | *Ledebouria revoluta* | Herb | Indigenous | LC | - | - | | x | | | |
| Hydrocharitaceae | *Lagarosiphon* species | Herb | Indigenous | - | - | - | | | x | | |
| Hypoxidaceae | *Hypoxis acuminata* | Herb | Indigenous | LC | - | - | x | x | | | |
| Hypoxidaceae | *Hypoxis argentea* | Herb | Indigenous | LC | - | - | x | | | | |
| Hypoxidaceae | *Hypoxis costata* | Herb | Indigenous | LC | - | - | x | | | | |
| Hypoxidaceae | *Hypoxis galpinii* | Herb | Indigenous | LC | - | - | x | | | | |
| Hypoxidaceae | *Hypoxis iridifolia* | Herb | Indigenous | LC | - | - | x | | | | |
| Hypoxidaceae | *Hypoxis rigidula* | Herb | Indigenous | LC | - | - | x | | | | |
| Iridaceae | *Crocosmia paniculata* | Herb | Indigenous | LC | - | - | | | x | | |
| Iridaceae | *Dierama* species | Herb | Indigenous | - | - | - | | | x | | |
| Iridaceae | *Gladiolus crassifolius* | Geophytic herb | Indigenous | LC | - | Protected | | | x | | |
| Iridaceae | *Gladiolus elliotii* | Geophytic herb | Indigenous | LC | - | Protected | | | x | | |
| Iridaceae | *Gladiolus longicollis* subsp. *platypetalus* | Geophytic herb | Indigenous | LC | - | Protected | | | x | | |
| Iridaceae | *Gladiolus sericeovillosus* subsp. *calvatus* | Geophytic herb | Indigenous | LC | - | Protected | | | x | | |
| Iridaceae | *Gladiolus* species (no flowers) | Geophytic herb | Indigenous | LC | - | Protected | x | | | x | |
| Iridaceae | *Watsonia* species (no flowers) | Herb | Indigenous | - | - | Protected | | | x | | |
| Juncaceae | *Juncus dregeanus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Juncaceae | *Juncus effusus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Juncaceae | *Juncus oxycarpus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Juncaceae | *Juncus oxymeris* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Lamiaceae | *Acrotome* cf. *inflata* | Herb | Indigenous | LC | - | - | | x | | | |
| Lamiaceae | *Leonotis dysophylla* | Shrub | Indigenous | LC | - | - | | x | | | |
| Lamiaceae | *Mentha longifolia* | Herb | Indigenous | LC | - | - | | | x | | |
| Lamiaceae | *Ocimum obovatum* subsp. *obovatum* | Herb | Indigenous | LC | - | - | x | | | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Lamiaceae | *Coleus kirkii (=Pycnostachys reticulata)* | Herb | Indigenous | LC | - | - | | | x | | |
| Lamiaceae | *Rabdosiella calycina* | Shrub | Indigenous | LC | - | - | | x | | | |
| Lamiaceae | *Salvia repens* | Herb | Indigenous | LC | - | - | x | | | | |
| Lamiaceae | *Syncolostemon pretoriae (=Hemizygia pretoriae)* | Herb | Indigenous | LC | - | - | x | | | | |
| Lobeliaceae | *Lobelia flaccida* | Herb | Indigenous | LC | - | - | x | x | x | x | |
| Lobeliaceae | *Lobelia erinus* | Herb | Indigenous | LC | - | - | x | | | | |
| Lobeliaceae | *Monopsis decipiens* | Herb | Indigenous | LC | - | - | x | | x | | |
| Lythraceae | *Nesaea radicans* | Herb | Indigenous | LC | - | - | x | | | | |
| Malvaceae | *Hermannia depressa* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Malvaceae | *Hermannia transvaalensis* | Herb | Indigenous | LC | - | - | x | x | x | | |
| Malvaceae | *Hibiscus microcarpus* | Herb | Indigenous | LC | - | - | x | | | | |
| Malvaceae | *Hibiscus trionum** | Herb | Alien | LC | - | - | x | | | x | |
| Malvaceae | *Malva parviflora** | Herb | Alien | NE | - | - | | | | | x |
| Myrtaceae | *Eucalyptus* species* | Tree | Alien (NEMBA Category 2 or not listed) | NE | - | - | | x | x | | x |
| Onagraceae | *Ludwigia octovalvis* | Herb | Indigenous | LC | - | - | | | x | | |
| Onagraceae | *Oenothera indecora** | Herb | Alien | NE | - | - | | | x | | |
| Onagraceae | *Oenothera rosea** | Herb | Alien | NE | - | - | x | | x | | |
| Orobanchaceae | *Striga bilabiata* | Herb | Indigenous | LC | - | - | | x | | | |
| Orobanchaceae | *Striga elegans* | Herb | Indigenous | LC | - | - | x | | | | |
| Oxalidaceae | *Oxalis corniculata** | Herb | Alien | NE | - | - | x | | | | |
| Oxalidaceae | *Oxalis obliquifolia* | Herb | Indigenous | LC | - | - | x | | | | |
| Papaveraceae | *Papaver aculeatum** | Herb | Alien | NE | - | - | | | | | |
| Pinaceae | *Pinus patula** | Tree | Alien (NEMBA Category 2) | NE | - | - | | | | | x |
| Plantaginaceae | *Plantago lanceolata** | Herb | Alien | NE | - | - | | | x | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Plantaginaceae | *Plantago major** | Herb | Alien | NE | - | - | x | x | | | |
| Poaceae | *Agrostis eriantha* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Agrostis lachnantha* | Graminoid | Indigenous | LC | - | - | | x | x | | |
| Poaceae | *Andropogon appendiculatus* | Graminoid | Indigenous | LC | - | - | | x | x | | |
| Poaceae | *Andropogon eucomus* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Aristida aequiglumis* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Aristida bipartita* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Aristida congesta* subsp. *congesta* | Graminoid | Indigenous | LC | - | - | x | x | | x | |
| Poaceae | *Aristida congesta* subsp. *barbicollis* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Aristida junciformis* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Poaceae | *Arundinella nepalensis* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Brachiaria serrata* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Bromus catharticus* | Graminoid | Alien | NE | - | - | | x | | | x |
| Poaceae | *Chloris virgata* | Graminoid | Indigenous | LC | - | - | | | | | x |
| Poaceae | *Cortaderia selloana** | Graminoid | Alien (NEMBA Category 1b) | NE | - | - | | | | x | |
| Poaceae | *Cymbopogon caesius* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Cymbopogon nardus* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Cymbopogon pospischilii* | Graminoid | Indigenous | LC | - | - | x | x | x | | |
| Poaceae | *Cynodon dactylon* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Digitaria eriantha* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Elionurus muticus* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Eragrostis capensis* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Eragrostis chloromelas* | Graminoid | Indigenous | LC | - | - | x | x | x | x | |
| Poaceae | *Eragrostis curvula* | Graminoid | Indigenous | LC | - | - | x | x | x | x | |
| Poaceae | *Eragrostis gummiflua* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Poaceae | *Eragrostis* cf. *heteromera* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Eragrostis plana* | Graminoid | Indigenous | LC | - | - | x | x | x | x | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Poaceae | *Eragrostis pseudosclerantha* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Eragrostis racemosa* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Eragrostis* species | Graminoid | Indigenous | LC | - | - | x | x | | x | |
| Poaceae | *Harpochloa falx* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Helictotrichon turgidulum* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Heteropogon contortus* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Hyparrhenia dregeana* | Graminoid | Indigenous | LC | - | - | x | x | x | x | x |
| Poaceae | *Hyparrhenia hirta* | Graminoid | Indigenous | LC | - | - | x | x | x | x | |
| Poaceae | *Hyparrhenia tamba* | Graminoid | Indigenous | LC | - | - | x | | | x | |
| Poaceae | *Imperata cylindrica* | Graminoid | Indigenous | LC | - | - | | | x | x | |
| Poaceae | *Koeleria capensis* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Leersia hexandra* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Lolium* cf. *multiflorum** | Graminoid | Alien | NE | - | - | | | | | x |
| Poaceae | *Melinis nerviglumis* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Microchloa caffra* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Panicum schinzii* | Graminoid | Indigenous | LC | - | - | | | | | x |
| Poaceae | *Panicum maximum* | Graminoid | Indigenous | LC | - | - | | | | | x |
| Poaceae | *Paspalum dilatatum** | Graminoid | Alien | NE | - | - | x | | x | | x |
| Poaceae | *Paspalum distichum* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Paspalum urvillei** | Graminoid | Alien | NE | - | - | | | x | | x |
| Poaceae | *Pennisetum clandestinum** | Graminoid | Alien (NEMBA Category 1b) | NE | - | - | | | x | | x |
| Poaceae | *Pennisetum sphacelatum* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Poaceae | *Pennisetum thunbergii* | Graminoid | Indigenous | LC | - | - | x | | x | | |
| Poaceae | *Phragmites australis* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Poaceae | *Setaria pallide-fusca* | Graminoid | Indigenous | LC | - | - | | x | | | |
| Poaceae | *Setaria* species | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Setaria sphacelata* | Graminoid | Indigenous | LC | - | - | x | | | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Poaceae | *Sorghum halepense** | Graminoid | Alien (NEMBA Category 2) | LC | - | - | | | | | |
| Poaceae | *Sporobolus africanus* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Stipagrostis species* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Themeda triandra* | Graminoid | Indigenous | LC | - | - | x | x | x | | |
| Poaceae | *Trachypogon spicatus* | Graminoid | Indigenous | LC | - | - | x | | | | |
| Poaceae | *Tragus berteronianus* | Graminoid | Indigenous | LC | - | - | | | | | x |
| Poaceae | *Tristachya leucothrix* | Graminoid | Indigenous | LC | - | - | x | x | | | |
| Poaceae | *Urochloa panicoides* | Graminoid | Indigenous | LC | - | - | | | | | x |
| Polygalaceae | *Polygala hottentotta* | Herb | Indigenous | LC | - | - | x | | x | | |
| Polygonaceae | *Persicaria decipiens* | Herb | Indigenous | LC | - | - | | | x | | |
| Polygonaceae | *Persicaria lapathifolia** | Herb | Alien | NE | - | - | | | x | | |
| Polygonaceae | *Rumex acetosella** | Herb | Alien | NE | - | - | x | | x | x | |
| Polygonaceae | *Rumex crispus** | Herb | Alien | NE | - | - | | | x | | |
| Pteridaceae | *Cheilanthes hirta* var. *hirta* | Fern | Indigenous | LC | - | - | | x | | | |
| Pteridaceae | *Pellaea calomelanos* var. *calomelanos* | Fern | Indigenous | LC | - | - | | x | | | |
| Rhamnaceae | *Phylica paniculata* | Shrub | Indigenous | LC | - | - | | x | | | |
| Rosaceae | *Agrimonia procera* | Herb | Indigenous | LC | - | - | | x | x | | |
| Rosaceae | *Cotoneaster franchetii** | Tree | Alien | NE | - | - | | x | | | |
| Rosaceae | *Prunus persica** | Tree | Alien | NE | - | - | | | | | x |
| Rosaceae | *Pyracantha angustifolia** | Tree | Alien (NEMBA Category 1b) | NE | - | - | | x | x | | |
| Rosaceae | *Rubus ludwigii* | Shrub | Indigenous | LC | - | - | | x | | | |
| Rubiaceae | *Oldenlandia herbacea* | Herb | Indigenous | LC | - | - | | x | | | |
| Rubiaceae | *Pentanisia prunelloides* | Shrub | Indigenous | LC | - | - | x | | | | |
| Rubiaceae | *Pygmaeothamnus zeyheri* var. *zeyheri* | Dwarf Shrub | Indigenous | LC | - | - | x | | | | |
| Rubiaceae | *Richardia brasiliensis** | Herb | Alien | NE | - | - | x | | | x | x |
| Salicaceae | *Populus cf. niger** | Tree | Alien | NE | - | - | | | | | x |

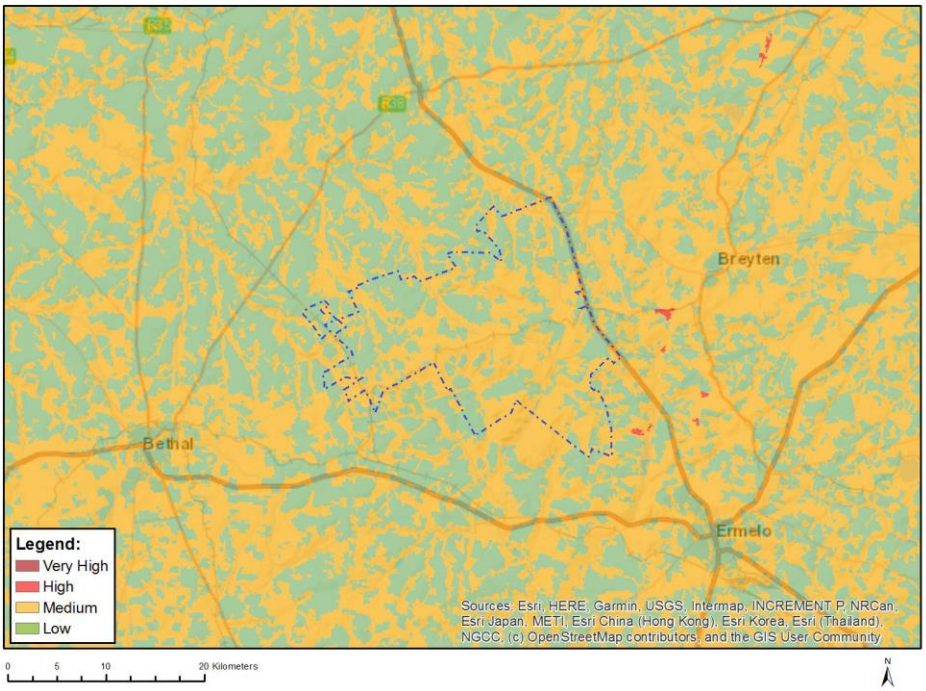
| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| Salicaceae | *Populus x canescens** | Tree | Alien (NEMBA Category 2) | NE | - | - | | | x | | x |
| Salicaceae | *Salix babylonica** | Tree | Alien | NE | - | - | | | x | | x |
| Scrophulariaceae | *Chaenostoma cf. cordatum* | Herb | Indigenous | LC | - | - | | | x | | |
| Scrophulariaceae | *Jamesbrittenia aurantiaca* | Herb | Indigenous | LC | - | - | x | | | | |
| Scrophulariaceae | *Limosella* sp. | Herb | Indigenous | LC | - | - | | | x | | |
| Scrophulariaceae | *Nemesia fruticans* | Herb | Indigenous | LC | - | - | x | | x | | |
| Scrophulariaceae | *Selago densiflora* | Herb | Indigenous | - | - | - | x | | x | x | |
| Selaginellaceae | *Selaginella dregei* | Fern | Indigenous | LC | - | - | | x | | | |
| Solanaceae | *Datura stramonium** | Herb | Alien (NEMBA Category 1b) | NE | - | - | | | | | x |
| Solanaceae | *Physalis angulata** | Shrub | Alien | NE | - | - | | | | | |
| Solanaceae | *Solanum elaeagnifolium** | Herb | Alien (NEMBA Category 1b) | NE | - | - | x | x | | | |
| Solanaceae | *Solanum panduriforme* | Shrub | Indigenous | LC | - | - | x | x | | | |
| Solanaceae | *Solanum sisymbriifolium** | Herb | Alien (NEMBA Category 1b) | NE | - | - | x | x | | | |
| Typhaceae | *Typha capensis* | Graminoid | Indigenous | LC | - | - | | | x | | |
| Verbenaceae | *Verbena brasiliensis** | Herb | Alien (NEMBA Category 1b) | NE | - | - | | x | x | x | |
| Verbenaceae | *Verbena bonariensis** | Herb | Alien (NEMBA Category 1b) | NE | - | - | x | | x | x | x |
| Verbenaceae | *Verbena rigida** | Herb | Alien (NEMBA Category 1b) | NE | - | - | x | | | x | x |
| Red List Categories<br>NE = Not Evaluated | | | | | | | | | | | |

| Family | Species Name | Growth Form | Origin | Conservation Status | | | Habitat Units | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | National Red List Status | Mpumalanga Red List Status | Mpumalanga Protected Status | Mixed Dry Grassland | Rocky Shrubland | Moist Grassland | Old lands (secondary grassland) | Modified & Transformed Sites (e.g., Alien Tree Plantations, Cultivated Fields), road sides, farm yards) |
| LC = Least Concern<br>NT = Near Threatened | | | | | | | | | | | |
| *Indicates alien species | | | | | | | | | | | |

# Appendix D: Summary and Comment on the Sensitivity Rating of the DFFE Screening Tool

## Sensitivity Rating of the National Web Based Screening Tool

The National Web-based Environmental Screening Tool rates the Plant Species Theme for the proposed Project as 'Medium' sensitivity on account of the potential presence of two flora species of conservation concern that are listed in the table below. Also refer to the map showing the spatial sensitivity.




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | | X | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| Low | Low Sensitivity |
| Medium | Sensitive species 1252 |
| Medium | Khadia carolinensis |
| Medium | Sensitive species 1200 |
| Medium | Aspidoglossum xanthosphaerum |
| Medium | Miraglossum davyi |
| Medium | Sensitive species 41 |
| Medium | Sensitive species 691 |
| Medium | Pachycarpus suaveolens |
| Medium | Sensitive species 851 |

## Appraisal of the Sensitivity Rating

No flora species listed as Near Threatened or threatened on the national Red List were recorded in the study area during the field survey. However, habitat suitability assessments indicate that it is probable that a number of such taxa may be present, including species highlighted by the screening tool, such as *Khadia carolinensis, Pachycarpus suaveolens,* Sensitive species 41, Sensitive species and 691 Sensitive species 851. The National Web Based Screening Tool rating of 'medium' sensitivity is therefore confirmed.

# Appendix E: Compliance with Plant Species Protocol.

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Plant Species | Relevant Section in Report |
|---|---|
| **The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline7; and must;** | |
| 2.2.1 identify the SCC which were found, observed or are likely to occur within the study area; | Section 7.2.1 |
| 2.2.2 provide evidence (photographs or sound recordings) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility, immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3); | Section 7.2.1 |
| 2.2.3 identify the distribution, location, viability and provide a detailed description of population size of the SCC, identified within the study area; | Section 7.2.1 |
| 2.2.4 identify the nature and the extent of the potential impact of the proposed development on the population of the SCC located within the study area; | Section 10.3 |
| 2.2.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases, including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases; | Section 7.2.1 |
| 2.2.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area; | Section 10.3 |
| 2.2.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, include a motivation for the deviation; | Section 7.2.1 |
| 2.2.8 identify any dynamic ecological processes occurring within the broader landscape that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems; | Section 8 |
| 2.2.9 identify any potential impact of ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long-term viability; | Section 8 & Section 10.3 |
| 2.2.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; | N/A |
| 2.2.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species10; or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity | Section 7.2.1 |
| 2.2.12 identify any alternative development footprints within the preferred site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification | Section 9 |
| 3.1 This report must include as a minimum the following information: | |
| 3.1.1 contact details and relevant experience as well as the SACNASP | Page 3 & Appendix A |

| Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Plant Species | Relevant Section in Report |
|---|---|
| registration number of the specialist preparing the assessment including a curriculum vitae; | |
| 3.1.2 a signed statement of independence by the specialist; | Page 3 |
| 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; | Section 3.2 & Section 4 |
| 3.1.4 a description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant; | Section 3 & Section 10.1 |
| 3.1.5 a description of the mean density of observations/number of sample sites per unit area and the site inspection observations; | Section 3.2 & Appendix B |
| 3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data; | Section 4 |
| 3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported; | Section 7.2.1 |
| 3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area; | iNaturalist – Andrew Zinn profile |
| 3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant; | N/A |
| 3.1.10 a discussion on the cumulative impacts; | Section 10.3.4 |
| 3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr); | Section 12 & Section 13 |
| 3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; | Section 14 |
| 3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate; | N/A |
| 3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report. | EAP to incorporate |