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ECOLOGY & BIODIVERSITY CONSULTANTS

UJEKAMANZI WIND ENERGY FACILITY 2

Biodiversity Impact Assessment for the proposed Main Transmission Stations, Loop In-Loop Out Powerlines and Overhead Powerline at the Ujekamanzi Wind Energy Facility 2 Area, Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga

UJEKAMANZI WIND ENERGY FACILITY 2: MTS 2 and LILO 2

Biodiversity Impact Assessment for the proposed Main Transmission Stations, Loop In-Loop Out Powerlines and Overhead Powerline at the Ujekamanzi Wind Energy Facility 2 Area, Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga

by
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Commissioned by

SiVEST SA (Pty) Ltd

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April 2023

National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	**Title page and Chapter 10 p114**
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Page 8**
(c) an indication of the scope of, and the purpose for which, the report was prepared;	**Chapter 2 Page 19-21**
(cA) an indication of the quality and age of base data used for the specialist report;	**Chapter 4 Page 24 and 27 And Chapter 5**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Chapter 3 P22 And Chapter 5 P31 And Chapter 7 P82-105**
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Chapter 4.1 2 p24 Chapter 4.2 1p27**
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Chapter 4 P24-30**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	**Chapter 5 p31-59**
(g) an identification of any areas to be avoided, including buffers;	**Paragraph 5.2 P37-51**
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**P38-39**
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	**Comprehensively done in Chapters 5, 6 and 7**
(k) any mitigation measures for inclusion in the EMPr;	**Chapter 7 Impact table P86-104**

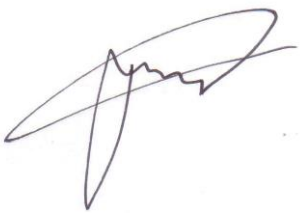
(l) any conditions for inclusion in the environmental authorisation;	**No-Go areas identified P39**
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**Monitor success of rehabilitation Chapter 7**
(n) a reasoned opinion— i. whether the proposed activity, activities or portions thereof should be authorised; I A. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	**Paragraph 7.2 P86 and Chapter 8 P 105-108**
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**N/A** -No feedback has yet been received from the public participation process regarding the visual environment
(p) any other information requested by the competent authority	**N/A**. No information regarding the visual study has been requested from the competent authority to date.
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**N/A**

TABLE OF CONTENTS

DECLARATION OF INDEPENDENCE

We, George Johannes Bredenkamp, Id 4602105019086, SACNASP Reg No 400086/83 and Jacobus Casparus Petrus Van Wyk, Id 680804 5041084, SACNASP Reg No 400062/09 declare that we:

- Hold higher degrees (MSc and DSc) in the biological sciences, which allowed registration by South African Council for National Scientific Professions as Professional Ecologist that sanction me to function independently as specialist scientific consultant;
- Act as an independent specialist consultant in the field of ecology, vegetation science, botany zoology and wetlands;
- Are employed by Eco-Agent CC, CK 95/37116/23, of which GJ Bredenkamp is the owner;
- Abide by the Code of Ethics of the SACNASP;
- Are committed to biodiversity conservation but concomitantly recognize the need for economic development;
- Are assigned as specialist consultants by Pierre Joubert Landscape Architect and Environmental Planner for the project **"Biodiversity Impact Assessment for the proposed Main Transmission Stations, Loop In-Loop Out Powerlines and Overhead Powerline at the Ujekamanzi Wind Energy Facility 2 Area, Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga**" described in this report;
- Declare that, as per prerequisites of the Natural Scientific Professions Act (Act No. 27 of 2003), as amended by the Science and Technology Laws Amendment Act (Act 7 of 2014), this investigation of vegetation exclusively reflects our own observations and unbiased scientific interpretations, and was executed to the best of our ability;
- Within our fields of expertise, we reserve the right to form and hold our own opinions within the constraints of our training and experience and therefore will not submit willingly to the interests of other parties or change our statements to appease or unduly benefit them;
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed;
- Do not have, and will not have any vested or conflicting interests in the proposed development;
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority with regard to the Environmental Impact Assessment requirements;
- Will provide the client and competent authority with access to all information at our disposal, regarding this project, whether favourable or not;
- Reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognise that written consent from the client(s) will be required for us to release any part of this report to third parties;
- In addition, remuneration for services provided by us is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.



GJ Bredenkamp JPC van Wyk

DISCLAIMER:

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. The biodiversity team can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. Although the authors exercised due care and diligence in rendering services and preparing documents, they accept no liability. The client, by receiving this document, indemnifies the authors against all actions, claims, demands, losses, liabilities, costs, damages, and expenses arising from or in connection with services rendered, directly or indirectly by the authors and using this document. This report should therefore be viewed and acted upon with these limitations in mind.

EXECUTIVE SUMMARY

ABO Wind renewable energies (Pty) Ltd is proposing to develop a renewable energy cluster, located south of Ermelo in the Mpumalanga Province. The cluster is collectively referred to as “ABO Wind Ujekamanzi Wind Energy Facilities”, consisting of 2 x Wind Energy Facilities (WEF’s 1 and 2) and associated Electrical Grid Infrastructure (EGI), A Main Transmission Substation (MTS) and a Loop-In-Loop-Out (LILO) for the grid connection.

This report is the **Biodiversity Impact Assessment for the proposed Main Transmission Stations, the Loop In-Loop Out Powerlines and Overhead Powerline at the Ujekamanzi Wind Energy Facility 2 (WEF 2) Area.**

The calculated size of the WEF 2 area investigated to determine suitable areas for the proposed cluster is approximately 12427 hectares. The proposed WEF 2 project is located approximately 43 km south of Ermelo and 17 km north of Amersfoort, in the Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga Province. Eco-Agent CC was appointed by SiVEST to do an impact assessment on the biodiversity (fauna and flora) of the site.

This study was done in accordance with the National Environmental Management Act (Act 107 of 1998) Amendment of the Environmental Impact Assessment Regulations 2014, 7 April 2017. (GNR. 324, 325, 326 & 327: Listing Notices 1, 2, 3).

Furthermore, the results of the National Environmental Screening Tool (NEMA Government Notices 648 (2019) and 655 (2020)) indicate Very High sensitivity for Terrestrial Biodiversity and Medium for Animal Species sensitivity, Low to Medium sensitivity for Plant Species sensitivity.

The Terms of Reference for this assignment is interpreted as follows: Compile a study of the biodiversity, which includes the vegetation, flora and fauna (except avifauna and bats) on the site, as indicators of ecological sensitivity, and then perform an impact assessment in accordance with the requirements of relevant national and provincial environmental authorities.

Vegetation

The relevant literature and databases were used to obtain data regarding threatened, protected, alien invasive and medicinal plant species, also regional vegetation, threatened status of vegetation types, protected and conservation areas, critical biodiversity areas, wetlands and water courses.

Standard methods for vegetation surveys were applied. Plant communities were mapped and described including total floristic composition per pant community. Both the literature and field data were applied in analyses to determine ecological sensitivity and conservation status per plant community.

SANBI and DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022) indicate that the Amersfoort Highveld Clay Grassland and Wakkerstoom

Montane Grassland are not listed as threatened ecosystems.

Irreplaceable CBAs occur in the central-northern and eastern parts of the WEF 2 area, mostly restricted to high-altitude grassland associated ridges t. These areas of the study site are the most important for conservation. **CBA Optimal sites** occur widespread over the western and central parts of the site. These areas are natural grassland of conservation importance, with some upper reaches of west-flowing drainage lines occurring in these areas. **Other Natural Areas also** representing grassland occur in patches in the eastern and western extremes of the site. Local **ESA corridors** occur mainly in the western parts of the site. All the grasslands are highly fragmented by cultivation areas and are often disturbed/degraded, classified as Highly or Moderately modified.

The general vegetation of the study area, particularly the crests and higher slopes, is **dense grassland** that occurs on dark clayey soil derived from dolerite. This grassland is mostly dominated by *Eragrostis curvula*, *Eragrostis chloromelas* and *Eragrostis plana,* indicating a high degree of grazing. Many other grass and forb species occur, particularly on these higher-lying areas in the undulating landscape. Eight plant communities were identified, mapped and floristically described while a further three units are mapped and briefly mentioned.

Due to its very high plant species richness, the **Sensitive Highland Grassland** is associated with **Irreplaceable Critical Biodiversity Area** (CBA) and consequently has High ecological sensitivity and a high conservation status. This grassland is restricted to the central northern and eastern parts of the site. Parts of this grassland is regarded as **No-Go** area.

Due to its very high plant species richness, **Highland Grassland** is often associated with the **Optimal Critical Biodiversity Area** (CBA). This vegetation has a lower conservation status than the Sensitive Highland Grassland, which is classified as an **Irreplaceable CBA**. In terms of biodiversity sensitivity the Highland Grassland is consequently placed between High and Medium sensitivity. The reason for this relatively lower sensitivity is particularly because it is classified as an Optimal CBA and not an Irreplaceable CBA. This implies a lower status than Irreplaceable, but nevertheless a Critical Biodiversity Area. The Highland Grassland occupies large areas over the western and central parts of the site.

The proposed development includes (i) a proposed preferred **Main Transmission Station (MTS 1)**, located in **Highland Grassland** (no alternatives suggested) (ii) the Main Transmission Station links to the existing 400 kV Overhead Eskom line with **Loop In-Loop Out** powerlines, which mainly transects **Highland Grassland** and (iii) an Overhead Powerline crossing **Sensitive Highland Grassland** to the preferred substation on WEF 2, and further to a planned WEF 1 site towards the north.

Due to their situation in the lower-lying valleys and flatter terrain **Degraded Grasslands** had been utilised more intensively over many years and consequently some varying degrees of disturbance resulted in loss of some plant species and lower plant species richness. The resulting ecological sensitivity, based on biodiversity, was calculated as **Medium-Low**. These areas are, from a biodiversity sensitivity point of view, suitable for any of the

proposed developments. **The preferred WEF 2 Substation 1 is located within Degraded Grassland.**

Fauna

The general WEF study site contains three of the four natural mammal and herpetofauna habitats, namely terrestrial, rupicolous and wetlands. The current WEF 2 study site (including the Main Transmission Station 1, Loop In-Loop Out powerlines and Overhead Powerlines) has only terrestrial habitat, but this report includes the expected fauna of the entire WEF 2 study site.

It is estimated that 59 mammal species (excluding bats) may from time to time occur on or near the study site area and 10 were confirmed on or close to the site. Most of the species of the resident diversity are common and widespread (viz. aardvark, rock hyrax, scrub hare, African mole-rat, yellow mongoose, black-backed jackal, blesbok, common duiker, African mole rat, multimammate mouse and Highveld gerbil).

Data from various sourced indicate that 14 listed threatened mammal species may occur in the area of the study site. Of these at least four were confirmed by sight records or reports from local people.

None of the mammal species predicted to visit the area of the site, will be threatened by the construction or the during the operational phase of the planned Wind Energy Facility. These mammal species are all quite motile and if present in the way of the construction, will easily move away from the danger.

Of the 50 reptile species that may occur on the study site, two were confirmed during the site visit and of the possible 17 amphibian species which may occur on the study site, two were confirmed during the site visit. The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity are common and widespread for example leopard tortoise, common house snake, mole snake, common egg eater, Mozambique spitting cobra, tree agama, puff adder, striped skink, common dwarf gecko, Van Son's gecko, Boettger's caco, bubbling kassina, guttural toad and eastern olive toad.

Three listed Red Data herpetofauna species, the coppery grass lizard, the striped harlequin snake and plain stream frog may occur on or in the vicinity of the site. Two species with no national conservation status but with Mpumalanga Conservation status, the spotted harlequin snake and many-spotted snake may also be found on the site.

From a mammal and herpetological perspective, there is no objection against the proposed development if the mitigation measures are adhered to and no development occurs on the nearby rocky ridges or near the drainage lines.

Impact Assessment

The Impact Assessment was done according to the methods prescribed by SiVest. The

impact tables were compiled by applying the prescribed Excel spread sheet. Impacts were determined on the vegetation and species of all plant communities.

The Impact Assessment was done according to the methods prescribed by SiVest. The impact tables were compiled by applying the prescribed Excel spread sheet. Impacts were determined on the vegetation and species of all plant communities.

Only a single location for the MTS, a single alignment for the Loop In-Loop Out powerline and a single alignment for the Overhead Powerline were provided as the preferred. As the impacts on vegetation and plant species for the MTS and sections of the LILO and the entire Overhead Powerline are **Medium** an Alternative for the MTS and the LILO are suggested. It seems that there is no possibility for alternatives for the Overhead powerline.

The impacts on biodiversity of the construction of the proposed MTS 1 will, without as well as with mitigation measures, be **Medium**, during the construction and the operational phases. This is because it is situated on **Highveld Grassland**, which is ecologically sensitive on Optimum Critical Biodiversity Area. (see Table 7.1 and 7.2 above).With mitigation the impact can be lowered.

The suggested **alternative for the MTS (MTS 2)** is Agricultural Field or Degraded Grassland, located south of the preferred MTS 1. Here impacts on vegetation and plant species will be much lower.

Where the **LILO 1** transects the **Highland Grassland** the impacts are Medium without mitigation, during the construction and operational phases. With mitigation the impacts can be lowered. Where the LILO 1 crosses Agricultural Fields or even smaller Drainage Lines, the impacts are Low.

The suggested **alternative LILO 2** transects mainly Agricultural Fields and Degraded Grassland, where impact on vegetation and plant species will be Low.

The impacts of the proposed **Overhead Powerline 1** on Highland Grassland or Sensitive Highland Grassland are mostly **Medium**. Both these two grassland types are located on ecologically sensitive grassland, which are Critical Biodiversity areas. It seems that there is no possibility for alternatives.

The impacts of the developments on mammals and herpetofauna are Low.

It is concluded that from a biodiversity perspective, alternatives for the MTS 1 and the LILO 1 are preferred, should this be feasible.

It is suggested that the **cumulative impact** on vegetation, plants and fauna of the Ujekamanzi WEF, in relation to the Majuba solar PV, is rather low.

1. BACKGROUND AND ASSIGNMENT

The following information was provided by SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST").

ABO Wind renewable energies (Pty) Ltd is proposing to develop a renewable energy cluster, located south of Ermelo in the Mpumalanga Province (Figure 1.1 below). The cluster is collectively referred to as "ABO Wind Ujekamanzi Wind Energy Facilities", consisting of 2 x Wind Energy Facilities (WEF 1 and WEF 2) and associated Electrical Grid Infrastructure (EGI), a Main Transmission Substation (MTS) and a Loop-In-Loop-Out (LILO) for WEF 1 and WEF 2.

This report contains the basic biodiversity assessment and resulting impact assessment for the preferred Main Transmission Substation (MTS), Loop-In-Loop-Out (LILO) and the for the Overhead Powerline for the Ujekamanzi Wind Energy Facility 2 (WEF2). No alternatives are proposed.

The calculated size of the WEF1 area to be investigated is approximately 13463 hectares. The proposed WEF1 project is located approximately 35 km south of Ermelo and 24 km north of Amersfoort, in the Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga Province (Figure 1.1 below).

Eco-Agent CC was appointed by SiVEST to assess the biodiversity and ecological sensitivity for the areas relevant for this development. The study includes vertebrate fauna, vegetation, flora and ecological sensitivity. The fauna study however excludes birds and bats, which are investigated by other independent bird and bat specialists.

This investigation is in accordance with the EIA Regulations No. R982-985, Department of Environmental Affairs and Tourism, 4 December 2014. emanating from Chapter 5 of the National

Environmental Management Act, 1998 (Act No. 107 of 1998), and the Amendment of the Environmental Impact Assessment Regulations, 7 April 2017. (GNR. 324, 325, 326 & 327: and the Mpumalanga Tourism and Parks Agency (MTPA)). It is also in accordance with the Protocols published in Government Notice 648 Government Gazette 45421, 10 May 2019 (Biodiversity) and Government Notice 655 Government Gazette 42946, January 2020 and Government Notice no 320 (Government gazette 43855) (March 2020). (Plants and Animals).

In accordance with the Natural Scientific Professions Act (Act 27 of 2003; and the later Science and Technology Laws Amendment Act (Act 7 of 2014) only a person registered with the South African Council for Natural Scientific Professions may practice in a consulting capacity. Prof GJ Bredenkamp of EcoAgent CC, assisted by Mr JPC van Wyk, undertook an independent and professional assessment of the biodiversity and ecological sensitivity.

The vegetation and flora study includes the identification and floristic-cum-habitat description of plant communities, representing scale related mappable ecosystems. These mappable ecosystems should be useful for the planning of the development, including conservation of sensitive ecosystems and their biodiversity (fauna and flora), as well as other land-use management units.

The fauna study focuses on the reigning status of threatened and sensitive mammals & herpetofauna likely to occur on the proposed development site (the entire Ujekamanzi WEF site) and whose conservation status should be considered in the decision-making process. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the proposed development. The secondary objective of the investigation was to gauge which mammals and herpetofauna might still reside on the site and comment on the mammal and herpetofauna diversity of the study area.

The Terms of Reference for this assignment is interpreted as follows: Compile a study of the biodiversity and ecological sensitivity on the site and do an assessment of the impacts that the proposed (preferred and alternative) MTS and LILO developments can have on the biodiversity.

In the light of the above. the following had to be done:

1.1. Initial preparations:

Obtain all relevant maps and information on the natural environment of the concerned area.

<u>These include</u>:

- Results of the **National Environmental Screening Tool** with relevance to biodiversity, plant species and animal species, and where relevant of aquatic systems.
- Regional **Vegetation Types**
- **Threatened Ecosystems**.
- Information (maps) about **Critical Biodiversity Areas and Ecological Support Areas, Conservation Areas, Protected Areas and hydrology (wetlands),** and any other environmentally / ecologically sensitive areas in relation to the study site.
- Information on **Red Data** listed plant species and other plant species of conservation concern that may occur in the area.

- Delimit the various **plant communities** as relatively homogeneous vegetation-cum-habitat (ecosystem) mapping units that can be recognised on aerial photographs / Google Earth images of the site.

1.2. Vegetation and habitat survey:

- List the plant species (trees, shrubs, grasses and herbaceous species) present in each relatively homogeneous vegetation-cum-habitat (ecosystem) mapping unit, for floristic confirmation and description of plant communities (ecosystems) and for vegetation status assessment.
- Identify suitable habitat for any Red Data listed plant species that may possibly occur on the site.
- Identify from this list any red data plant species, protected plant species, alien plant species, and medicinal plants that occur or may potentially occur on the study areas.

1.3. Plant community delimitation and description

- Process data (vegetation and habitat classification) to identify the plant communities that are present on the site, on an ecological basis (= vegetation-cum-habitat).
- Prepare a vegetation map of the area.
- Describe the vegetation and habitat of each mapping unit.
- Determine the sensitivity of each mapping unit in terms of biodiversity and presence of rare or protected plant species, alien and weedy species.
- Determine the ecological status of each plant community in terms of primary, secondary, disturbed, degraded, transformed vegetation.
- Prepare a Site Sensitivity Verification Statement as required by Government Notice 648 (2019) and Government Notice 655 (2020) (Screening Tool).

1.4. Fauna survey

- List relevant fauna species (excluding birds and bats) that may potentially occur on the site. using literature and existing data bases.
- List the relevant fauna species (excluding birds and bats) present on the site.
- List relevant **Red Data** fauna species (excluding birds and bats) that occur or may possibly occur on the site.

This report resulted from a site visit by the EcoAgent team on 13-15 January 2023 to assess the vegetation, flora and relevant fauna and ecological sensitivity.

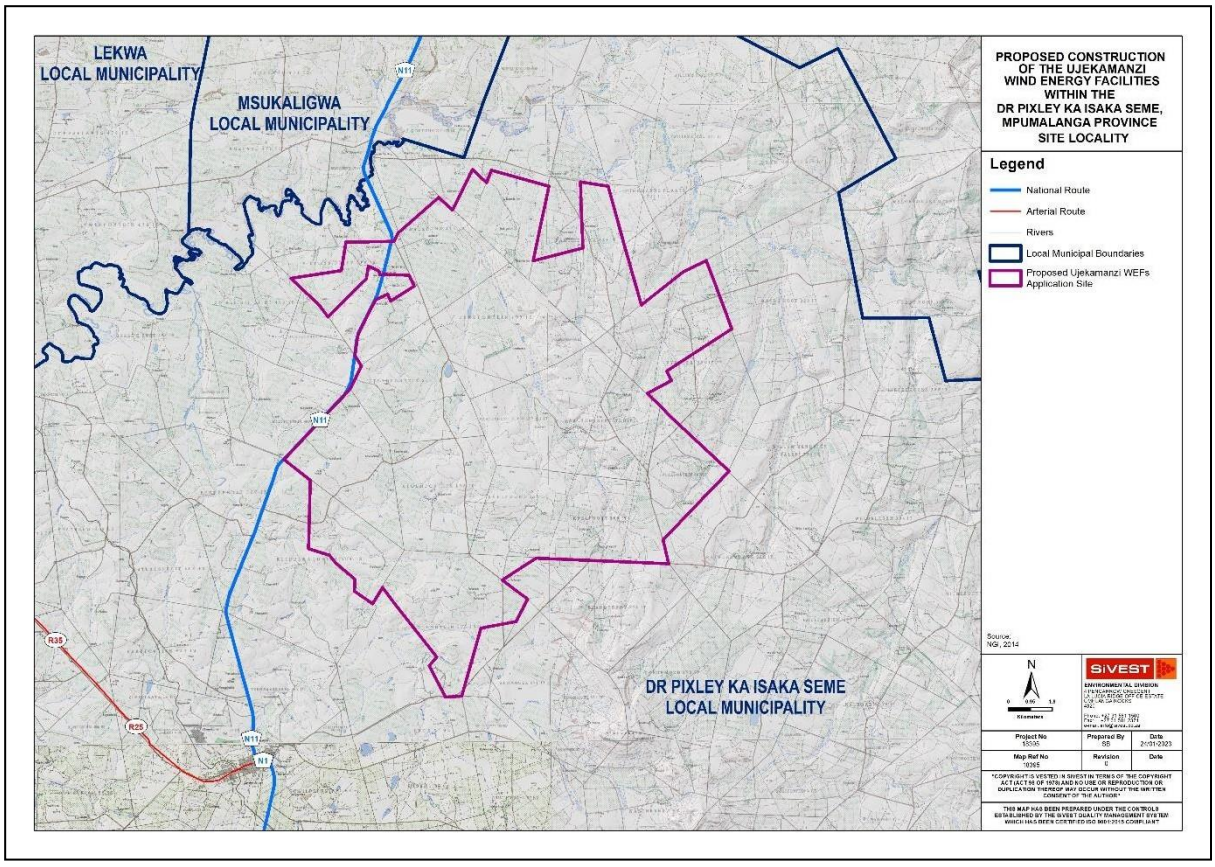


Figure 1.1: The locality of the ABO Wind Renewable Energies cluster (map provided by SiVest).

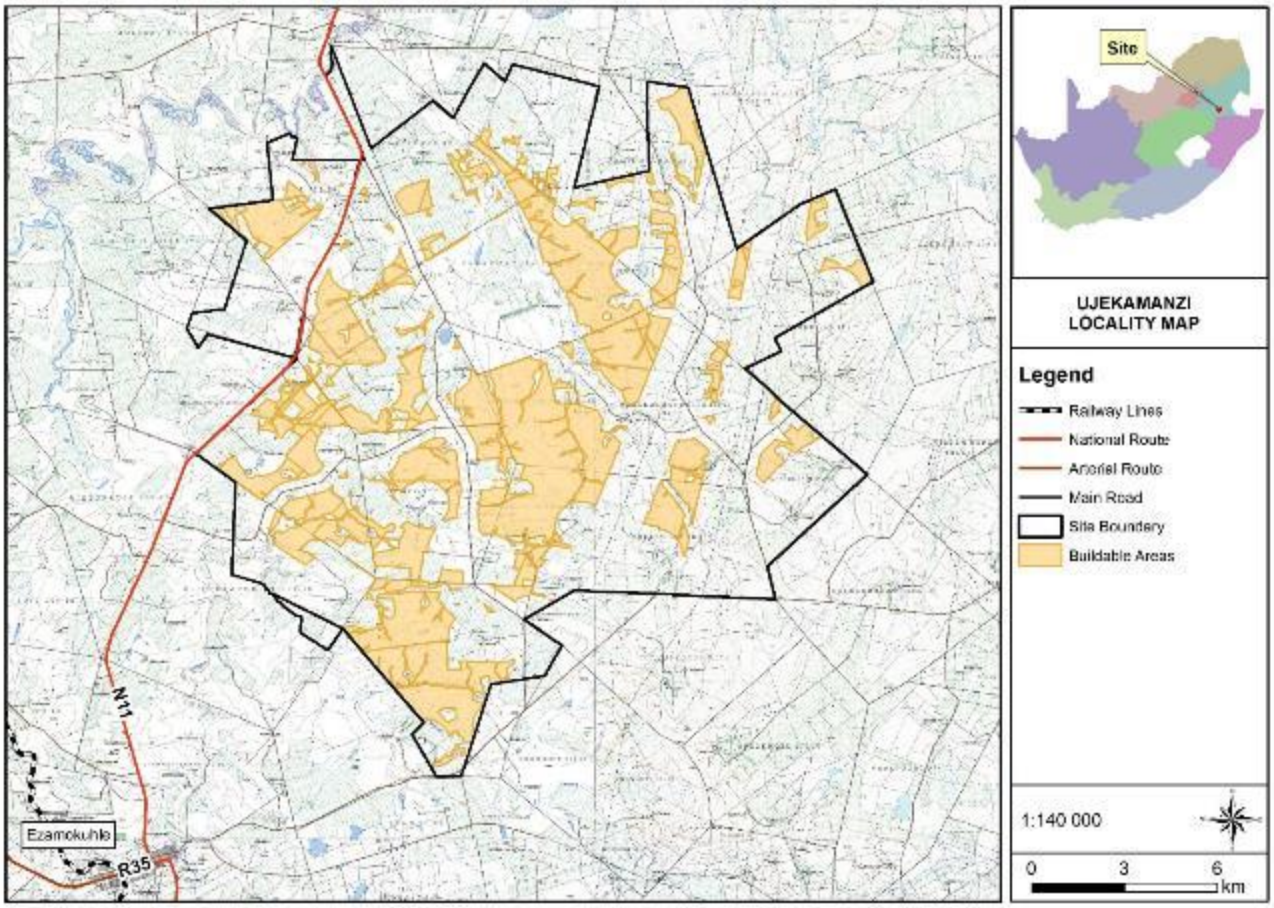


Figure 1.2: The locality of the ABO Wind Renewable Energies cluster, with an indication of suitable building areas (map provided by SiVEST).

2. RATIONALE AND SCOPE

2.1 Rationale

It is widely recognised that to conserve natural resources it is of the utmost importance to maintain ecological processes and life support systems for plants, animals and humans. To ensure that sustainable development takes place, it is therefore important that possible impacts on the environment are considered before relevant authorities approve any development. This led to legislation protecting the natural environment. In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. In South Africa, the Environmental Conservation Act (Act 73 of 1989), the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998) and the National Environmental Management Biodiversity Act, 2004 (Act 10 0f 2004) ensure the protection of ecological processes, natural systems and natural beauty, as well as the preservation of biotic diversity within the natural environment. They also ensure the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes, products or activities. In support of these Acts, a draft list of Threatened Ecosystems was published (Government Gazette 2009), as part of the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004), and these Threatened Ecosystems are described by SANBI & DEAT (2009) and a list of Threatened or Protected Species (TOPS) regulations is also available (NEMBA Notice 388 of 2013). International and national Red Data lists have also been produced for various plant and animal taxa.

All components of the ecosystems (physical environment, vegetation, animals) at a site are interrelated and interdependent. **A holistic approach is therefore imperative** to effectively include the development, utilisation and, where necessary, conservation of the given natural resources into an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001).

It is therefore necessary to make a thorough inventory of the plant communities, flora and relevant fauna on the sites, to evaluate the plant diversity and possible presence of plant and fauna species of conservation concern, red listed plant and fauna species and protected plant and fauna species, alien species, invader species and weedy species. From the results of this evaluation the **sensitivity** of the vegetation and the conservation value can be determined.

2.2 Legal Framework

Authoritative legislation that lists impacts and activities on biodiversity and wetlands and riparian areas that requires authorisation includes *inter alia*:

- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983);
- Government Gazette 34809 Threatened Terrestrial Ecosystems of South Africa 9 December 2011 NEMBA)
- Government Notice Regulation 1182 and 1183 of 5 September 1997, as amended (ECA);
- Government Notice Regulation 385, 386 and 387 of 21 April 2006 (NEMA);
- Government Notice Regulation 392, 393, 394 and 396 of 4 May 2007 (NEMA);
- Government Notice Regulation 398 of 24 March 2004 (NEMA);

- Government Notice Regulation 544, 545 and 546 of 18 June 2010 (NEMA)
- Government Notice Regulation 982, 983, 984 and 985 of 4 December 2014 (NEMA).
- National Environmental Management Act (Act 107 of 1998) Amendment of the Environmental Impact Assessment Regulations 2014, 7 April 2017. (Government Notice Regulations. 324, 325, 326 & 327: Listing Notices 1, 2, 3).
- National Environmental Management Act, 1998 (Act No. 107 of 1998)(including all later amendments and additions);
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)(including all later amendments and additions);
- National Environmental Management: Protected Areas Act 2003 (Act 57 Of 2003) (as Amendment Act 31 of 2004 and Amendment Act 15 of 2009)
- National Forests Act, 1998 (Act 84 of 1998);
- National Water Act, 1998 (Act 36 of 1998);
- The older Environment Conservation Act, 1989 (Act 73 of 1989);
- Government Notice 655 Government Gazette 42946, 10 January 2020 (Plants and Animals)(NEMA).
- Government Notice 648 Government Gazette 45421, 10 May 2019 (Biodiversity)(NEMA).
- Government Notice 689 Government Gazette 47526, 18 November 2022. The Revised National List of Ecosystems that are Threatened and in need of Protection.

2.3 The Scope and objectives

The Scope of this study is therefore:

- To identify describe and map the vegetation (ecosystems) that occur on the site;
- To assess the ecological sensitivity of these ecosystems and comment on ecologically sensitive areas, in terms of their plant diversity and where needed ecosystem function;
- To provide a list of plant species that do occur on site and that may be affected by the development;
- To identify relevant flora species of conservation concern that may occur on the site;
- Compile a list of relevant fauna that occur on the site or may from time to time occur on the site, with comments on preferred habitat and ecological sensitive areas for fauna;
- To evaluate the conservation importance and significance of the site with special emphasis on the current status of resident threatened fauna species;
- Confirm or dispute the environmental sensitivity as identified by the National web-based environmental screening tool;
- If relevant, indicate definite no-go areas and areas most suitable for the proposed development;
- Do an Assessment of the Impacts that the proposed development may have on the biodiversity;
- If relevant, provide management recommendations that might mitigate negative and enhance positive impacts on fauna and flora, should the proposed development be approved.

2.4 Limitations and Complications

A limitation was the limited time to assess the relatively large site, as well as the limited access to some parts of the site.

It is important to note that, from a biodiversity and ecological sensitivity perspective, cultivated fields, planted pastures and old fields are regarded as having low biodiversity and ecological sensitivity. Natural grasslands, on the other hand, are normally regarded as sensitive ecosystems, due to relatively high levels of biodiversity, while all wetland systems have high ecological sensitivity.

The specific limitations for the biodiversity specialists in **this project** are that from a biodiversity perspective:

- The areas with LOW biodiversity sensitivity are the agricultural lands, which are located in the lower-lying valleys and are not suitable and not preferred for a WEF.
- The areas with HIGHER biodiversity sensitivity on the higher-lying uplands and are the preferred buildable areas for the WEF.
- Two of the major blocks of buildable areas overlie Irreplaceable Critical Biodiversity Areas (Compare Figures 1.2 and 5.2).

The necessity and availability of adequate levels of energy is an urgent national need and the provision of reliable renewable energy is a national priority. Therefore, the challenge to the biodiversity specialists is to accommodate the needs of this important WEF2 project, and concomitantly provide for adequate opportunity for conservation of high biodiversity grasslands of conservation concern.

3. STUDY SITE

3.1 Location and the receiving environment

The proposed WEF1 cluster is located approximately 35 km south of Ermelo and 24 km north of Amersfoort, in the Dr Pixley Ka Isaka Seme local municipality, Gert Sibanda District Municipality, Mpumalanga Province. (Figure 3.1 below).

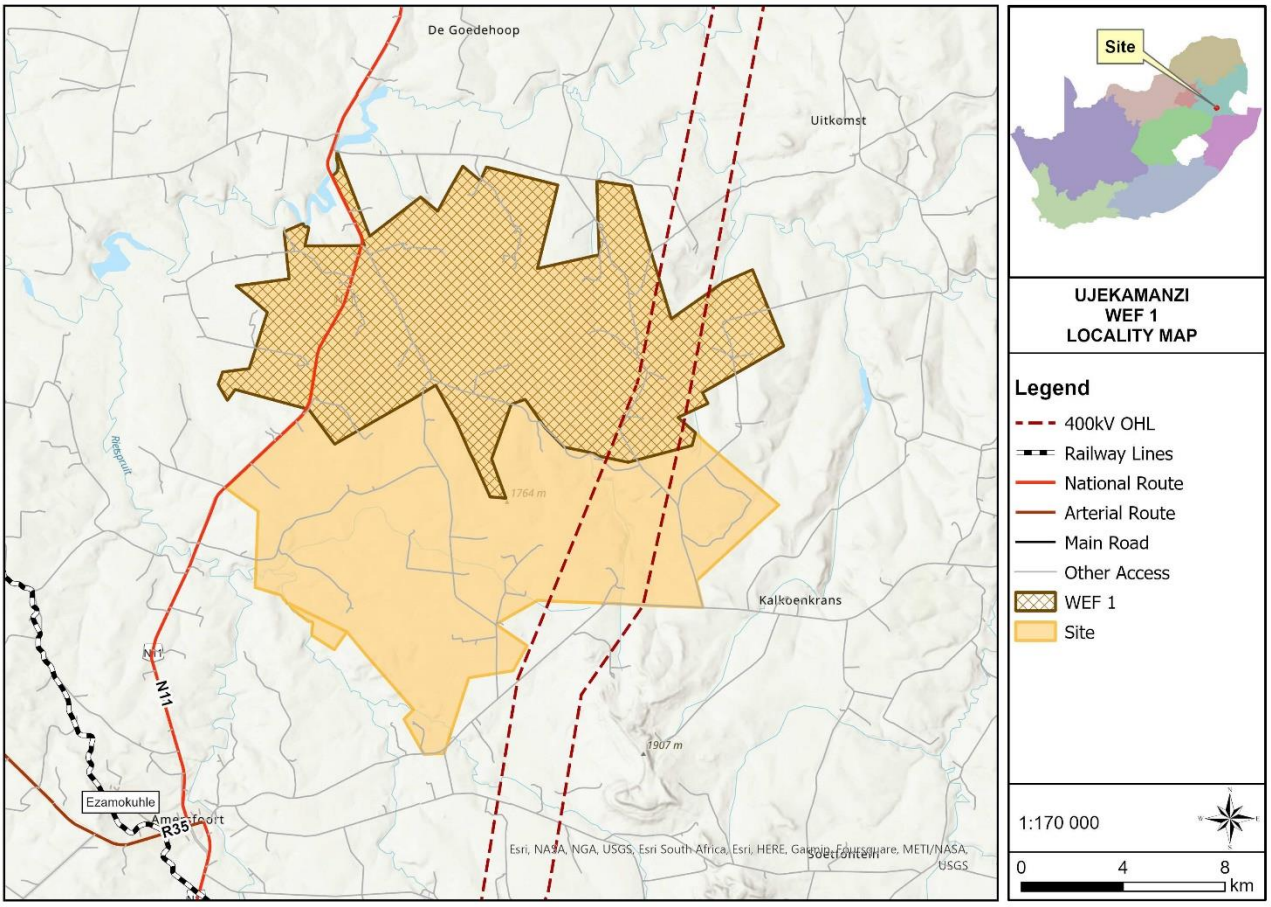


Figure 3.1: The locality of the proposed Ujekamanzi Wind Energy Facility 1 (WEF1).

Biophysical background

The Ujekamanzi WEF1 study site is located within a high altitude (1600-1750 m above sea level) slightly undulating landscape within the Amersfoort Highveld Clay Grassland vegetation type. The soils within this landscape are fertile, dark-coloured clays, derived from dolerite that is intrusive in the Karoo sediments of the Madzaringwe and Volksrust Formations. The area has relatively high rainfall, The regular annual precipitation is about 650-750 mm, and the cold winters have severe and frequent frost. The relatively higher lying uplands are drained by numerous drainage lines (Figure 3.3 below) that merge to form permanent spruits in the relatively lower-lying valleys, ultimately draining into the Vaal River, which is located just north of the study site.

- **Agriculture**: The rich soils in the relatively flat valleys, often along the spruits, are very suitable for crop production and are mostly ploughed for cultivation. This results in very valuable

agricultural land, though also results in the transformation of natural vegetation to agricultural fields, which, from a biodiversity perspective have Low Sensitivity.

- **Natural Grasslands**: Contrary to this, the higher-lying uplands are covered by lush, dense grassland, with many grass and forb species, but very limited woody species. The uplands are further characterised by crests, slopes, scarps, and varying soil depth and soil rockiness. The highly productive grasslands (high rainfall and nutrient rich soils) are utilised for grazing by livestock. Different grazing management regimes over this large area with many different owners/managers resulted in a wide range of grazing intensities over long periods of time. Consequently the vegetation consists of a mosaic of grassland patches varying from veld in very good condition to various degrees of disturbance and degradation. All these factors lead to a variety of ecosystems, which vary in biodiversity and consequently vary in ecological sensitivity. Large parts of these grassland are recognised as being Critical Biodiversity Areas, both Optimal and Irreplaceable (Figure 5.2 below).

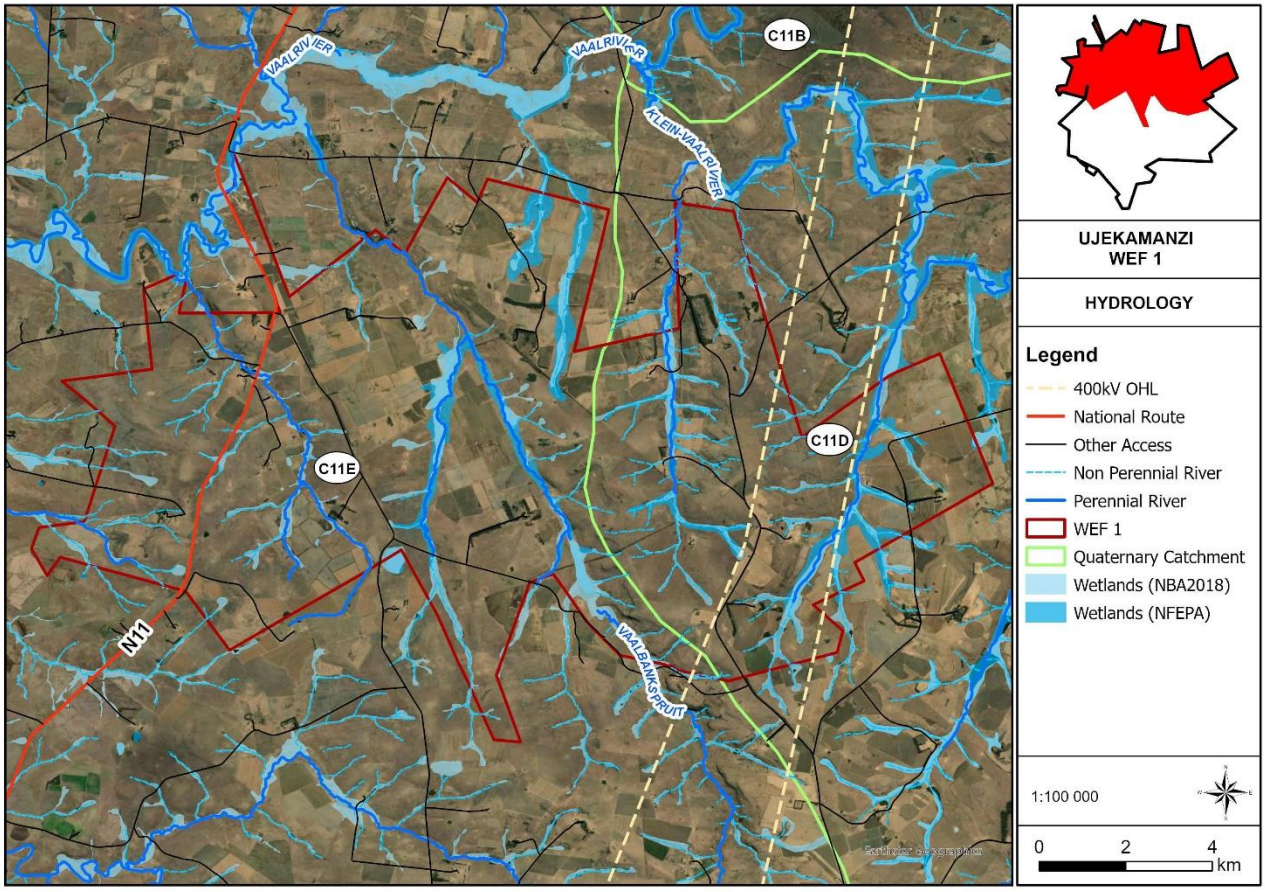


Figure 3.3: Hydrology in the area of the WEF 1 site.

4. METHODS

4.1 VEGETATION AND FLORA

4.1.1 Literature studies and databases:

For background information, the relevant maps, aerial photographs, and other information on the natural environment of the concerned area were obtained though literature studies and databases. These *inter alia* include:

- Results of the National Environmental **Screening Tool** with relevance to biodiversity, plant species and animal species, and where relevant of aquatic systems. (Government Notice 655 Government Gazette 42946, 10 January 2020 [Plants and Animals)(NEMA) and Government Notice 648 Government Gazette 45421, 10 May 2019 (Biodiversity)(NEMA)].
- The relevant **vegetation types** in which the site is located using Mucina & Rutherford (2006, 2012).
- **Threatened ecosystems** are identified using Mucina & Rutherford (2006, 2012) SANBI & DEAT (2009) and NEMA Government Gazette 34809 (2011) and Government Notice 689 (2022).
- Information (maps) about **Critical Biodiversity Areas and Ecological Support Areas,** and any other environmentally / ecologically sensitive areas in relation to the study site from the MTPA Conservation Plan.
- **Species of Conservation Concern**, including:
    - Information on **Red and Orange Data** listed plant species data from. SANBI and MTPA databases.
    - Critically Endangered, Endangered, Vulnerable and Protected Species (**NEMBA species, TOPS species**) are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007 (National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)).
    - **Nationally Protected Trees** as published in Government Notice No. 29062 3 (2006) (National Forests Act, 1998 (Act No. 84 0f 1998), as Amended (Department of Water Affairs Notice No 897, 2006).and that may occur in the area.
    - Other plant species of conservation concern, particularly **provincially protected species.**

4.1.2. Field studies: Vegetation and Flora surveys.

4.1.2.1 Vegetation and flora survey.

Prof GJ Bredenkamp of EcoAgent undertook the field survey on 13-15 January 2023, to assess the fauna, vegetation and flora, and the possible impacts of the proposed development on the

vegetation and plant and animal species, and to suggest possible mitigation options where needed.

A Google Earth image was used to stratify and map different units representing differences in cover and vegetation. At several sampling plots and transects within each mapping unit a description of the dominant and characteristic plant species found was made. These descriptions were based on **total floristic** composition, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). Data recorded resulted in a list of the plant species present, including trees, shrubs, grasses and forbs. A comprehensive species list was therefore derived for the site, but it is realised that some species could have been missed. These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina *et al*. 2000, Brown *et al.* 2013) and are considered an efficient method of describing vegetation and capturing species information. Within each mapping unit noted were made of relevant habitat features, with emphasis on topography and some soil properties Additional notes were made of any other features that might have had an ecological influence, e.g., previous utilization and disturbance.

From the floristic data an analysis of the presence of Alien and Invasive species on the site was made. Furthermore, the **ecological sensitivity** of each plant community was calculated by using plant species composition, plant species of conservation concern, habitat features and relevant legislation, including Critical Biodiversity Areas and the National Screening Tool. From this information an ecological sensitivity map was prepared.

Lastly an Impact Assessment was done by applying standard SiVEST assessment methods. (See Chapter 7 below)

4.1.2.2 Plant Species Status

Plant species recorded in each plant community with an indication of the status of the species by using the following symbols:
A Followed by Invasive category (1a, 1b, 2, 3) = Alien woody species
D = Dominant
d = subdominant
EG = Exotic Garden ornamental or Garden Escape
G = Indigenous Garden ornamental or Garden Escape
M= Medicinal plant species
N = Exotic, naturalized
P = Protected trees species
NP = nationally protected species (NEMBA)
p = provincially protected species
RD = Species of Conservation Concern, Red data listed plant
W = weed.

4.1.2.3 Species Richness

Species Richness is interpreted as follows: Number of indigenous species recorded in the sample plots representing the plant community. Alien woody species and weeds are not included (Table 4.1).

Table 4.1: Categories of plant species richness.

No of species	Category
1-24	Low
25-39	Medium
40-59	High
60+	Very High

4.1.2 4 Indigenous vegetation and Vegetation Status

Indigenous vegetation: According to NEMA (Act 107 of 1998, - Amendment of the Environmental Impact Assessment Regulations 2014, 7 April 2017 (GNR. 324, 325, 326 & 327: Listing Notices 1, 2, 3):Definitions) Indigenous vegetation refers to vegetation consisting of **indigenous plant species occurring naturally in an area**, regardless of the level of alien infestation **and where the topsoil has not been lawfully disturbed during the preceding ten years**.

The following criteria indicate vegetation status:

Primary vegetation is the ***original indigenous vegetation*** that occurred in the area, in this case the Eastern Highveld Grassland (Gm 12) vegetation type (Mucina & Rutherford 2012). The vegetation is *relatively undisturbed, or slightly disturbed*, though the vegetation **still consists of the original dominant, sub-dominant and associated plant species**.

Disturbed primary vegetation is where the ***original indigenous vegetation*** that occurred in the area is **disturbed but can still be identified by the original dominant, sub-dominant and most associated plant species**. Some of the species that were present may have disappeared, however, some other species (species of lower successional status or weedy species) increased in abundance or invaded into the original vegetation. Disturbed primary vegetation may recover when well- managed.

Degraded vegetation is where the ***original indigenous vegetation*** is so **severely disturbed by impacts (mostly man-induced) that the original dominant, sub-dominant and most associated plant species and vegetation structure are changed**. Some of the originally occurring species are **still sparsely present**, but they are mostly replaced by other species of lower successional status, alien invasive species or weedy species. Degraded vegetation **may not recover** without active application of rehabilitation measures. **Severely Degraded vegetation can be regarded as Transformed.**

Transformed vegetation is where the **original indigenous vegetation was destroyed with no or very little of the original plant species remaining**, e.g. cleared for development (construction, tilled for agriculture (e.g. maize), silviculture (e.g. pines, wattles, eucalypts), total cover by alien invasive plant species (e.g. black wattle), planted pasture (e.g. *Eragrostis*), sports fields (e.g. kikuyu grass). Transformed vegetation areas include areas where the topsoil has been disturbed during the **preceding ten years**. Recovery to the **original indigenous vegetation is almost impossible** though by active application of rehabilitation measures a vegetation cover (not representing or similar to the original indigenous vegetation!) can be established.

Secondary (indigenous) vegetation is where the original indigenous vegetation was destroyed but the transformed area was left unused and fallow for several years. Vegetation, different from the original indigenous vegetation, can become (naturally) established and develop through successional processes to a specific plant community with a specific indigenous plant species composition and with good cover, hence secondary vegetation may fall within the definition of indigenous vegetation as provided for in NEMA, but it mostly represents **Transformed vegetation**, as the original vegetation has been destroyed. A good example is where species rich *Themeda triandra*-dominated indigenous grassland was transformed for agriculture, (e.g. maize production) and then left fallow. Through successional phases secondary *Hyparrhenia hirta* – dominated grassland can become established. By applying specific rehabilitation and management procedures, the development of secondary vegetation can be enhanced.

4.2 FAUNA

The field survey was conducted on 13-15 January 2023. The days were sunny, pleasant and with moderate wind. During this visit, the observed and derived presence of mammals (excluding bats), reptiles and amphibians associated with the recognised habitat types of the study site was recorded. This was done with due regard to the well-recorded global distributions of Southern African vertebrates, coupled with the qualitative nature of recognised habitats.

4.2.1 Field Surveys

During the site visit, mammals (excluding bats), reptiles and frogs were identified by visual sightings through driving the roads within the area and by random transect walks. No trapping or mist netting was conducted as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

4.2.2 Desktop Surveys

As many mammals and herpetofauna are either secretive, nocturnal, hibernators and/or seasonal, and some are seasonal migrators, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of such species, based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done with a high level of confidence irrespective of season.

The probability of the occurrence of mammal, reptile and amphibian species was based on their respective geographical distributional ranges and the presence of suitable habitats on the study site:

High probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common to the area, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal and herpetofaunal species with its distributional range peripherally overlapping the study site, or its required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its

geographical isolation are taken into consideration. Species categorised as *medium* normally do not occur at high population numbers - but cannot be deemed as rare.

Low probability of occurrence would imply that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals, reptiles and amphibians categorised as low are generally deemed to be rare.

Mammals
Conclusions were drawn based on the impressions gathered during the site visit, as well as publications such as The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005), Smithers' Mammals of Southern Africa; A Field Guide (2012) and Stuarts' Field Guide to Mammals of Southern Africa (Stuart & Stuart, 2015). The latest taxonomic nomenclature was used.

Herpetofauna
As most reptiles and amphibians are secretive, nocturnal and/or poikilothermic or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The probability of the occurrence of reptile and amphibian species was based on their respective geographical distributional ranges and the suitability of on-site habitats.

A list of herpetofauna (reptile and amphibian) species that may occur on the site was compiled, based on the data and impressions gathered during the site visit, as well as publications such as FitzSimons' Snakes of Southern Africa (Broadley, 1990), Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998), A Guide to the Reptiles of Southern Africa (Alexander and Marais, 2007), Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014), A Complete Guide to the Snakes of Southern Africa (Marais, 2022), Amphibians of Central and Southern Africa (Channing 2001), Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter, et al, 2004), Frogs of Southern Africa; A Complete Guide (Du Preez & Carruthers, 2017) and Field Guide to the Frogs & Other Amphibians of Africa (Channing & Rodel, 2019).

4.2.3 Specific Requirements

Mammals:
In the broader sense, the site was surveyed and assessed for the potential occurrence of South African Red Data mammal species **in the Mpumalanga Province** (Skinner & Chimimba, 2005, Apps, 2012, Stuart & Stuart, 2015 & Child, Roxburgh, Do Linh San, Raimondo & Davies-Mostert, 2016):

Rough-haired golden mole (*Chrysospalax villosus*);
Highveld golden mole (*Amblysomus septentrionalis*);
Juliana's golden mole (*Neamblysomus julianae*);
Sclater's golden mole (*Chlorotalpa sclateri*);
Robust golden mole (*Amblysomus robustus*);

Robert's Marsh Rat (*Dasymys robertsii)*;
White-tailed mouse (*Mystromys albicaudatus*);
Swamp musk shrew *(Crocidura mariquensis);*
Maquassie musk shrew (*Crocidura maquassiensis*);
Southern African hedgehog *(Atelerix frontalis)*;
African clawless otter (*Aonyx capensis*);
Spotted-necked otter (*Hydrictis maculicollis*);
Brown hyena (*Parahyaena brunnea*);
Mountain reedbuck (*Redunca fulvorufula*);
Oribi (*Ourebia ourebi*);
Red duiker (*Cephalophus natalensis*);
Suni (*Neotragus moschatus*);
Grey rhebok (*Pelea capreolus*);
Tsessebe (*Damaliscus lunatus*);
Roan (*Hippotragus equinus*);
Sable (*Hippotragus niger*);
African wild dog (*Lycaon pictus*);
Serval (*Leptailurus serval*);
Spotted hyaena (*Crocuta crocuta*);
Cheetah (*Acinoyx jubatus*);
Leopard (*Panthera pardus*);
African Striped Weasel (*Poecilogale albinucha*);
Ground pangolin (*Smutsia temminckii*);
and Samango monkey (*Cercopithecus albogularis*).

However, **within this study area** more emphasis was put on the potential occurrence of Red Data mammal species (threatened or rare), which are known to occur on the farms of the study area, or from similar habitats in proximity of the study area. (data provided by MTPA):

Aardvark (*Orycteropus afer)*
Oribi (*Ourebia ourebi*);
Serval (*Leptailurus serval*)
Southern African hedgehog *(Atelerix frontalis)*;

From the Screening Tool results the following mammal species were emphasised as having at least medium sensitivity:

Maquassie musk shrew (*Crocidura maquassiensis*);
Oribi (*Ourebia ourebi*);
Rough-haired golden mole (*Chrysospalax villosus*)

From nearby situations the Spotted-necked otter (*Hydrictis maculicollis*) was also recorded.

Herpetofauna:
On the broader scale the site was surveyed and assessed for the potential occurrence of South African Red Data herpetofauna species in Mpumalanga (Minter, *et al*, 2004; Alexander & Marais, 2007; Bates, *et al*, 2014 and Du Preez & Carruthers, 2017):

Nile Crocodile (*Crocodylus niloticus*);
Giant Bullfrog (*Pyxicephalus adspersus*);
Spotted Shovel-Nosed Frog (*Hemisus guttatus*);
Plain Stream Frog (*Strongylopus wageri*)
Coppery Grass Lizard (*Chamaeasaura aenea*);
Large-Scaled Grass Lizard (*Chamaeasaura macrolepis);*
Giant Dragon Lizard (*Smaug giganteus*);
Fitzsimons' Flat Lizard (*Platysaurus orientalis fitzimonsi*);
Breyer's Long-Tailed Seps (*Tetradactylus breyeri*);
Striped Harlequin Snake (*Homoroselaps dorsalis*)
and Southern African Python (*Python natalensis*).

The Southern African Python (*Python natalensis*) has no Red Data status but is still legally considered as a ToPS species.

Herpetofauna species (threatened or rare) that do occur on the farms in the study area or from similar habitats in proximity of the farms in the study area include the following (Provided by MTPA):

Reptiles
Many spotted snake (*Amplorhinus multimaculatus*)

Amphibia
Plain stream frog (*Strongylopus wageri*).

5. RESULTS VEGETATION AND FLORA

5.1 RESULTS OF THE LITERATURE STUDY AND DATABASE SURVEY

5.1.1 Vegetation Type

The study site is mainly situated within the Amersfoort Highveld Clay Grassland (Gm 13) vegetation type, with limited eastern parts located in the Wakkerstroom Montane Grassland (GM14) (Mucina & Rutherford 2006, 2017) (Figure 5.1 below).

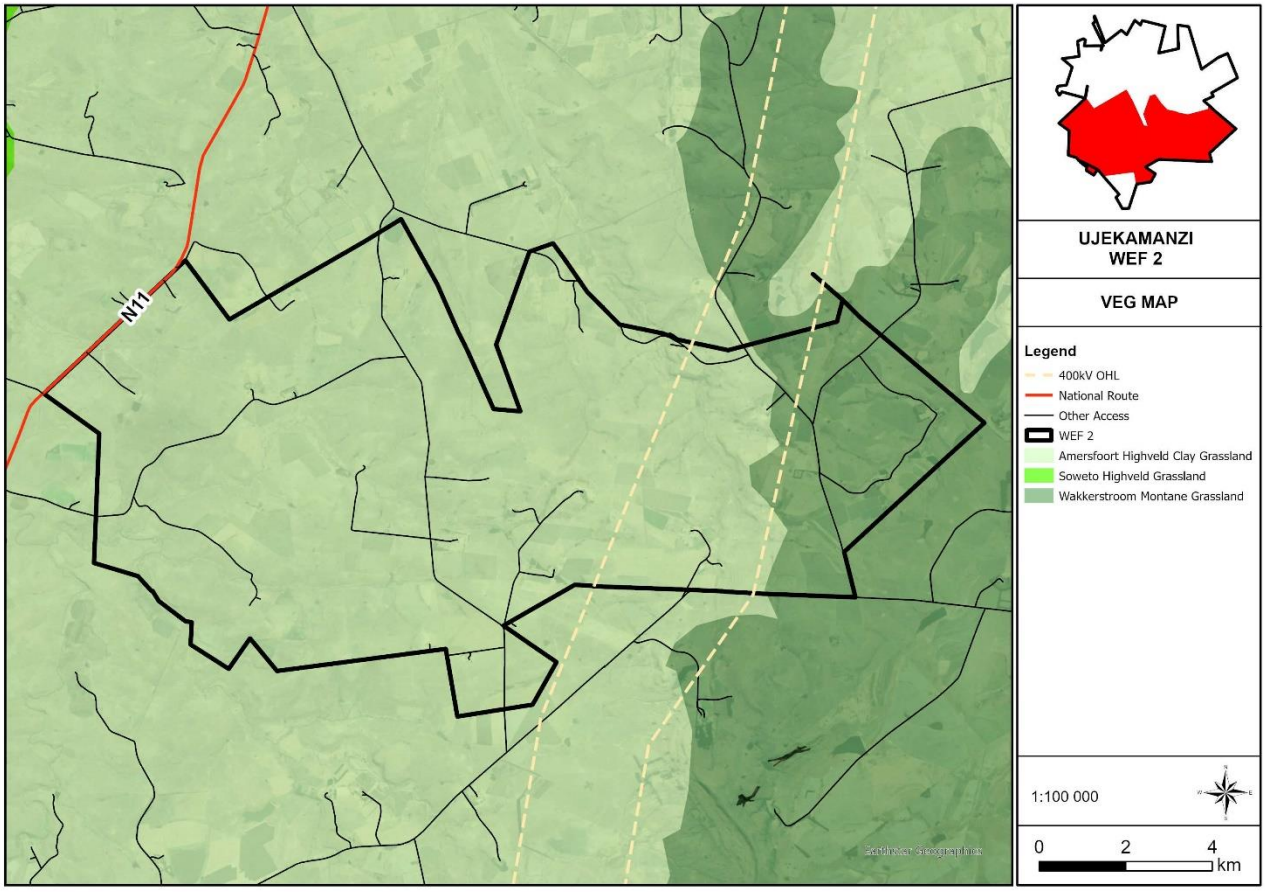


Figure 5.1: The site is located within the Amersfoort Highveld Clay Grassland and the Wakkerstroom Montane grassland (Mucina & Rutherford 2006).

A comprehensive species list from the Amersfoort Highveld Clay Grassland was obtained from Mucina & Rutherford (2006, 2017). Due to the relatively large area of the study site within Amersfoort Highveld Clay Grassland, and the variety of plant communities, many of these species are expected to occur in the study site area:

On some of the slopes limited **shrubby woody species** occur:

Diospyros lycioides *Diospyros austro-africana*

Grass species often encountered in these situations include:

Andropogon appendiculatus		*Eragrostis capensis*	
Andropogon schirensis		*Eragrostis chloromelas*	d
Aristida bipartita		*Eragrostis curvula*	d
Aristida congesta		*Eragrostis plana*	d
Aristida junciformis		*Eragrostis racemosa*	
Aristida stipitata		*Harpochloa falx*	
Brachiaria serrata		*Heteropogon contortus*	
Cymbopogon caesius		*Koeleria capensis*	
Cymbopogon pospischilii		*Microchloa caffra*	
Cynodon dactylon		*Setaria incrassata*	
Digitaria diagonalis		*Setaria nigrirostris*	
Digitaria monodactyla		*Setaria sphacelata*	
Digitaria tricholaenoides		*Themeda triandra*	d
Diheteropogon amplectens		*Tristachya leucothrix*	
Elionurus muticus			

Furthermore, **forb species** that occur at many localities within this area include:

Abildgaardia ovata		*Hermannia transvaalensis*	
Acalypha peduncularis		*Hilliardiella natalensis*	
Anthospermum rigidum		*Hilliardiella oligocephala*	
Berkheya insignis		*Hypoxis rigidula*	
Berkheya pinnatifida		*Hypoxis villosa*	
Berkheya setifera		*Ipomoea crassipes*	
Boophone disticha	*RD*	*Ipomoea oblongata*	
Bulbostylis contexta		*Pelargonium luridum*	
Chaetacanthus costatus		*Pentanisia angustifolia*	
Crabbea acaulis		*Pentanisia prunelloides*	
Cynoglossum hispidum		*Peucadanum magalismontanum*	
Dicoma anomala		*Polygala uncinata*	
Eucomis autumnalis	*RD*	*Polygala hottentotta*	
Euphorbia clavarioides truncata		*Pseudognaphaleum luteo-album*	
Euphorbia striata		*Rhynchosia effusa*	
Gnidia burchellii		*Rhynchosia totta*	
Gnidia capitata		*Salvia repens*	
Haplocarpha scaposa		*Schistostephium crataegifolium*	
Helichrysum caespititium		*Sonchus nanus*	
Helichrysum rugulosum		*Wahlenbergia undulata*	
Hermannia depressa			

5.1.2 Threatened Ecosystems

According to Mucina & Rutherford (2006, 2017) Amersfoort Highveld Clay Grassland is classified as **Vulnerable,** as about 25% has been transformed, mainly by cultivation of crops, while many parts are overgrazed (Mucina & Rutherford 2006) This vegetation is, however, **not listed** as

threatened by SANBI & DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022).

The Wakkerstroom Montane Grassland is **Least Threatened** (Mucina & Rutherford 2006), though according to SANBI & DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022). The Ecosystem status for the Wakkerstroom/Luneberg area, within the Wakkerstroom Montane Grassland is **Endangered.** The study site does not fall into this category.

On the specific site the vegetation within the valleys is often transformed by ploughing and cultivation of maize and limited other crops, though the higher-lying areas are covered by grassland and mostly grazed by livestock.

5.1.3 Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)

In terms of the MBSP Terrestrial Assessment (Figure 5.2 below):
Irreplaceable CBAs occur in the central-northern and eastern parts of the area (marked red in Figure 5.2), mostly restricted to high-altitude grassland. These areas of the study site are the most important for conservation;

CBA Optimal sites occur over much of the western and central parts of the site. These areas are natural grassland of conservation importance, with several upper reaches of drainage lines occurring in these areas;

Other Natural Areas also representing grassland occur in the far western and eastern parts of the site (Figure 5.2 below), though these are highly fragmented by cultivation areas and are often disturbed/degraded.

Local **ESA corridors** occur mainly in the north-western parts of the site.

All the grasslands are highly fragmented by cultivation areas and are often disturbed/degraded, classified as Highly or Moderately modified.

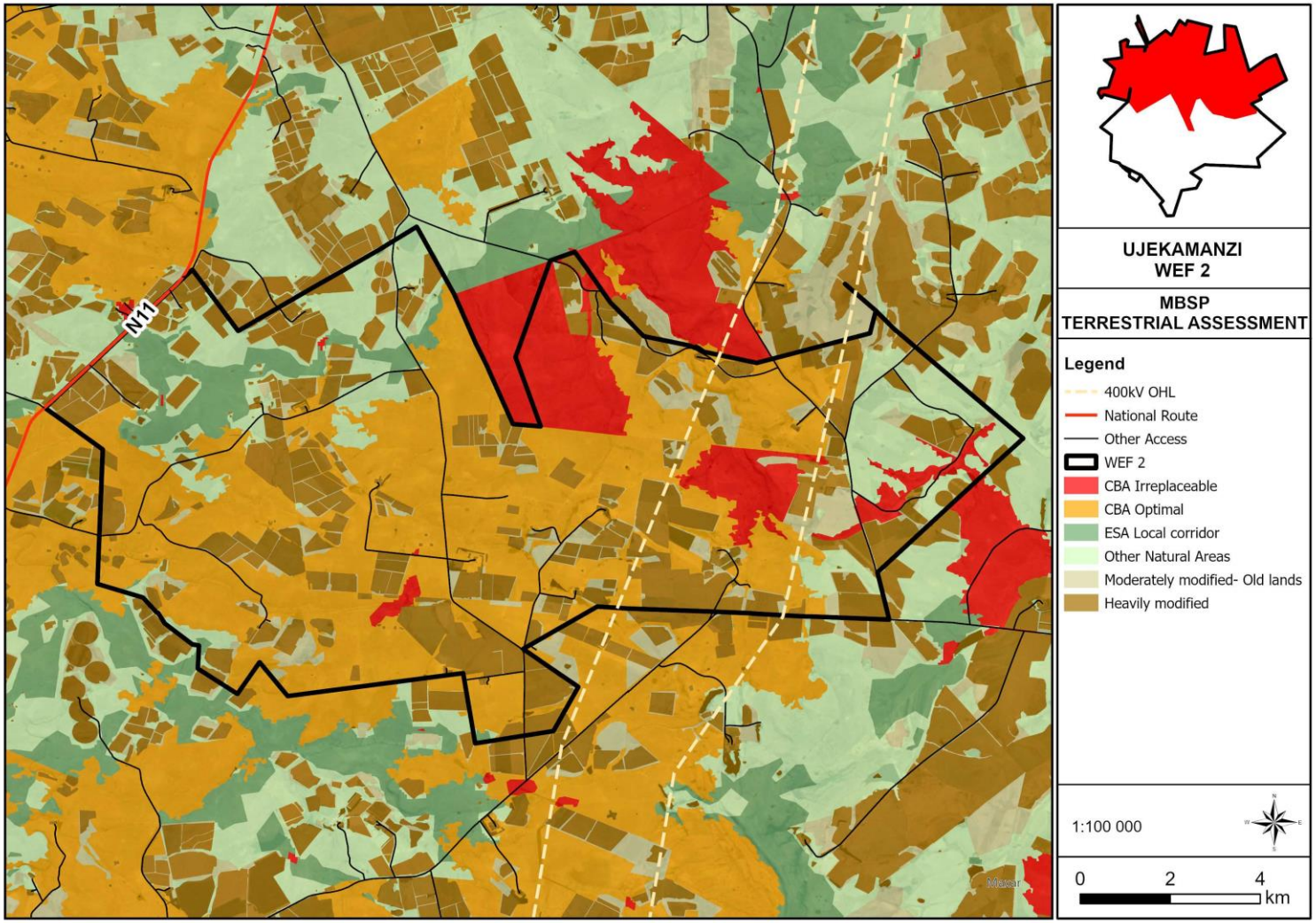


Figure 5.2: Irreplaceable CBAs occur in the central to south-eastern parts of the area (marked red). CBA Optimal areas occur scattered on the site.

5.1.4 Protected and Conservation Areas

No formal protected or conservation area occur in the Amersfoort Highveld Clay Grassland.

5.1.5 Species of Conservation Concern (CCS), Red Listed plant species

Red Data listed plant species and Orange listed plant species (= plant species of conservation concern) are those plants that are important for South Africa's conservation decision making processes. These plants are nationally protected by the National Environmental Management: Biodiversity Act (Raimondo *et al*, 2009).

Threatened species (Red Data listed species) are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species.

Additionally, the Orange listed categories are Near Threatened (NT), Data Deficient (DD), (DDT = lack of taxonomic data), Critically Rare (CR), Rare (R) and Declining (D). This is in accordance with the Red List for South African Plants (Raimondo *et al*. 2009 upgraded on SANBI website).

Lists of Red Data plant species (Raimondo *et al* 2009) for the area in general were obtained from DEA Screening Tool, (2022) MTPA (2022) and SANBI (Table 5.1 below).

Table 5.1 List of threatened or sensitive plant species for the area recorded by (MTPA) Mpumalanga

Family	Species	Status Mpumalanga	Habitat
Fabaceae	*Argyrolobium campicola*	NT	**grassland**
Apocinaceae	*Aspidoglossum xanthosphaerum*	VU	Marshy sites
Amaryllidaceae	*Boophone disticha*	Declining	**Grassland** *recorded on WEF 1 site*
Hyacinthaceae	*Eucomis autumnalis*	Declining	Damp grassland *Recorded on WEF 1 site*
Hyacinthaceae	*Eucomis montana*	Declining	Rocky montane grassland
Hyacinthaceae	*Eucomis pallidiflora (=E. pole-evansii)*	NT	wetlands
Orchidaceae	*Eulophia cooperi*	Rare	**grassland**
Orchidaceae	*Eulophia parvilabris*	Rare	Stream valleys
Iridaceae	*Gladiolus malvinus*	VU	Dolerite outcrops
Iridaceae	*Gladiolus robertsoniae*	NT	Wet rocky dolerite
Gunneraceae	*Gunnera perpensa*	Declining	Marshy area
Iridaceae	*Hesperantha rupestris*	DD	Wetland/rocky?
Hypoxidaceae	*Hypoxis hemerocallidea*	LC	Widely distributed, *Recorded on WEF 1 site*
Aizoaceae	*Khadia carolinensis*	VU	Rocky outcrops *Recorded on WEF 1 site*
Fabaceae	*Lotononis difformis*	VU	**grassland**
Amaryllidaceae	*Nerine gracilis*	NT	Wet or damp areas
Amaryllidaceae	*Nerine platypetala*	VU	Edges of marshes
Apocinaceae	*Pachycarpus suaveolens*	VU	**grassland**

The records of MTPA indicate that the species listed in Table 5.1 were previously recorded from farms within or from similar habitats in proximity of the farms on the WEF 1 study site. It can be

assumed that they may occur locally in suitable habitats. Many of these species are wetland associated and as drainage lines, streams and wetlands are generally excluded from the proposed development, these species should therefore not be affected. However, several of the species do occur in grasslands on the WEF 1 site, particularly the higher-altitude grasslands (marked **bold** in Table 5.1 above).

Other plant species that may occur in the area of the study site are listed by the **Screening Tool** (Table 5.2 below):

Table 5.2 List of medium sensitive plant species for the area listed by the Screening Tool
(Note: specialists may not provide the names of species marked with numbers)

Feature(s)
Sensitive species 998
Aspidoglossum xanthosphaerum
Sensitive species 851
Sensitive species 1252
Sensitive species 41
Khadia alticola
Lotononis amajubica
Sensitive species 691
Sensitive species 314
Sensitive species 321
Zaluzianskya distans

Additional threatened plant species listed by SANBI for the wider area ire listed in Table 5.3.

Table 5.3: Additional species: SANBI (wider area)

Family	Species	Status	Habitat
Amaryllidaceae	*Crinum bulbispermum*	Declining	Close to wetlands
Amaryllidaceae	*Crinum macowanii*	Declining	Moist grassland
Asphodelaceae	*Aloe eckonis*	LC	Rocky grassland

All three the above plant species were observed in the WEF 1 study area during this survey.

It must however be noted that area covered by the MTS sites and the LILO's as well as the Overhead powerline, are relatively small, and the chances that any of the red data or threatened plant species occur on these particular sites, or along the corridors of the powerlines, are therefore limited. However, these species have been previously recorded from the general vicinity of the WEF 2 study site.

5.1.6 NEMBA / TOPS plant species

These species are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007, Government Gazette 574 of 2013 and Notice 256 of 2015 and National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004).

No NEMBA/TOPS plant species occur on the site.

5.1.7 Nationally Protected Trees

The National Forest Act, 1998 (Act No. 84 of 1998) enforces the protection of several indigenous trees. The removal, thinning or relocation of protected trees will require a permit from the Department of Agriculture, Forestry and Fisheries (DAFF) (Notice of the List of Protected Tree Species under the National Forests Act, 1998, Notice 835, Government Gazette 39741, No 19, 29 August 2014).

No protected trees occur on the site.

5.1.8 Provincially Protected Plants

Most of the above listed species are also provincially protected.

5.2 RESULTS OF THE VEGETATION AND FLORA SURVEY

The general vegetation of the study area, particularly the crests and higher slopes, is **dense grassland** that occurs on dark clayey soil derived from dolerite. This grassland is mostly dominated by *Eragrostis curvula*, *Eragrostis chloromelas* and *Eragrostis plana,* indicating a high degree of grazing. Many other grass and forb species occur, particularly on these higher-lying areas in the undulating landscape.

The vegetation map of the entire WEF 2 site shows ten plant communities and a further three mapping units. Only four plant communities are relevant for this particular study (Table 5.2 below):

Table 5.2: List of mapping units with ecological sensitivity in WEF1:

No	Plant Community	Sensitivity	Size (hectares)
1	Highland Grassland	Medium-High	1530
2	Sensitive Highland Grassland	High (partly No-Go)	1001
3	Degraded / Disturbed Grassland	Medium-Low	2521
4	Agriculture, Old Fields, Planted Pastures	Low	5169

A vegetation map showing the distribution of the mapping units is presented in Figure 5.3 while the ecological sensitivity is given in Figure 5.4.

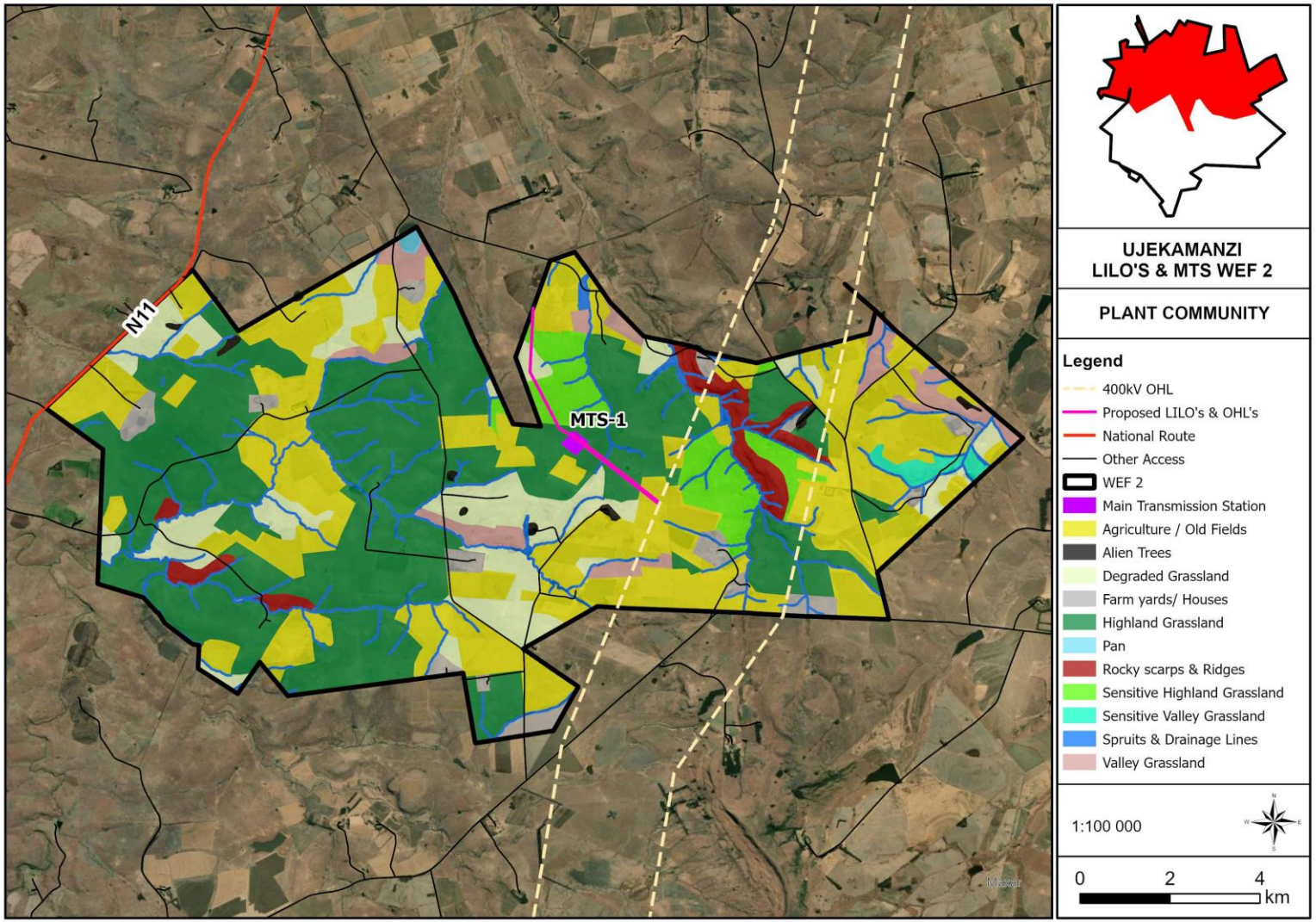


Figure 5.3: A vegetation map for the proposed Ujekamanzi Wind Energy Facility 2 (WEF 2, indicating the proposed Main Transmission Station (MTS), the Loop In-Loop Out powerlines and Overhead Powerline.

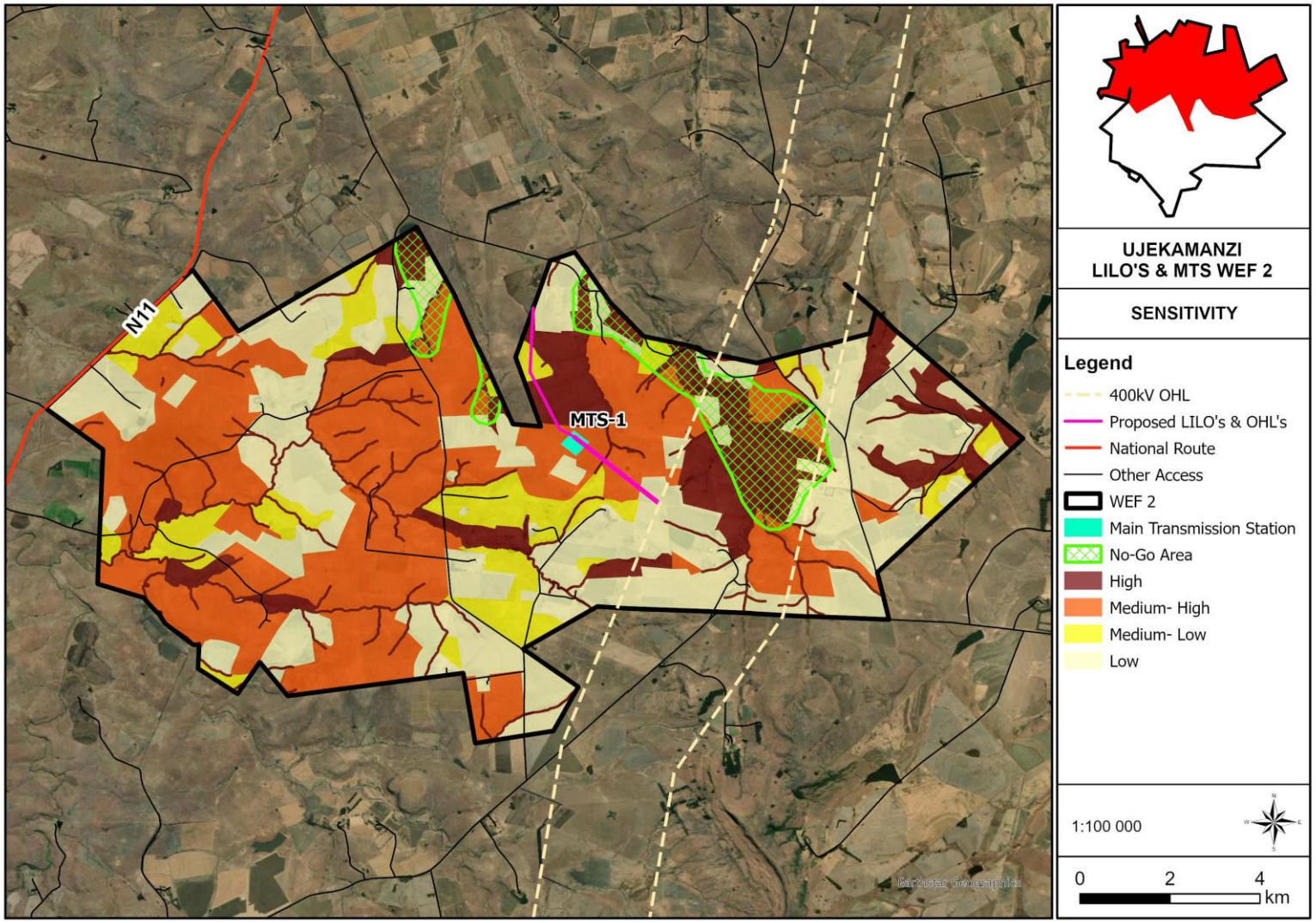


Figure 5.4: Ecological sensitivity for the proposed Ujekamanzi Wind Energy Facility 2 (WEF 2) indicating the proposed Main Transmission Station (MTS), the Loop In-Loop Out powerlines and the Overhead powerline and indicating the N0-Go area.

5.2.1. Highland Grassland

Only a single Main Transmission Stations **MTS 1** located within the Highland Grassland is proposed. **No Alternatives are proposed.** Furthermore, it is suggested that the footprints of **pylons** for the Overhead Powerline and the Loop in-Loop Out powerlines are relatively small and far apart. Not all plant species recorded during this investigation from this plant community are present within the area of the proposed MTS 1, the Overhead Powerlines or the Loop In-Loop Out powerlines, but the habitat is certainly suitable for most of these species.

This is the typical and widespread natural grassland found in the Amersfoort Highveld Clay Grassland type, as described in Mucina & Rutherford (2006, 2017). (Figure 5.3). This plant community covers about 4490 ha hectares on the WEF 2 study area (Table 5.2 above) and occur on the higher-lying crests and higher slopes (Figure 5.5). The nutrient-rich, dark clay soil is mostly doloritic in origin. Due to high rainfall the soils are often moist, retaining the moisture due to high clay content. The vegetation is mostly dense, short grassland, dominated by grass species and scanty distribution of many forb species. This grassland is often well grazed by livestock, leading to the dominance of *Eragrostis plana* and *Eragrostis curvula*, while *Themeda triandra* is less prominent on well-grazed grazed sites. Woody species are rare, restricted to local rocky areas.

Figure 5.5: Highland Grassland.

Limited **woody species** may occur, but alien and invasive species were not present on the MTS 1 site.

Woody species

Searsia discolor

Grass and sedge species often encountered in these situations include:

Aristida sciurus		*Eragrostis plana*	D
Cymbopogon nardus		*Eragrostis racemosa*	
Cyperus congestus		*Heteropogon contortus*	
Cyperus rupestris		*Microchloa caffra*	
Elionurus muticus		*Setaria nigrirostris*	
Eragrostis capensis		*Setaria sphacelata*	d
Eragrostis chloromelas	d	*Themeda triandra*	d
Eragrostis curvula	D	*Tristachya leucothrix*	

Furthermore, **forb species** that occur at many localities include:

Acalypha peduncularis		*Ipomoea oblongata*	
Aloe ecklonis	p	*Justicia betonica*	
Anthospermum hispidulum		*Ledebouria ovatifolia*	
Berkheya insignis		*Lobelia erinus*	
Berkheya pinnatifida		*Monopsis decipiens*	
Berkheya setifera		*Monsonia attenuata*	
Blepharis subvolubilis		*Nidorella anomala*	
Boophone disticha	RD	*Oenothera rosea*	
Cirsium vulgare	W	*Oenothera tetraptera*	
Commelina africana		*Oxalis obliquifolia*	
Conyza podocephala		*Pelargonium luridum*	
Crabbea acaulis		*Pentanisia angustifolia*	
Euphorbia clavarioides truncata		*Peucadanum magalismontanum*	
Gladiolus sp.		*Plantago lanceolata*	
Haplocarpha scaposa		*Plantago minor*	
Helichrysum cf callicomum		*Polygala amatymbica*	
Helichrysum miconiifolium		*Polygala hottentotta*	
Helichrysum nudifolium		*Pseudognaphaleum luteo-album*	
Helichrysum rugulosum		*Ranunculus multifidus*	
Hermannia betonicifolia		*Rhynchosia totta*	
Hermannia depressa		*Salvia repens*	
Hilliardiella natalensis		*Sutera caerulea*	
Hilliardiella oligocephala	M	*Trachyandra asperata*	
Hypochaeris radicata		*Scabiosa columbaria*	
Hypoxis rigidula		*Selago densiflora*	
Indigofera hilaris		*Senecio erubescens*	
Ipomoea crassipes		*Senecio inaequalis*	

Solanum panduriforme		*Wahlenbergia undulata*	
Striga asiatica		*Xenostegia tridentata*	
Verbena braziliensis	W		

The relatively large area occupied by this plant community contributes to the presence of many plant species.

Table 5.3: Number of plant species recorded in the Highland Grassland

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	1	0	1	0	0	0
Grasses	16	0	16	0	0	0
Forbs	57	2	59	1	1	1
Total	74	2	76	1	1	1

The plant species richness is Very High. A single species of conservation concern and a single protected species were observed. There is habitat for more, rare species of conservation concern.

Table 5.4: Highland Grassland - Summary			
Status	High altitude primary grassland		
Soil	Black clay soil	**Rockiness**	1% locally
Conservation value:	Medium-High	**Ecological sensitivity**	Medium-High
Species richness:	High	**Need for rehabilitation**	N/A
Dominant spp.	*Eragrostis plana, Eragrostis curvula, Themeda triandra, Setaria sphacelata*		

Discussion

The Highland Grassland occupies a large part of the study site (Figure 5.3). Due to its very high plant species richness within the WEF 2 study site, this plant community is associated with the **Optimal Critical Biodiversity** Area (CBA). Within the study area only the Highland Grassland falls in this CBA category. This vegetation has a somewhat lower conservation status than the Sensitive Highland Grassland (Plant Community 5.2.2 below), which is classified as an Irreplaceable CBA. In terms of biodiversity sensitivity the Highland Grassland is consequently placed between High and Medium sensitivity.

Considering the above, from a biodiversity point of view, it is suggested that the placement of MTS 1 is not ideal. Probably a**n alternative MTS 2** a bit further south in Agricultural Field or Degraded Grassland could provide a more suitable, conservation friendly, locality.

It is suggested that the footprints of **pylons** for the Overhead Powerline and the Loop in-Loop Out powerlines are relatively small and far apart, leaving large areas of natural veld undisturbed and available for grazing by livestock and/or wildlife.

Furthermore, the nature of the proposed wind turbine development with several widely scattered wind turbines (500-600 m apart), each with a relatively small footprint (up to 1 ha), and therefore with large tracks of natural undisturbed veld, it is suggested that proposed development (except maybe the MTS) can be supported in this vegetation. Large areas will be kept undeveloped (by this project) and will be available for conservation or farming purposes and will still be available for grazing by livestock and/or wildlife.

5.2.2. Sensitive Highland Grassland

The proposed **Overhead Powerline** will cross this grassland. The Sensitive Highland Grassland is restricted to High-lying plateaux areas in the **central-eastern** part of the study area, (Figure 5.3). Within the study site this plant community covers 563 hectares (Table 5.2 above). This undulating area (Figure 5.6 below) contains in addition to typical grassland, also more rocky soils on upland crests and damp grassland in lower-lying areas, and is therefore also, as a whole, **very rich in plant species**.

Figure 5.6: Sensitive Highland Grassland above scarps or on crests.

The nutrient-rich, dark clay soil is mostly doloritic in origin. Due to high rainfall the soils are often moist, retaining the moisture due to high clay content. The vegetation is dense, short grassland, dominated by grass species and is very rich in forb species, though the latter is widely distributed and bever dominant. This grassland is often well grazed by livestock, leading to the dominance of *Eragrostis plana* and *Eragrostis curvula*, while *Themeda triandra* is less prominent on well-grazed grazed sites. Woody species are restricted to local rocky areas.

On some of the slopes limited **woody species** may occur on rocky areas, though woody species are absent in the MTS site.

Woody species

Searsia discolor

Grass and sedge species often encountered in these situations include:

Andropogon schirensis		*Eragrostis chloromelas*	d
Aristida bipartita		*Eragrostis curvula*	D
Aristida congesta		*Eragrostis plana*	D
Brachiaria serrata		*Eragrostis racemosa*	
Cymbopogon caesius		*Harpochloa falx*	
Cymbopogon nardus		*Heteropogon contortus*	
Cymbopogon pospischilii		*Microchloa caffra*	
Cynodon dactylon		*Setaria nigrirostris*	
Cyperus congestus		*Setaria sphacelata*	d
Digitaria diagonalis		*Themeda triandra*	d
Digitaria monodactyla		*Tragus berteronianus*	
Elionurus muticus		*Tristachya leucothrix*	
Eragrostis capensis			

Furthermore, **forb species** that occur at many localities within this area include:

Acalypha peduncularis		*Helichrysum rugulosum*	
Anthospermum hispidulum		*Hermannia betonicifolia*	
Berkheya insignis		*Hermannia depressa*	
Berkheya pinnatifida		*Hilliardiella natalensis*	
Berkheya setifera		*Hilliardiella oligocephala*	M
Blepharis subvolubilis		*Hypochaeris radicata*	
Boophone disticha	RD	*Hypoxis hemerocallidea*	RD
Centella asiatica		*Hypoxis rigidula*	
Cirsium vulgare	W	*Indigofera hilaris*	
Commelina africana		*Ipomoea crassipes*	
Conyza podocephala		*Ipomoea oblongata*	
Crabbea acaulis		*Justicia betonica*	
Dicoma anomala		*Ledebouria cooperii*	
Eriosema cordatum		*Ledebouria ovatifolia*	
Euphorbia clavarioides truncata		*Lobelia erinus*	
Euphorbia striata		*Monopsis decipiens*	
Gerbera piloselloides		*Monsonia attenuata*	
Gladiolus sp.		*Nidorella anomala*	
Gnidia capitata		*Oenothera tetraptera*	
Haplocarpha scaposa		*Oxalis obliquifolia*	
Helichrysum caespititium		*Pachycarpus appendiculatus*	
Helichrysum miconiifolium		*Pelargonium luridum*	
Helichrysum nudifolium		*Pentanisia angustifolia*	

Peucadanum magalismontanum	*Scabiosa columbaria*	
Plantago lanceolata	*Schistostephium crataegifolium*	
Polygala hottentotta	*Selago densiflora*	
Pseudognaphaleum luteo-album	*Senecio erubescens*	
Rhynchosia adenodes	*Senecio inaequalis*	
Rhynchosia totta	*Solanum panduriforme*	
Sphenostylis angustifolia	*Striga asiatica*	
Tephrosia capensis	*Verbena braziliensis*	W
Trachyandra asperata	*Wahlenbergia undulata*	

Many plant species occur in this high-altitude grassland due to local variations in habitat.

Table 5.5: Number of plant species recorded in the Sensitive Highland Grassland

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	1	0	1	0	0	0
Grasses	25	0	25	0	0	0
Forbs	63	2	65	3	0	0
Total	89	2	91	3	0	0

The plant species richness is Very High. Some Red Data species do occur locally.

Table 5.6: Sensitive Highland Grassland - Summary			
Status	High-altitude primary grassland		
Soil	Dark clay soil	**Rockiness**	2%
Conservation value:	High	**Ecological sensitivity**	High
Species richness:	High	**Need for rehabilitation**	N/A
Dominant spp.	*Eragrostis plana, Eragrostis curvula, Setaria sphacelata, Themeda triandra*		

Discussion

Due to its very high plant species richness, this plant community is associated with **Irreplaceable Critical Biodiversity Area** (CBA) and consequently has High ecological sensitivity and a high conservation status.

To connect the **preferred substation** with the **preferred Main Transmission Station**, it seems unavoidable that the Overhead powerline will have to cross the **Sensitive Highland Grassland.** It is suggested that the footprints of **pylons** for the Overhead Powerline are relatively small and far apart, leaving large areas of natural veld undisturbed and available for grazing by livestock and/or wildlife.

Considering the nature of the proposed development with several widely spaced wind turbines (500-600 m apart), each with a relatively small footprint (up to 1 ha), and therefore with large tracks of natural undisturbed veld, it is suggested that development can be supported in this vegetation.

5.2.3. Degraded Grassland

There is a possibility that the **MTS 1** m located within Degraded Grassland. Patches of Degraded Grassland occur scattered over the study site (Figure 5.3) and together covers about 1253 hectares (Table 5.2 above). These grassland patches are more associated with the lower-lying valley areas where more intensive grazing practices occurred over long periods, causing various degrees of degradation (Figure 5.7). Although somewhat related to the Highland Grassland (plant community 5.2.1.above), the plant species composition is impoverished, with much less species present, and mostly dominated by *Eragrostis plana.*

The following plant species were recorded locally in the Degraded Grassland:

Woody species

Acacia mearnsii	A1b	*Eucalyptus camaldulensis*	2A/1b

Grass and sedge species often encountered in these situations include:

Cymbopogon nardus		*Eragrostis plana*	D
Cynodon dactylon		*Eragrostis racemosa*	
Cynodon hirsutus		*Eragrostis superba*	
Cyperus esculentus		*Heteropogon contortus*	
Elionurus muticus		*Paspalum dilatatum*	
Eragrostis chloromelas	d	*Pennisetum clandestinum*	A
Eragrostis curvula	D	*Themeda triandra*	d

Forbs:

Acalypha peduncularis		*Ipomoea oblongata*	
Anthospermum hispidulum		*Oenothera rosea*	
Berkheya echinacea		*Oenothera tetraptera*	
Berkheya pinnatifida		*Plantago lanceolata*	
Berkheya setifera		*Pseudognaphaleum luteo-album*	
Cirsium vulgare	W	*Solanum incanum*	
Commelina africana		*Solanum panduriforme*	
Conyza podocephala		*Solanum sisymbriifolium*	W
Helichrysum nudifolium		*Scabiosa columbaria*	
Helichrysum rugulosum		*Selago densiflora*	
Hermannia betonicifolia		*Senecio inaequalis*	
Hermannia depressa		*Solanum panduriforme*	
Hilliardiella oligocephala		*Trifolium africanum*	
Hypochaeris radicata		*Verbena braziliensis*	W
Indigofera hilaris			

Table 5.7: Number of plant species recorded in the Degraded Grassland

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	0	2	2	0	0	0
Grasses	13	1	14	0	0	0
Forbs	26	3	29	0	0	0
Total	39	6	45	0	0	0

The plant species richness is Medium. No species of conservation concern or protected species were observed.

Table 5.8: Degraded Grassland - Summary			
Status	Degraded		
Soil	Black clay soil	**Rockiness**	0%
Conservation value:	Medium-Low	**Ecological sensitivity**	Medium-Low
Species richness:	High	**Need for rehabilitation**	N/A
Dominant spp.	*Eragrostis plana, Eragrostis curvula*		

Discussion

Due to their situation in the lower-lying valleys and flatter terrain these grasslands had been utilised more intensively over many years and consequently some varying degrees of disturbance resulted in loss of some plant species and lower plant species richness (Figure 5.10 below). The resulting ecological sensitivity, based on biodiversity, was calculated as Medium-Low. These areas are currently **suitable** for the proposed developments, and may therefore be **preferred for the MTS 1** in WEF2.

Figure 5.7: Degraded Grassland

5.2.9. Agriculture, Old Fields, Planted Pastures

Locally the proposed Overhead powerline will cross Agricultural Fields. Agriculture is very important in this area, as shown in the results of the DEA Screening Tool (Figure 5.8, below). Agricultural fields of various ages, mainly for cultivation of maize, but also other crops, occur scattered over the study area of the area (Figure 5.3 above and Figures 5.9 below). Agriculture, Old Fields and Planted pasture cover about 5169 hectares within the study site (Table 5.2 above). Currently the ecological and biodiversity sensitivity of agricultural fields, old fields and planted pastures, based on vegetation and flora, is **Low**, and the resulting nature conservation value is also **Low.** The only area where **agriculture sensitivity is Low,** is along the Vaalbankspruit river area.

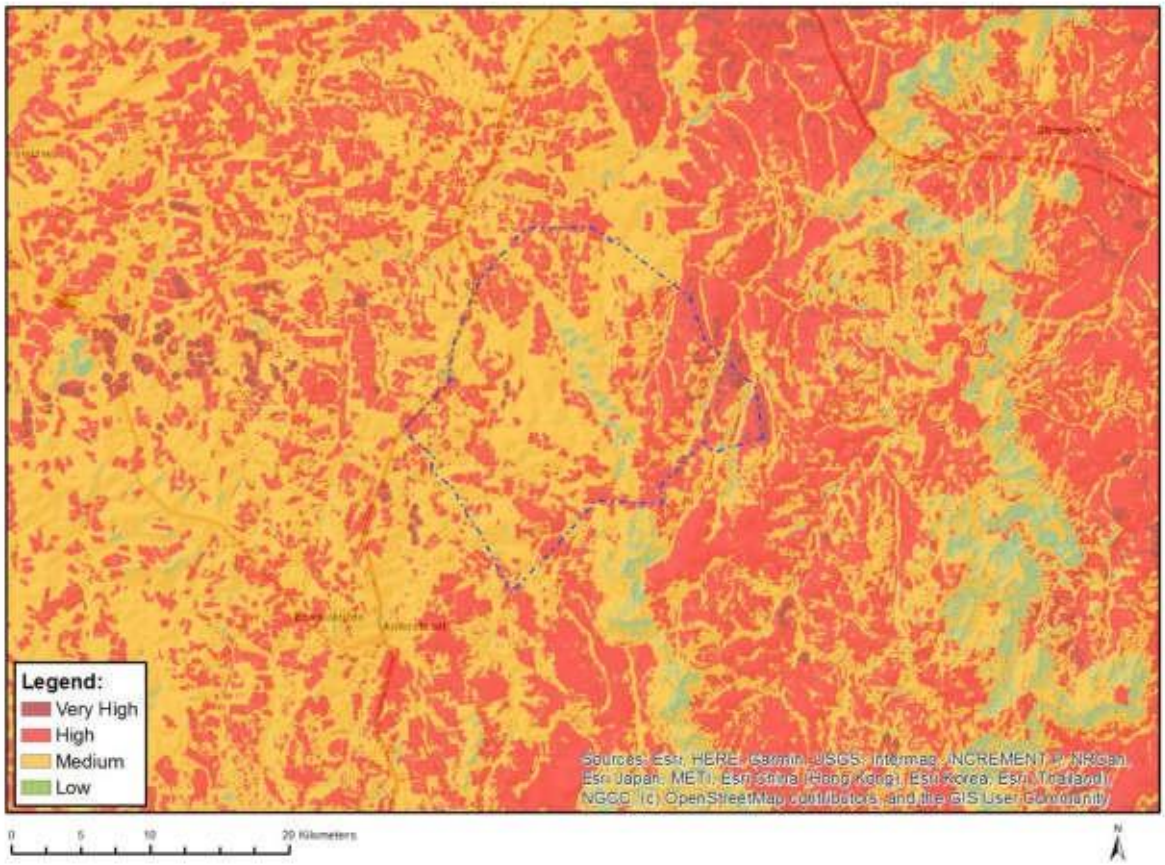


Figure 5.8: Results of the Screening Tool indicate that the almost entire area has High to Medium agricultural sensitivity.

Figure 5.9: Cultivated Fields.

Table 5.9: Agriculture, Old Fields and Planted pasture: summary			
Status	Transformed, original vegetation cleared and removed		
Soil	Dark loam soil or darker coloured clay soils	**Rockiness % cover**	0
Conservation priority:	Low	**Sensitivity:**	Low
Species Richness	Low	**Need for rehabilitation**	Low
Dominant spp.	*Cynodon dactylon, Hyparrhenia hirta, Eragrostis curvula,*		

Discussion

The plant species richness is Low, with no species of conservation concern present, but several weed species present. From a natural , indigenous vegetation point of view the Agricultural Fields have low conservation value and low ecological sensitivity. This does not exclude occasional possible occurrence of species of conservation concern in the grassland strips between agricultural fields, this is however not likely. The Agricultural lands, old Fields and Planted Pasture areas are all suitable for the planned overhead powerline.

5.3 ANALYSIS

5.3.1 Alien and Invasive plants species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants be controlled and eradicated by means of an eradication and monitoring program. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

Previously declared weeds and invasive plants were controlled by regulations of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA). Later Alien and Invasive Species Regulations, as well as a new draft list of categories of invasive species in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) was published in the Government Gazette No. 32090, in April 2009. Several amendments followed. Considering Sections 66(1), 67(1) 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act (Act 10 of 2004) the latest Alien and Invasive plant **species list** was published in 2020 (Government Gazette 43726, Notice 1003,18 September 2020).This notice replaces and repeals any Alien and Invasive **species lists** published under the Act, including Notice 599 of 1 August 2014, (Government Gazette 37886) and Notice 864, 29 July 2016, (Government Gazette 40166), and Notice R507, 508 and 509 of 19 July 2013 (Government Gazette 36683).

Below is a brief explanation of the categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) and described in Regulation Gazette 10244, Vol 590, and No 37885 (1 August 2014):

Category 1a: Invasive species requiring **compulsory** control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. A person in control of a Category 1a Listed Invasive Species must **immediately** take steps to combat or **eradicate** listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and allow an authorised official from the Department to enter onto land to monitor, assist with or implement the combatting or eradication of these listed invasive species. No permits will be issued.

Category 1b: Invasive species require **compulsory** control as part of an invasive species **control program** that will result in **removal and destruction** of all such listed species. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management program. No permits will be issued.

Category 2:
Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a **permit** to carry out a restricted activity within an area specified in the Notice or an area specified in the permit (e.g. a plantation, woodlot, orchard etc.), as the case may be.

Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 Listed Invasive Species without a permit.

A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.

If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3.

Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, according to Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.

In summary: Category 2 Invasive species are regulated within a specific **area**. A **permit** for this specific area is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. A landowner on whose land a Category 2 Listed Invasive Species occurs, or a person in possession of a permit, **must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.**

Category 2 Listed Invasive Species that occur outside the specified area contemplated, must, for purposes of these regulations, be considered as Category 1b listed invasive species and must be managed accordingly.

No permits will be issued for Category 2 species to exist in riparian zones. These are considered as Category 1b listed invasive plants species and must be managed accordingly.

Category 3: Invasive species regulated by activity. Category 3 Listed Invasive Species are species that are subject to **exemptions** in terms of section 71(3) and **prohibitions** in terms of section 71A of Act. This means that a permit to have these species on the particular property is **not required**, though the landowner is still responsible to control this species and is prohibited of growing, breeding or in any other way propagating these listed invasive species, or allow it to multiply and spread. Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any way acquiring or disposing of any specimen of these listed invasive species are also prohibited.

Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered as a Category 1b Listed Invasive Species and must be managed accordingly.

In terms of the amendments to the regulations under the Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983) and Regulation 598, Government Gazette 37885, August 2014) (Alien and Invasive Species Regulations), landowners are legally responsible for the control of alien species on their properties.

It should further be noted that the National Environmental Management: Biodiversity Act (2004), Chapter 5, Part 2, Section 73(2), states that a person who is the owner of land on which a listed invasive species occurs must notify any relevant competent authority in writing of the listed invasive species that occur on that land.

Furthermore, that according to the National Environmental Management: Biodiversity Act (2004), Alien and Invasive species Regulations (2017), Chapter 7, Section 29 (1), (2) and (3), the seller of any immovable property must, prior to the conclusion of the relevant sale agreement, **notify** the purchaser of that property in writing of the presence of listed invasive species on that property.

A few listed alien and invasive plant species were observed on the WEF 1 study site.

Some *Acacia* trees occur close to the alignment of the Overhead powerline, close to the MTS 1

Species name	**Common name**	**Category**
Acacia mearnsii	Black wattle	2
Eucalyptus camaldulensis	River gum	2, 1b in Grassland biome
Pyracantha angustifolia	Fire Thorn	1b
Rosa rubiginosa	Eglantine rose	1b

5.3.2 Medicinal Plants

Only medicinal plants listed by Van Wyk, Van Oudtshoorn & Gericke (2005), and rare medicinal plants as indicated by Williams, Victor & Crouch (2013) were indicated with the letter “M” in the list of species for each plant community.

4.3.3 Ecological Sensitivity

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

The vegetation sensitivity assessment aims to identify whether the vegetation within the study area is of conservation concern and thus sensitive to development:

In order to determine the sensitivity of the vegetation (ecosystem) on the site, weighting scores are calculated per plant community. The following six criteria are used, and each allocated a value of 0-3.

- Conservation status of a regional vegetation unit, based on biodiversity;
- Listed ecosystem (e.g. wetlands, hills and ridges etc)

- Legislative protection (e.g. threatened ecosystems, SANBI & DEAT 2009, Government Gazette NEMA 2011)
- Plant and fauna species of conservation concern (e.g. red listed, nationally or provincially protected plant species, habitat or potential habitat to plants species of conservation concern, protected plants or protected trees);
- Situated within ecologically functionally important features (e.g. wetlands or riparian areas; important habitat for rare plant and fauna species);
- Conservation importance (e.g. untransformed and un-fragmented natural vegetation, high plant species richness, important habitat for rare fauna species, Critical Biodiversity Areas).

Sensitivity is calculated as the sum the values of the criteria. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity). A maximum score of 18 can be obtained, a score of 15-18 indicated high sensitivity. The sensitivity scores are as follows (Table 5.16):

Table 5.16: Sensitivity Weighting scores for vegetation.

Scoring	15-18	12-14	9-11	6-8	0-5
Sensitivity	High	Medium-High	Medium	Medium-Low	Low
SIVEST sensitivity	NO-GO	High	Medium	Low	Low

Development on vegetation that has High sensitivity will normally not be supported, except that specific circumstances may still lead to support of the proposed development. Portions of vegetation with Medium-High or Medium sensitivity should be conserved**.** Development may be supported on vegetation considered to have Medium-Low or Low sensitivity.

The result of the sensitivity assessment (Table 5.17 below) indicates that the Sensitive Highland Grassland, Rocky Scarps and Ridges and Spruits and Drainage Lines have **High ecological sensitivity**. The Highland Grassland has **Medium-High** ecological sensitivity, The Wakkerstroom Grassland has **Medium sensitivity.** The Degraded Grassland has **Medium-Low ecological** sensitivity while the Agricultural area, Old Fields and Planted Pastures have **Low** ecological sensitivity.

Special care must be taken with the placement of any structures or power lines in the High and Medium-High sensitivity areas, in order to provide adequate conservation of these areas.

Table 5.17: Scoring of vegetation that occurs within the study area (see Table 5.16).

Vegetation	Conservation Status of regional Vegetation unit	Listed Ecosystem	Legislated Protection	Species of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18
5.2.1. Highland Grassland	**3**	**2**	**1**	**2**	**3**	**3**	**14 Medium-High**
5.2.2. Sensitive Highland Grassland	**3**	**3**	**3**	**3**	**3**	**3**	**18 No-Go**
5.2.3 Degraded / Disturbed Grassland	**3**	**0**	**0**	**0**	**2**	**1**	**6 Medium-Low**
5.2.4 Agriculture, Old Fields, Planted Pastures	**1**	**0**	**0**	**0**	**1**	**1**	**3 Low**

5.3.4 Conservation Value

The **conservation value** is in line with the ecological sensitivity, with the ecosystems with High and Medium-High sensitivity, also with High conservation value.

5.3.5 Assessment of Screening Tool Results

The results of the DEA Screening Tool are indicated in Figures 5.10-5.12 (below).

5.3.5.1 Plant Species Sensitivity

The Result of the DEA Screening Tool analysis for Plant Species Sensitivity for the site is given in Figure 5.10 (below). The plant species sensitivity is shown as **Low** for the agriculture areas and **Medium** for more natural areas.

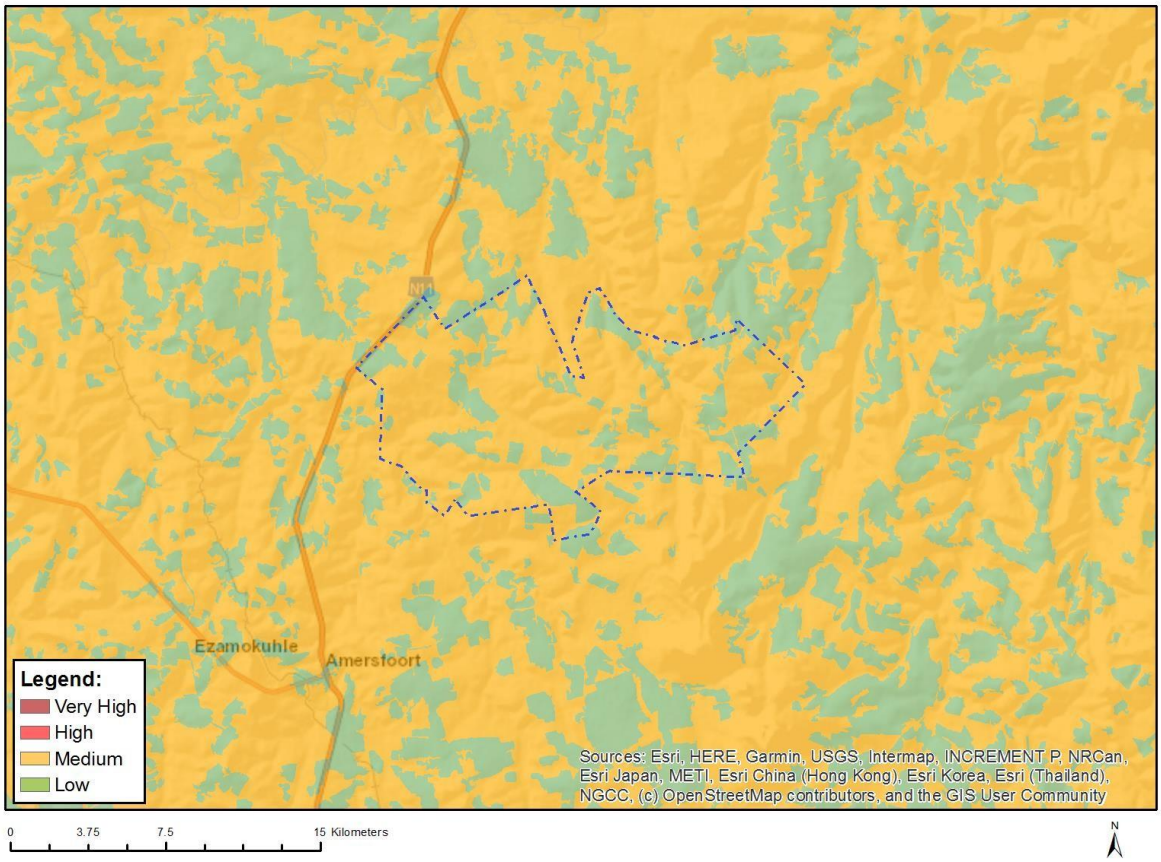


Figure 5.10: The Result of the DEA Screening Tool analysis for Plant Species Sensitivity for the study area.

(Note: specialists may not provide the names of species marked with numbers)

Feature(s)
Sensitive species 998
Aspidoglossum xanthosphaerum
Sensitive species 851
Sensitive species 1252
Sensitive species 41
Khadia alticola
Lotononis amajubica
Sensitive species 691
Sensitive species 314
Sensitive species 321
Zaluzianskya distans

In general, the DEA Screening Tool result of **Low to Medium** Plant Species Sensitivity for the terrestrial habitat is **confirmed.** The cultivated areas have **Low** plant species sensitivity while terrestrial grassland plant communities have **Medium** plant species sensitivity.

However, the current vegetation survey results indicate Medium to Very High **plant species richness** in the various plant communities on the site and several threatened plant species are listed from different sources. Seven plant species were recorded from the site.

It was therefore indicated that some plant communities have **High** ecological **(biodiversity)** sensitivity (see Figure 5.15 below), and these areas are also indicated as being "Irreplaceable" in the MBSP Critical Biodiversity assessment.

5.3.5.2 Animal Species Sensitivity

The Result of the DEA Screening Tool analysis for Animal Species Sensitivity for the powerline transect area is given in Figure 5.11 (below). This Sensitivity is regarded as **Medium to High**. This is **confirmed,** but in this case the High Animal Species Diversity is often caused by **birds listed** under Animal Species Diversity. The avifauna is however not reported on by EcoAgent. As far as **mammals** are concerned, the **Medium** animal species sensitivity is confirmed.

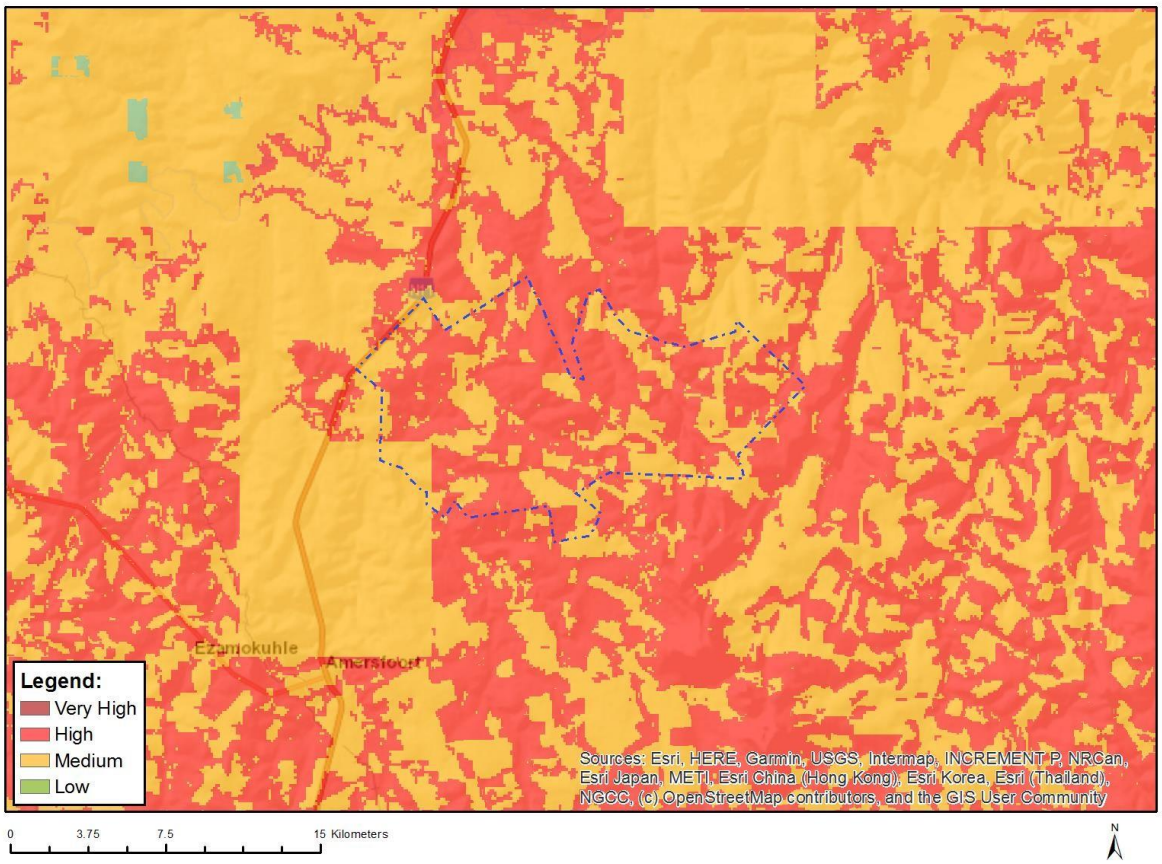


Figure 5:11 The Result of the DEA Screening Tool analysis for Animal Species Sensitivity for the study area

From the Screening Tool results the following mammal species were emphasised as having at least medium sensitivity:

Maquassie musk shrew (*Crocidura maquassiensis*);
Oribi (*Ourebia ourebi*);
Rough-haired golden mole (*Chrysospalax villosus*)

and Spotted-necked otter (*Hydrictis maculicollis*) from nearby situations.

5.3.5.3 Terrestrial Biodiversity Sensitivity

The Result of the DEA Screening Tool analysis for Terrestrial Biodiversity Sensitivity for the study is given in Figure 5.12 (below). This Sensitivity is regarded as **Very High**.

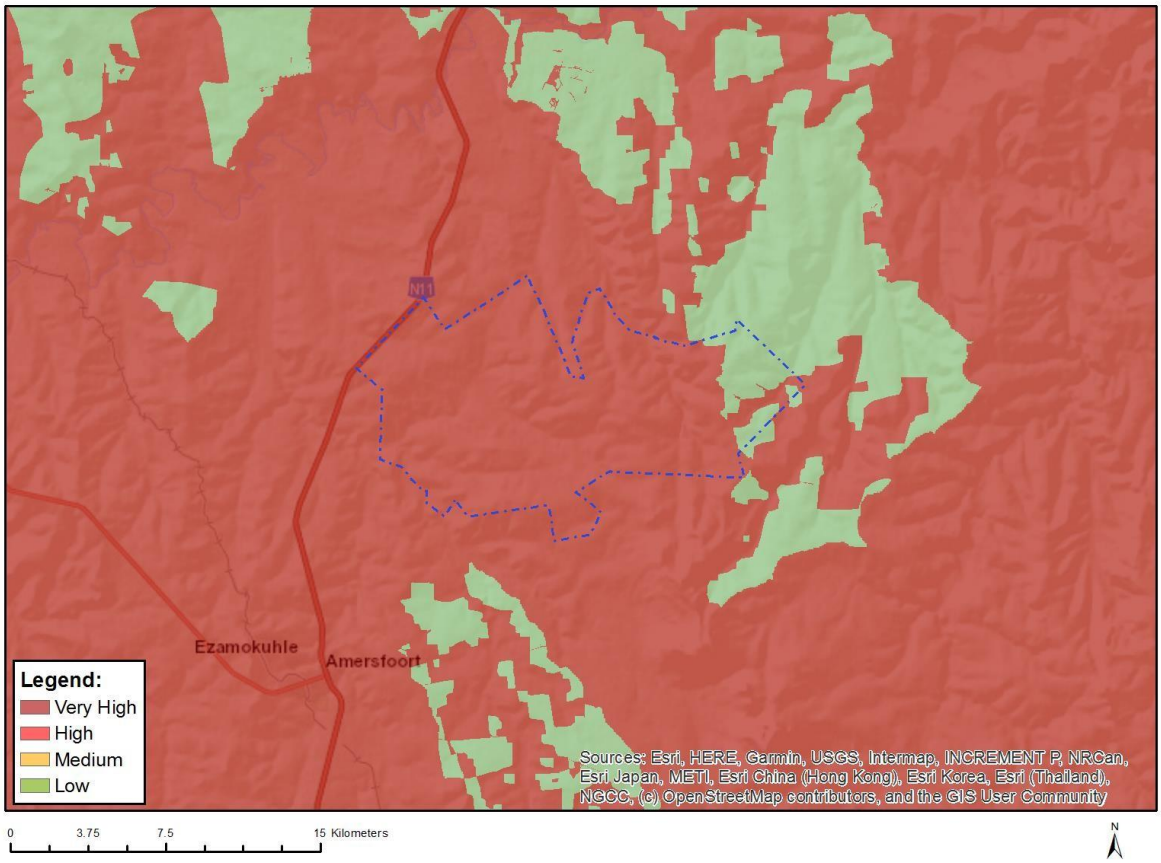


Figure 5.12: The Result of the DEA Screening Tool analysis for Terrestrial Biodiversity Sensitivity for the study area.

The Terrestrial Biodiversity Sensitivity is regarded to be **Very High** in the larger south-western part of the study site**.** The Very High Sensitivity is because, according to Mucina and Rutherford (2006, 2017) the Ecosystem status for this vegetation type (Amersfoort Highveld Clay Grassland) is **Vulnerable**, as so much of this vegetation type is already transformed. Of high significance is that, in terms of the MBSP Terrestrial Assessment (Figure 5.2 above), large areas are classified as **Critical Biodiversity Areas** (Irreplaceable and Optimal) and Ecological Support Areas are present.

The **Low** Terrestrial Biodiversity Sensitivity in the north-eastern part is mainly due to agricultural areas, showed as Modified in the MBSP Terrestrial Assessment (Figure 5.2 above).

The result of the screening tool on terrestrial biodiversity sensitivity for the proposed WEF development area is **confirmed.**

5.4 DISCUSSION AND CONCLUSION

5.4.1 Literature and database study

The larger Ujekamanzi WEF study site is located within a high altitude (1600-1750 m above sea level) slightly undulating landscape within the Amersfoort Highveld Clay Grassland and Wakkerstroom Montane grassland vegetation type. The soils within this landscape are fertile, dark-coloured clays, derived from dolerite that is intrusive in the Karoo sediments of the Madzaringwe and Volksrust Formations. The area has relatively high rainfall, The regular annual precipitation is about 650-750 mm, and the cold winters have severe and frequent frost. The relatively higher lying uplands are drained by numerous drainage lines (Figure 3.3 below) that merge to form permanent spruits in the relatively lower-lying valleys, ultimately draining into the Vaal River, which is located just north of the study site.

According to Mucina & Rutherford (2006, 2017) Amersfoort Highveld Clay Grassland is classified as **Vulnerable,** as about 25% has been transformed, mainly by cultivation of crops, while many parts are overgrazed. This vegetation is, however, **not listed** as threatened by SANBI & DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022). There are no statutorily conserved areas.

Irreplaceable CBAs occur in the central-northern and eastern parts of the area (marked red in Figure 5.2), mostly restricted to eastern high-altitude grassland. These areas of the study site are the most important for conservation.
CBA Optimal sites occur widespread on western and central areas of the site. These areas are natural grassland of conservation importance, with several upper reaches of drainage lines occurring in these areas.

Several threatened plant species are listed from different sources. Of these seven plant species were recorded from the site.

No TOPS species or nationally protected tree species occur on the site.

5.4.2 Results of field study and data processing

Due to its very high plant species richness, the **Sensitive Highland Grassland** (plant community 5.2.2) is associated with **Irreplaceable Critical Biodiversity Area** (CBA) and consequently has High ecological sensitivity and a high conservation status and value.

Similarly, due to its very high plant species richness, **Highland Grassland** (plant community 5.2.1) is often associated with the **Optimal Critical Biodiversity Area** (CBA), that occurs widespread over the study site. This vegetation has a somewhat lower conservation status than the Sensitive Highland Grassland (plant community 5.2.2). The proposed, preferred **Main Transmission Station in WEF2** is located in the Highland Grassland. From a biodiversity perspective this is **not preferred, and an alternative location should be investigated.**

To connect the **preferred substation** with the **preferred Main Transmission Station**, it seems unavoidable that the Overhead powerline will have to cross the **Highland Grassland** and the **Sensitive Highland Grassland.** It is suggested that the footprints of **pylons** for the

Overhead Powerline are relatively small and far apart, leaving large areas of natural veld undisturbed and available for grazing by livestock and/or wildlife.

Considering the nature of the proposed development with several widely spaced wind turbines (500-600 m apart), each with a relatively small footprint (<1 ha), and therefore with large tracks of natural undisturbed veld, it is suggested that development can *inter alia* be supported in **Sensitive Highland Grassland and the Highland Grassland**, on condition that a strip of Sensitive Highland Grassland immediately east of the Rocky Scarps and Ridges be included in the No-go area. Large areas will be then kept undeveloped for conservation purposes and will still be available for grazing by livestock and/or wildlife. **This will imply that a large area within the Sensitive Highland Grassland and the Highveld Grassland will be available for the wind turbines**.

Due to their situation in the lower-lying valleys and flatter terrain **Degraded Grasslands** (plant community 5.2.3) had been utilised more intensively over many years and consequently some varying degrees of disturbance resulted in loss of some plant species and lower plant species richness. The resulting ecological sensitivity, based on biodiversity, was calculated as **Medium-Low**. These areas are, from a biodiversity sensitivity point of view, **suitable** for the proposed developments.

All transformed areas, cultivated lands, old fields, farmyards, patches of alien trees etc have Low biodiversity sensitivity with low conservation value.

6. RESULTS: FAUNA

The results of the fauna study are relevant for the WEF2 study site. Although the specific area covered by this WEF 2 Main Transmission Station an associated Loop In-Loop Out powerlines and Overhead Powerline is much smaller, the results of the fauna study for the entire WEF project remain valid and relevant and are presented with only limited changes.

6.1 MAMMALS

6.1.1 Mammal Habitat Assessment

Acocks (1988), Mucina and Rutherford (2006), Low and Rebelo (1996), Knobel and Bredenkamp (2006), SANBI & DEAT (2009) discuss the vegetation types of the study area in broad terms. Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996), and latterly by Mucina and Rutherford (2006, 2012, 2017) as well Knobel and Bredenkamp (2006). The definitions of biomes are basically similar, and all remain valid for mammals and are therefore recognised as a reasonable determinant of mammal distribution.

Mammals are closely dependent on broadly defined habitat types: terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. From a mammal habitat perspective, it was established that although three of the four major habitats are naturally present on or near the entire WEF study site, only the terrestrial habitat is present on the site relevant for this study. However, rupicolous and wetland habitats occur close by.

At the time of the site visit the basal cover was good in many places (Figure 6.1 below) and would provide adequate nourishment and cover for small terrestrial mammals.

Important wetland-associated vegetation occurs along the drainage lines (Figure 6.3 below) and dams (Figure 6.4 below) on the site. These water bodies would provide habitat for a few water-dependent mammal species. The drainage lines are also important as corridors for mammal movement.

Only small areas of natural arboreal habitat is present in the vicinity of the study site (Figure 6.5 below). However, arboreal habitat is absent from the specific site. Due to the absence of arboreal habitat, species like tree squirrels, South African galago, vervet monkeys, woodland thicket rat and woodland dormouse should not occur on the site. Exotic trees such as *Eucalyptus* trees are present on many farms. There are also several dead logs, which would provide shelter and food for small mammals.

Figure 6.1: An area with good basal cover in spite of heavy grazing.

Figure 6.2: Natural rupicolous habitat in the vicinity the site

Figure 6.3: One of many drainage lines in the vicinity of the site.

Figure 6.4: “Ons Pan” a large body of water in the vicinity of the site.

Figure 6.5: Arboreal habitat in the vicinity the site.

6.1.2 Observed and Expected Mammal Species Richness

Small mammals are not obvious in the open Highveld grassland. Large and medium-sized mammals (such as buffalo, blue wildebeest, black wildebeest, red hartebeest, eland, plains zebra, white rhino, lion, cheetah and spotted hyena) have long ago been eradicated from the Highveld areas and are now only seen in certain nature conservation areas and game farms. However, a number of small to medium-sized mammal species are expected in most highveld grassland localities (Borent CC, 2012). These include several species of rodents, mongooses, porcupine, aardvark, .duiker, steenbok, oribi, caracal, African wild cat and black-backed jackal.

A list of all mammals that may occur on site was compiled from the existing mammal literature (Skinner & Chimimba 2006, Friedman 2005), based on the known habitat preference and distribution of these species.

It is estimated that 59 mammal species (excluding bats) may from time to time occur on or near the study site area (Table 6.1), and 10 were confirmed in the general area in vicinity of the site (Table 6.2). Obviously not all will occur on the specific MTS, LILO or Overhead Powerline site area, but it is possible that several of them may visit the site from time to time, over a long period of time.

Most of the species of the resident diversity (Table 6.1) are common and widespread (viz. aardvark, rock hyrax, scrub hare, African mole-rat, yellow mongoose, black-backed jackal, blesbok, common duiker, African mole rat, multimammate mouse and Highveld gerbil). Many

of the species listed in Table 6.1 are robust, some with strong pioneering capabilities allowing them to invade and occupy new habitats. The reason for their survival success is predominantly seated in their remarkable reproduction potential (e.g. multimammate mice species), and to a lesser extent their reticent and cryptic nature (e.g. scrub hares, genets and mongooses).

Red Data Mammal species listed by Mpumalanga Province (MTPA) for the farms of the study area:
Swamp musk shrew (*Crocidura mariquensis*) – probably present in the area of the site;
Southern African hedgehog *(Atelerix frontalis)* – probably present in the area of the site;
African clawless otter (*Aonyx capensis*) - probably present in the area of the site;
Serval (*Leptailurus serval*) - probably present in the area of the site;
Oribi (*Ourebia ourebi*)- probably present in the area of the site;

From the **Screening Tool** results the following red data mammal species were noted as having medium sensitivity in the area of the study site:
Oribi (*Ourebia ourebi*) - probably present in the area of the site;
Maquassie musk shrew (*Crocidura maquassiensis*); doubtful;
Spotted-necked otter (*Hydrictis maculicollis*) doubtful.

Table 6.1 (below) provides information on mammal species that may from time-to-time occur in the area of the site.

Table 6.1: **Mammal diversity of the WEF 2 study site.**
The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Skinner & Chimimba [2005], Apps [2012], Stuart & Stuart [2015] & Child *et.a*l.[2016]).
Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004): CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.
Probability:
high Definitely there or have a *high* probability to occur;
medium probability to occur based on ecological and distributional parameters;
low probability to occur based on ecological and distributional parameters.

Probability	RD	SCIENTIFIC NAME	ENGLISH NAME
		Order: AFROSORICIDA	
		Family: Chrysochloridae	Golden Moles
medium	**VU**	*Chrysospalax villosus*	Rough-haired golden mole
medium	**NT**	*Amblysomus septentrionalis*	Highveld golden mole
		Order: MACROSCELIDEA	
		Family: Macroscelididae	Elephant-shrews
high		*Elephantulus myurus*	Eastern rock elephant-shrew
		Order: TUBULIDENTATA	
		Family: Orycteropodidae	**Aardvark**
high		*Orycteropus afer*	Aardvark

Probability	RD	SCIENTIFIC NAME	ENGLISH NAME
		Order: HYRACOIDEA	
		Family: Hyracoidea	**Hyrax**
high		*Procavia capensis*	Rock hyrax
		Order: LAGOMORPHA	
		Family: Leporidae	**Hares, rabbits and rock rabbits**
high		*Lepus saxatilis*	Scrub hare
		Order: RODENTIA	
		Family: Bathyergidae	**Mole-rats**
high		*Cryptomys hottentotus*	African mole-rat
		Family: Hystricidae	**Porcupines**
high		*Hystrix afriaeaustralis*	Cape porcupine
		Family: Tryonomyidae	**Canerats**
?		*Thryonomys swinderianus*	Greater cane rat
		Family: Pedetidae	**Springhare**
high		*Pedetes capensis*	Springhare
		Family: Muridae	**Rats and mice**
high		*Rhabdomys pumilio*	Four-striped grass mouse
?	**NT**	*Dasymys robertsii*	Robert's marsh rat
low		*Mus indutus*	Desert pygmy mouse
low		*Mus minutoides*	Pygmy mouse
high		*Mastomys natalensis*	Natal multimammate mouse
high		*Mastomys coucha*	Southern multimammate mouse
high		*Micaelamys namaquensis*	Namaqua rock mouse
high		*Otomys angoniensis*	Angoni vlei rat
high		*Otomys irroratus*	Vlei rat
low		*Otomys sloggetti*	Sloggett's vlei rat
low		*Tatera brantsii*	Highveld gerbil
low	**VU**	*Mystromys albicaudatus*	White-tailed mouse
high		*Dendromus melanotis*	Grey pygmy climbing mouse
medium		*Dendromus mesomelas*	Brants' climbing mouse
high		*Dendromus mystacalis*	Chestnut climbing mouse
high		*Steatomys pratensis*	Fat mouse
		Order: PRIMATES	
		Family: Cercopithecidae	Baboons and monkeys
low		*Papio hamadryas*	Chacma baboon
		Order: EULIPOTYPHA	
		Family: Soricidae	**Shrews**
low		*Myoserex varius*	Forest shrew
medium	**NT**	*Crocidura mariquensis*	Swamp musk shrew
low	**VU**	*Crociduara maquassiensis*	Maquassie musk shrew
medium		*Crocidura cyanea*	Reddish-grey musk shrew

Probability	RD	SCIENTIFIC NAME	ENGLISH NAME
low		*Crocidura flavescens*	Greater red musk shrew
		Family: Erinaceidae	**Hedgehog**
high	**NT**	*Atelerix frontalis*	Southern African hedgehog
		Order: CHIROPTERA	**Bats NOT PART OF THIS REPORT**
		Order: CARNIVORA	
		Family: Hyaenidae	Hyaenas
medium		*Proteles cristatus*	Aardwolf
low	**NT**	*Parahyaena brunnea*	Brown Hyaena
		Family: Felidae	**Cats**
high		*Caracal caracal*	Caracal
low	**NT**	*Leptailurus serval*	Serval
high		*Felis silvestris*	African wild cat
		Family: Viverridae	**Civets and genets**
high		*Genetta genetta*	Small-spotted genet
low		*Genetta tigrina*	South African large-spotted genet
		Family: Herpestidae	**Suricates and mongooses**
high		*Suricata suricatta*	Suricate
high		*Cynictis penicillata*	Yellow mongoose
low		*Galerella sanguinea*	Slender mongoose
high		*Ichneumia albicauda*	White-tailed mongoose
high		*Atilax paludinosus*	Marsh mongoose
		Family: Canidae	**Foxes, wild dogs and jackals**
high		*Vulpes chama*	Cape fox
high		*Canis mesomelas*	Black-backed jackal
		Family: Mustelidae	**Otters, honey badger, weasel and polecat**
high	**NT**	*Aonyx capensis*	African clawless otter
low	**VU**	*Hydrictis maculicollis*	Spotted-necked otter
low	**NT**	*Poecilogale albinucha*	African stopped weasel
high		*Idonyx striatus*	Striped polecat
		Order: SUIFORMES	
		Family: Suidae	**Pigs**
medium		*Potamochoerus larvatus*	Bushpig
		Order: RUMINANTIA	
		Family: Bovidae	**Antelopes and buffalo**
high		*Connochaetes gnou*	Black wildebeest
high		*Damaliscus pygargus phillipsi*	Blesbok
high		*Sylvicapra grimmia*	Common duiker
low	**EN**	*Redunca fulvorufula*	Mountain reedbuck
low	**NT**	*Pelea capreolus*	Grey rhebok

Probability	RD	SCIENTIFIC NAME	ENGLISH NAME
high	EN	*Ourebia ourebi*	Oribi
high		*Raphicerus campestris*	Steenbok

high Definitely present or have a high probability to occur;
medium Medium probability to occur based on ecological and distributional parameters;
low Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the second column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 6.2: Mammal species positively confirmed on the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Orycteropus afer	Aardvark	Fresh diggings & spoor	Terrestrial
Procavia capensis	Rock hyrax	Sight record	Rupicolous
Lepus saxatilis	Scrub hare	Scat	Terrestrial
Cryptomys hottentotus	African mole-rat	Tunnels	Terrestrial
Cynictis penicillata	Yellow mongoose	Sight record	Terrestrial
Canis mesomelas	Black-backed jackal	Scat	Terrestrial
Connochaetes gnou	Black wildebeest	Sight record	Terrestrial
Damaliscus pygargus phillipsi	Blesbok	Sight record	Terrestrial
Sylvicapra grimmia	Common duiker	Sight record	Terrestrial
Ourebia ourebi	Oribi	Sight record	Terrestrial

6.1.3.Threatened and red listed mammal species

Fourteen of the mammal species listed in Table 6.1 are red data species. All Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats.

The site falls outside the natural distribution range of some mammal species, which would not occur on the site. These include Juliana's golden mole, Sclater's golden mole, robust golden mole, ground pangolin, samango monkey, leopard, cheetah, spotted hyena, red duiker, suni, tsessebe, roan and sable.

Due to the presence of rupicolous habitat, the mountain reedbuck and grey rhebok could occur on or near the site.

According to Johan Ziervogel (082 315 3993) of the farm Vlakfontein, there are otters on his farm (pers.comm.). However, he could not distinguish between Cape clawless otter and spotted-necked otter. The drainage lines on the site are perennial, therefore otters should occur in the vicinity of the study site. The drainage lines and other water bodies should provide suitable habitat for the Robert's marsh rat and swamp musk shrew and both species could occur in the vicinity of the site.

The Highveld golden mole occurs in montane grasslands, often in thickets of oldwood trees (*Leucosidea sericea)* near streams (Skinner & Chimimba, 2005). Such habitat occurs on site and there is a real possibility that this species could occur in the vicinity of the site.

The white-tailed mouse distribution includes the southern parts of Mpumalanga Province (Skinner & Chimimba, 2005) and this rodent was recorded in the former Transvaal in areas of dense grass and sandy soil, but also from rocky areas with good grass cover (Rautenbach, 1982). Such habitat occurs on the site and it is possible that this species is present in the vicinity of the site.

According to Mpumalanga Tourism and Parks Agency records, the Southern African hedgehog has been recorded in the quarter degree square, 2629BD (Phumla Nkosi pers.comm.).

It is possible that Red Data carnivores could occur in the vicinity of the site. There is a good possibility that the serval, brown hyena and the African Striped Weasel could occur in the area.

6.1.4 Rough-haired golden mole (*Chrysospalax villosus*)

According to the Screening Tool Report for Ujekamanzi (UKZ) project, Mpumalanga Province, the rough-haired golden mole (*Chrysospalax villosus*) has a medium sensitivity.

According to Skinner & Chimimba (2005) rough-haired golden moles occur in grassland, with a preference for dry, sandy ground on the fringes of marshes or vleis. Such habitat occurs in the vicinity of the site and there is a possibility that they could occur. The wind farms will not affect this species.

6.1.5 Maquassie musk shrew (*Crociduara maquassiensis*)

According to the Screening Tool Report for Ujekamanzi (UKZ) project, Mpumalanga Province, the Maquassie musk shrew (*Crocidura maquassiensis*) has a medium sensitivity.

This rare species is only known from selected localities (Skinner & Chimimba, 2005). With so few records it is impossible to assess the habitat requirements of the species properly. However, rocky areas in a grassland ecosystem seem to be the preferred areas. Such habitats occur in a restricted areas on the site. A slight possibility exists that this species could occur in the vicinity of the site.

6.1.6 Spotted-necked otter (*Hydrictis maculicollis*)

According to the Screening Tool Report for the wider Ujekamanzi (UKZ) project, Mpumalanga Province, the Spotted-necked otter (*Hydrictis maculicollis*) has a medium sensitivity.

Johan Ziervogel of the farm Vlakfontein mentioned that he had seen otters on his farm (pers.comm). However, he could not distinguish between Cape clawless otter and spotted-necked otter. There is suitable habitat for spotted-necked otters in the vicinity of the study site. If the wetlands, drainage lines and their buffers are protected, both otter species will be conserved on the study site. The wind farms will not affect this species.

6.1.7 Oribi (*Ourebia ourebi ourebi*)

According to the Screening Tool Report for Ujekamanzi (UKZ) project, Mpumalanga Province, the oribi (*Ourebia ourebi ourebi*) has a medium sensitivity.

The oribi is a rare animal with the Red Data status of *Endangered* and has become extinct in many areas. The presence of this species was confirmed close to the site. A single adult oribi ram was observed on the site with coordinates 26°21'45" S; 29°59'25"E.

The wind farms would not affect this species, but the possibility exists that during the construction phase, workers could poach small antelope or set snares to catch small game, which may include the oribi.

6.1.8.Conclusion

Although several mammal species may from time to time occur in the area of the site, only few may probably be encountered at any one time. This is due to low densities of small species, not easily seen. Many smaller mammals are either secretive, nocturnal, hibernators and/or seasonal, and some are seasonal migrators. However, by applying the standard methods of deducing probable presence by using the recognised literature on distribution and habitat preferences, and knowledge of habitats present on the site, a list of mammals could successfully be compiled with an acceptable level of confidence.

None of the mammal species predicted to visit the area of the site, will be threatened by the construction or the during the operational phase of the planned Wind Energy Facility. These mammal species are all quite motile and if present in the way of the construction, will easily move away from the danger.

From a mammal perspective, the MTS and LILO can be supported.

6.2 HERPETOFAUNA

6.2.1 Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types: terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological habitat perspective, it was established that three

of the four major habitats are naturally present on the study site, namely terrestrial, rupicolous and wetlands.

A few termitaria were recorded on the drier areas of the site. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the herpetofauna population density for the study site is higher. At the time of the site visit the basal cover was good in many places (Figure 6.6 below) and would provide adequate cover for herpetofauna.

Figure 6.6: A moribund termite mound close to the site.

Figure 6.7: Natural rupicolous habitat close to the site.

Rupicolous habitats were found close to the study site (Figure 6.7 above). Due to the presence of rupicolous habitat species like common girdled lizard, common crag lizard, southern rock agama and variable skink should occur on the site. Good manmade rupicolous habitat exists in the form of houses and building ruins. These rupicolous habitats offer nooks and crannies as refuge for some rupicolous herpetofauna.

A small area of natural arboreal habitat is present in the vicinity of the study site (Figure 6.9 below). However, in total, natural arboreal habitat is absent from the site. Due to the absence of arboreal habitat, species like boomslang and common flap-necked chameleon should not occur on the site. On many farms exotic trees such as *Eucalyptus* are present. There are also several dead logs, which would provide shelter and food for small mammals.

There are several drainage lines in the vicinity. Several small dams occur locally in the drainage lines. Moist grassland occurs in the floodplain areas of the drainage lines. Important wetland-associated vegetation cover occurs along the drainage lines (Figure 6.10 below), wetlands, pans and dams (Figure 6.10 below) on the site. These water bodies would provide habitat for water-dependent herpetofauna species. The drainage lines are also important as corridors for herpetofauna.

Except for the N11 on the western part of the study site, connectivity of the site with surrounding areas is good. Real opportunities for migration exist along the drainage lines and ridges.

Figure 6.9: Arboreal habitat in the vicinity of the study site.

Figure 6.10: A large drainage line in the vicinity of the site.

6.2.2 Expected and Observed Herpetofauna Species Richness

A total of 67 herpetofauna species (50 reptile species and 17 amphibia species) were identified from the literature as potential occupants of the WEF 2 study site (Table 6.3). Obviously not all will occur on the specific MTS, LILO or Overhead Powerline site area, but it is possible that several of them may visit the site from time to time, over a long period of time. Many of these herpetofauna species are robust generalists with the ability to capitalise on different environments. It should be noted that potential occurrence is interpreted as being possible over a period of time, as a result of expansions and contractions of population densities and ranges which stimulate migration.

Of the 50 reptile species that may occur on the study site, two were confirmed during the site visit (Table 6.4) and of the possible 17 amphibian species which may occur on the study site (Table 6.3), two were confirmed during the site visit (Table 6.5).

The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 6.3) are fairly common and widespread for example. leopard tortoise, common house snake, mole snake, common egg eater, Mozambique spitting cobra, tree agama, puff adder, striped skink, common dwarf gecko, Van Son's gecko, Boettger's caco, bubbling kassina, guttural toad and eastern olive toad.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

Table 6.3: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Minter, *et.al* (2004), Alexander & Marais (2007), Bates *et.al* (2014) and Du Preez & Carruthers (2017).

high Definitely there or have a *high* probability of occurring;
medium probability of occurring based on ecological and distributional parameters;
low probability of occurring based on ecological and distributional parameters.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103. In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002), Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) and Bates, *et.al*, Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (2014) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

PROBABILITY Red Data	**SCIENTIFIC NAME**	**ENGLISH NAME**
	CLASS: REPTILIA	**REPTILES**
	Order: TESTUDINES	**TURTLES, TORTOISES AND TERRAPINS**
	Family: Pelomedusidae	**Side-necked Terrapins**
medium	*Pelomedusa subrufa*	Marsh Terrapin
	Order: SQUAMATA	**SCALE-BEARING REPTILES**
	Suborder: LACERTILIA	**LIZARDS**
	Family: Gekkonidae	**Geckos**
high	*Lygodactylus capensis capensis*	Common Dwarf Gecko
low	*Lygodactylus ocellatus ocellatus*	Spotted Dwarf Gecko
low	*Pachydactylus capensis*	Cape Gecko
high	*Pachydactylus vansoni*	Van Son's Gecko
	Family: Lacertidae	**Old World Lizards or Lacertids**
high	*Nucras lalandii*	Delalande's Sandveld Lizard
low	*Nucras ornata*	Ornate Sandveld Lizard
low	*Pedioplanis burchelli*	Burchell's Sand Lizard
	Family: Cordylidae	**Cordylids**
Low **NT**	*Chamaesaura aenea*	Coppery Grass Lizard
low	*Chamaesaura aniguina anguina*	Cape Grass Lizard
high	*Cordylus vittifer*	Common Girdled Lizard
medium	*Pseudocordylus melanotus melanotus*	Common Crag Lizard
	Family: Gerrhosauridae	**Plated Lizards**
high	*Gerhosaurus flavigularis*	Yellow-Throated Plated Lizard
	Family: Scincidae	**Skinks**
low	*Acontias breviceps*	Short-Headed Legless Skink
low	*Acontias gracilicauda*	Thin-Tailed Legless Skink

PROBABILITY Red Data	SCIENTIFIC NAME	ENGLISH NAME
high	*Afroablepharus wahlbergii*	Wahlberg's Snake-Eyed Skink
medium	*Trachylepis capensis*	Cape Skink
high	*Trachylepis punctatissima*	Speckled Rock Skink
medium	*Trachylepis varia*	Variable Skink
low	*Scelotes mirus*	Montane Dwarf Burrowing Skink
	Family: Varanidae	**Monitor Lizards**
low	*Varanus niloticus*	Nile Monitor
	Family: Chamaeleonidae	**Chameleons**
low	*Chamaeleo dilepis dilepis*	Common Flap-Neck Chameleon
	Family: Agamidae	**Agamas**
high	*Agama aculeata distanti*	Eastern Ground Agama
medium	*Agama atra*	Southern Rock Agama
	Suborder: SERPENTES	**SNAKES**
	Family: Typhlopidae	**Blind Snakes**
high	*Afrotyphlops bibronii*	Bibron's Blind Snake
	Family: Leptotyphlopidae	**Thread Snakes**
high	*Leptotyphlops scutifrons*	Peter's Thread Snake
	Family: Viperidae	**Adders**
high	*Bitis arietans arietans*	Puff Adder
high	*Causus rhombeatus*	Rhombic Night Adder
	Family: Lamprophiidae	
high	*Aparallactus capensis*	Black-headed Centipede Eater
low	*Atractaspis bibronii*	Bibron's Stiletto Snake
Low **NT**	*Homoroselaps dorsalis*	Striped Harlequin Snake
low	*Homoroselaps*	Spotted Harlequin Snake
high	*Boaedon capensis*	Common House Snake
low	*Lamprophis aurora*	Aurora Snake
low	*Lamprophis fuscus*	Yellow-bellied Snake
medium	*Lamprophis guttatus*	Spotted Rock Snake
low	*Lycodonomorphus inornatus*	Olive Ground Snake
low	*Lycodonomorphus laevissimus*	Dusky-bellied Water Snake
high	*Lycodonomorphus rufulus*	Brown Water Snake
medium	*Lycophidion capense capense*	Cape Wolf Snake
medium	*Psammophis brevirostris*	Short-snouted Grass Snake
low	*Psammophis crucifer*	Cross-Marked Grass Snake
high	*Psammophylax rhombeatus rhombeatus*	Spotted Skaapsteker
low	*Amplorhinus multimaculatus*	Many-Spotted Snake
low	*Duberria lutrix lutrix*	South African Slug-Eater
high	*Pseudaspis cana*	Mole Snake
	Family: Elapidae	**Cobras, Mambas and Others**
medium	*Elapsoidea sundevallii*	Sundevall's Garter Snake

PROBABILITY Red Data	SCIENTIFIC NAME	ENGLISH NAME
high	*Hemachatus haemachatus*	Rinkhals
	Family: Colubridae	**Colubrids**
high	*Crotaphopeltis hotamboeia*	Red-Lipped Snake
high	*Dasypeltis scabra*	Rhombic Egg Eater
	CLASS: AMPHIBIA	**AMPHIBIANS**
	Order: ANURA	**FROGS**
	Family: Pipidae	**Clawed Frogs**
high	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	**Toads**
high	*Sclerophrys gutturalis*	Guttural Toad
low	*Sclerophrys capensis*	Raucous Toad
medium	*Vandijkophrynus gariepensis*	Karoo Toad
	Family: Hyperoliidae	**Reed Frogs**
high	*Kassina senegalesis*	Bubbling Kassina
high	*Semnodactylus wealii*	Rattling Frog
	Family: Breviceptidae	**Rain Frogs**
medium	*Breviceps mossambicus*	Mozambique Rain Frog
	Family: Phrynobatrachidae	**Puddle Frog**
medium	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family: Ptychadenidae	**Grass Frogs**
medium	*Ptychadena porosissima*	Striped Grass Frog
	Family: Pyxicephalidae	
high	*Amietia delalandii*	Common River Frog
high	*Strongylopus fasciatus*	Striped Stream Frog
high	*Strongylopus grayii*	Clicking Stream Frog
Low **NT**	*Strongylopus wageri*	Plain Stream Frog
high	*Cocosternum boettgeri*	Boettger's Caco or Common Caco
low	*Cocosternum nanum nanum*	Bronze Caco
high	*Tomopterna cryptotis*	Tremolo Sand Frog
high	*Tomopterna natalensis*	Natal Sand Frog

Table 6.4: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Trachylepis punctatissima	Speckled Rock Skink	Sight record of individuals on houses and natural rock.	Man-made and natural Rupicolous habitat
Psammophylax rhombeatus rhombeatus	Spotted Skaapsteker	Sight record of adult in grassveld	Terrestrial
Amietia delalandii	Common River Frog	Sight record of adults and tadpoles	Aquatic habitat
Xenopus laevis	Common Platanna	Sight record of tadpoles	Aquatic habitat

The speckled rock skink, spotted skaapsteker, common river frog and common platanna, listed in Table 6.4, should be common on the study site and elsewhere in its range.

6.2.3 Threatened and Red listed Reptile and Amphibian Species

The study site falls outside the natural range of the giant bullfrog (*Pyxicephalus adspersus*), spotted shovel-nosed frog (*Hemisus guttatus*), Nile crocodile (*Crocodylus niloticus*), Southern African python (*Python natalensis*), giant dragon lizard (*Smaug giganteus*), Fitzsimons' flat lizard (*Platysaurus orientalis fitzimonsi*), large-scaled grass lizard (*Chamaeasaura macrolepis* and Breyer's long-tailed seps (*Tetradactylus breyeri*) and these species should not occur on the study site.

The coppery grass lizard (*Chamaeasaura aenea*) has not been recorded in the Ditsong Museum for Natural History (Transvaal Museum) records and also in the Mpumalanga Tourism and Parks Agency records. However, the site is large and there is suitable habitat on the site. Therefore, there is a small possibility that the coppery grass lizard could occur on the site.

According to Mpumalanga Tourism and Parks Agency records both the striped harlequin snake (*Homoroselaps dorsalis*) and plain stream frog (*Strongylopus wageri*) have been recorded in the quarter degree square, 2629BD. There is a chance that these two Red Data species, spotted harlequin snake and plain stream frog, could occur on the site.

Two species with no national conservation status but with Mpumalanga Conservation status, spotted harlequin snake (*Homoroselaps lacteus*) and many-spotted snake (*Amplorhinus multimaculatus*) have been recorded in the quarter degree square 2629BD. There is a possibility that both the spotted harlequin snake and many-spotted snake could occur on the site.

6.2.5 Discussion: herpetofauna

No threatened herpetofauna species were recorded from the area of the site. Should rocky ridges and all spruits and wetland areas be protected, most herpetofauna species will not be threatened. by the construction or the phase of operation.

It is highly unlikely that any herpetofauna will be threatened by the Main Transmission Station, the Overhead Powerline or the Loop In-Loop Out powerlines on the WEF 2 development site.

6.2.6 General Discussion and conclusion: Fauna

The general WEF 2 study site contains three of the four natural mammal habitats, namely terrestrial, rupicolous and wetlands. However, on the study area of the Main Transmission Station, the Overhead Powerline or the Loop In-Loop Out powerlines on the WEF 2 development site, only terrestrial habitat is present.

Species richness: Only one of the four habitat types occur on the specific site. but the other habitats are present in the vicinity of the site. As a result of the large size of the entire WEF 2 site, the pristine grassland areas and the perennial nature of the drainage lines, the species richness of vertebrates is relatively high.

Endangered species: Bats excluded, fifteen mammal species with Red Data status could occur on the study site. These include the following species: rough-haired golden mole, Highveld golden mole, mountain reedbuck, grey rhebok, oribi, Cape clawless otter, spotted-necked otter, Robert's marsh rat, white-tailed mouse, swamp musk shrew, Maquassie musk shrew, Southern African hedgehog, serval, brown hyena and the African striped weasel.

Three listed Red Data herpetofauna species, the coppery grass lizard, the striped harlequin snake and plain stream frog may occur on the site. Two species with no national conservation status but with Mpumalanga Conservation status, the spotted harlequin snake and many-spotted snake can also occur on the site.

Sensitive species and/or areas (Conservation ranking): The study site falls mainly in the Amersfoort Highveld Clay Grassland (GM 13) vegetation type (Mucina & Rutherford, 2006, 2017) which has a Vulnerable status, but is **not listed** as threatened by SANBI & DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022).

Habitat(s) quality and extent: The habitat types are sensitive, but mostly of good quality. The quality of terrestrial habitat is good.

Impact on species richness and conservation: There should not be a large impact on the mammals, reptiles and amphibians.

However, any development will influence species richness and conservation. This would involve new structures, buildings, new roads carrying more vehicles and more habitat destruction, which will obviously influence any remaining vertebrates in some or other way. These structures may form barriers for vertebrate movement, and it may result in a decrease

in connectivity. Access roads could lead to an increase in poaching of animals on the study site. The development will have a permanent footprint.

Should the development go ahead, a very important indirect effect would be the likely impact that the proposed development might have on the water quality of the drainage lines due to surface water runoff, especially during the construction phase. This could have a negative impact on the vertebrates specifically, but also on conserving biodiversity and maintaining ecosystem functioning in the long term. (See wetland report by separate specialists).

Connectivity: Except for the N11 tarred road on the western part of the study site, good connectivity exists with adjacent areas. Real opportunities for migration exist along the drainage lines and ridges.
Management recommendation: The drainage lines as well as their buffer zones should be considered as ecologically highly sensitive since they also act as dispersal corridors. The normal 100 metres buffer zone outside the urban edge for riparian zones applies. The very few stands of indigenous trees on site should be protected. The removal of alien invasive plants and building rubble will improve the ecological condition of some areas on the site.
General: From a mammal and herpetological perspective, there is no objection against the proposed development if the mitigation measures are adhered to and no development occurs on the rocky ridges or near the drainage lines.

7. IMPACT ASSESSMENT

7.1 Methods

The following methodology was provided by SiVEST.

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one

(1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used.

Table 7.1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		
The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact Significance Rating**	**Description**
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

7.2 Results

Impact Tables were compiled by using the Excel spreadsheet, prescribed and provided by SiVEST.

The proposed layout for the Main Transmission Station, associated Loop In-Loop Out powerlines and the Overhead Powerline is shown in Figures 6.3 and 6.4 (above).

There are no alternatives given for the Main Transmission Station, associated Loop In-Loop Out powerlines and the Overhead Powerline.

It is suggested that alternatives for these be investigated.

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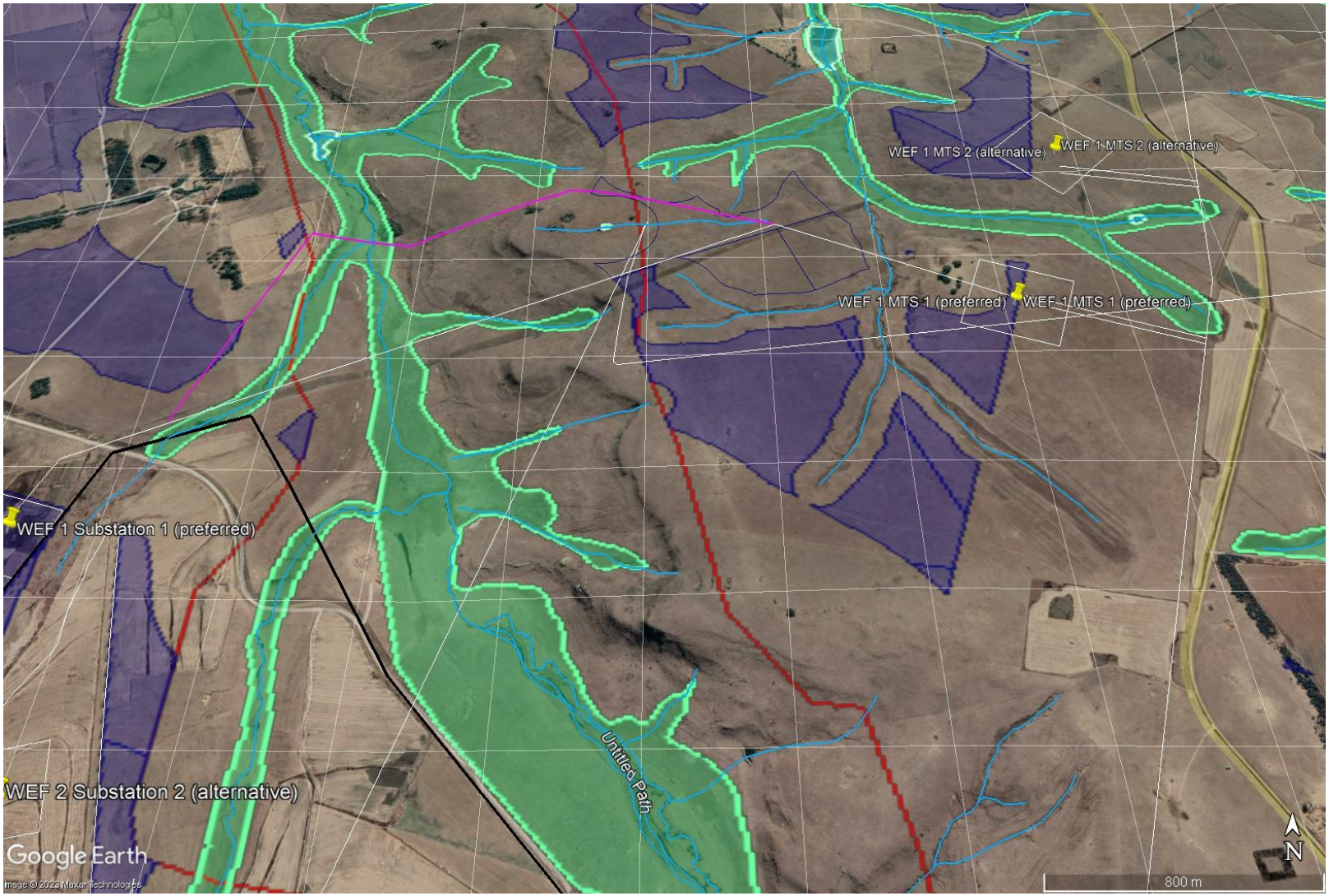

Figure 7.3: A suggested alternative route (purple line) for the Overhead Powerline being a slight deviation from the proposed preferred Overhead Powerline.

TABLE 7.1 RESULTS OF THE IMPACT ASSESSMENT ON BIODIVERSITY FOR THE MAIN TRANMISSION STATIONS AND LOOP IN-LOOP OUT POWERLINES AND OVERHEAD POWERLINE FOR THE UJEKAMANZI WIND ENERGY FACILITY 2 (WEF)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
MTS 1: Vegetation and plant species will be cleared for the construction of the MTS 1. The vegetation is **Highland Grassland** with **Very-High** species richness and **Medium-High** ecological sensitivity	Vegetation clearing for MTS 1 site area, access roads, service area will impact on vegetation and plant species.	1	3	3	3	1	3	33	-33	Medium	Remain within the MTS construction site - no access to adjacent vegetation. Disturbed areas around MTS must be rehabilitated using indigenous grass species. Control all alien invasive and weed species **This site is the proposed preferred site for the MTS**	1	3	3	2	1	2	20	-20	Low
LILO 1: Vegetation and plant species will be cleared for the construction of the LILO 1 powerlines. The vegetation is **Highland Grassland** with **Very High** species richness and **Medium-High** ecological sensitivity	Vegetation clearing for access and service roads, footprints of pylons, powerline and its service areas, may impact on vegetation and plant species.	1	3	2	3	1	3	30	-30	Medium	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service	1	2	2	2	1	2	16	-16	Low

											roads. Eradicate and control any alien and invasive plant species									
LILO 1: Clearing in Agricultural area, Low species richness and Low ecological sensitivity	Clearing for pylon footprint, access and service roads and powerline construction	1	2	1	1	1	1	6	-6	Low	Rehabilitate cleared areas immediately after construction of the pylons.. Eradicate and control any alien and invasive plant species	1	2	1	1	1	1	6	-6	Low
LILO 1: Smaller Drainage Lines) High species richness, High ecological sensitivity, No-Go areas	Vegetation clearing, powerline can possibly cross drainage lines without affecting vegetation?	1	2	2	2	1	2	16	-16	Low	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	2	2	1	2	16	-16	Low
Overhead Powerline 1: Vegetation and plant species in the **Sensitive Highland Grassland**, Very High species richness and High ecological sensitivity, potential No-Go area [Crossing this Sensitive	Clearing for pylon footprints, access and service roads is unavoidable for this Overhead Powerline construction. However, the overall pylon footprints are relatively small in relation to the size of this grassland over the WEF 2 area.	1	2	3	4	1	3	33	-33	Medium	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that	1	2	2	3	1	3	27	-27	Medi um

Highland Grassland seems to be unavoidable]											can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species									
Overhead Powerline 1: Vegetation and plant species in the **Highland Grassland** , Very High species richness and Medium-High ecological sensitivity.	Clearing for pylon footprints, access and service roads is unavoidable for this Overhead Powerline construction. However, the overall pylon footprints are relatively small in relation to the size of this grassland over the WEF 2 area.	1	2	2	3	1	3	27	-27	Medium	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	2	2	1	2	16	-16	Low
Suggested																				
Suggested MTS 2: Vegetation and plant species in the **Degraded Grassland** and Agricultural Field at **MTS 2 ,** Medium species richness and Medium-Low ecological sensitivity	Vegetation clearing for MTS 2 site area, access roads, service area will impact on vegetation and plant species.	1	2	2	2	1	1	8	-8	Low	Remain within construction site - no access to adjacent vegetation. Disturbed areas around MTS must be rehabilitated . **This site is the proposed preferred site for the MTS**	1	2	1	1	1	1	6	-6	Low
Suggested LILO 2: Vegetation and plant species in the **Highland Grassland** , Very High species richness and Medium-High ecological sensitivity, partly No-Go area	Clearing for pylon footprint, access and service roads and powerline construction	1	2	2	3	1	3	27	-27	Medium	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	2	2	1	2	16	-16	Low

Suggested LILO 2: Clearing in Degraded Grassland and Agricultural area, Medium to Low species richness and Medium-Low to Low ecological sensitivity	Clearing for pylon footprint, access and service roads and powerline construction	1	2	1	1	1	1	6	-6	Low	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	1	1	1	1	6	-6	Low
Mammals, unlikely to occur in the way of the construction, if present likely to move away.	Direct impacts on mammals by hunting, snares etc. Mammals may be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise of the construction activities.	2	2	2	2	1	2	18	-18	Low	The managers must ensure that no indigenous mammal species are disturbed, trapped, hunted or killed during the construction phase. Should any mammal species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. Conservation-orientated clauses should be built into contracts for personnel, complete with penalty clauses for non-compliance. . Normal farming with livestock or game should continue.	1	4	1	2	1	1	9	-9	Low

Herpetofauna direct impact or habitat loss	Direct impact on herpetofauna unlikely to be present.	2	2	2	2	1	2	18	-18	Low	Any reptile or amphibia species that are encountered or exposed during the construction phase, should be removed and relocated to natural areas in the vicinity. The contractor must ensure that no indigenous herpetofauna species are disturbed, trapped, hunted or killed during the construction phase. During the construction phase there may be increased surface runoff and a decreased water quality. Completing construction during the winter months would mitigate the environmental impact. The appropriate agency should implement an ongoing monitoring and eradication program for all invasive plant species growing on the site. Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred.	1	4	1	2	1	1	9	-9	Low

Operational Phase																				
MTS 1: Vegetation and plant species may be impacted on by maintenance of the MTS 1. area The vegetation is **Degraded Grassland** with **Medium** species richness and **Medium-Low** ecological sensitivity	Maintenance MTS 1 site area, access roads, service area will impact on vegetation and plant species.	1	3	3	2	3	2	24	-24	Medium	Remain within construction site - no access to adjacent vegetation. Rehabilitated areas around MTS 1 must be maintained .	1	3	2	2	3	2	22	-22	Low
LILO 1: Vegetation and plant species impacted on by maintenance of the LILO 1 powerlines. The vegetation is **Highland Grassland** with **Very High** species richness and **Medium-High** ecological sensitivity	Maintenance LILO 1 site area, access roads, service area will impact on vegetation and plant species.	1	3	3	2	3	3	36	-36	Medium	Remain within construction alignment - no access to adjacent vegetation. Rehabilitated areas around pylons must be maintained. Service road must be maintained, avoid erosion at all times and rehabilitate whenever needed.	1	2	2	2	3	2	30	-20	Low
LILO 1: Maintenance in Agricultural area, Low species richness and Low ecological sensitivity	Maintenance of pylon footprint, access and service roads and powerline	1	2	1	1	3	1	8	-8	Low	Rehabilitated areas around pylons must be maintained. Service road must be maintained, avoid erosion at all times and rehabilitate whenever needed.	1	2	1	1	3	1	8	-8	Low
LILO 1: Smaller spruits (Drainage Lines), High species richness, High ecological sensitivity, No-Go areas	Maintenance of Overhead Powerline site area, access roads, service area will impact on vegetation and plant species.	1	2	2	3	3	2	22	-22	Low	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	2	2	3	2	22	-22	Low

Overhead Powerline 1: Vegetation and plant species in the **Sensitive Highland Grassland**, Very High species richness and High ecological sensitivity, potential No-Go area [Crossing this Sensitive Highland Grassland seems to be unavoidable	Maintenance of Overhead Powerline site area, access roads, service area will impact on vegetation and plant species.	1	3	3	2	3	3	36	-36	Medium	Remain within construction site - no access to adjacent vegetation. Rehabilitated areas around pylons must be maintained. Service road must be maintained, avoid erosion at all times and rehabilitate whenever needed. .	1	2	2	2	3	2	20	-20	Low
Overhead Powerline 1: Vegetation and plant species in the **Highland Grassland** , Very High species richness and Medium-High ecological sensitivity.	Maintenance of Overhead Powerline site area, access roads, service area will impact on vegetation and plant species.	1	3	3	2	3	3	39	-36	Medium	Remain within construction site - no access to adjacent vegetation. Rehabilitated areas around pylons must be maintained. Service road must be maintained, avoid erosion at all times and rehabilitate whenever needed. .	1	2	2	2	3	2	20	-20	Low
Suggested																				
Suggested MTS 2: Vegetation and plant species in the **Degraded Grassland** and Agricultural Field at **MTS 2 ,** Medium species richness and Medium-Low ecological sensitivity	Vegetation clearing for MTS 2 site area, access roads, service area will impact on vegetation and plant species.	1	2	2	2	3	1	1-	-10	Low	Remain within construction site - no access to adjacent vegetation. Disturbed areas around MTS must be rehabilitated . **This site is the proposed preferred site for the MTS**	1	2	1	1	3	1	8	-8	Low

Suggested LILO 2: Vegetation and plant species in the **Highland Grassland** , Very High species richness and Medium-High ecological sensitivity, partly No-Go area	Maintenance for pylon footprint, access and service roads and powerline construction	1	2	2	3	3	2	22	-22	Low	Rehabilitate cleared areas immediately after construction of the pylons. Use only indigenous grass species for rehabilitation, Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	2	2	3	2	20	-20	Low
Suggested LILO 2: Clearing in Degraded Grassland and Agricultural area, Medium to Low species richness and Medium-Low to Low ecological sensitivity	Maintenance of pylon footprint, access roads, service area will impact on vegetation and plant species.	1	2	2	2	3	1	10	-10	Low	Strictly control access to adjacent natural veld. Avoid any actions that can lead to erosion, especially along service roads. Eradicate and control any alien and invasive plant species	1	2	1	2	3	1	9	-9	Low
Mammals, unlikely to occur in the way of the construction, if present likely to move away.	Direct impacts on mammals by hunting, snares etc. Mammals may be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise of the construction activities.	2	2	2	2	3	2	22	-22	Low	The managers must ensure that no indigenous mammal species are disturbed, trapped, hunted or killed during the construction phase. Should any mammal species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. Conservation-orientated clauses should be built into contracts for personnel, complete with penalty clauses for non-compliance. . Normal farming with livestock or	1	3	1	2	3	1	10	-10	Low

											game should continue.									
Herpetofauna direct impact or habitat loss	Direct impact on herpetofauna unlikely to be present.	1	2	2	2	3	1	10	-10	Low	Any reptile or amphibia species that are encountered or exposed during the construction phase, should be removed and relocated to natural areas in the vicinity. The contractor must ensure that no indigenous herpetofauna species are disturbed, trapped, hunted or killed during the construction phase. During the construction phase there may be increased surface runoff and a decreased water quality. Completing construction during the winter months would mitigate the environmental impact. The appropriate agency should implement an ongoing monitoring and eradication program for all invasive plant species growing on the site. Any post-development re-	1	2	2	2	3	1	10	-10	Low

											vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred.									
Decommission Phase																				
Vegetation and plant species	Demolishment and removal of infrastructure by heavy machinery, transport by heavy vehicles, presence of employees may influence vegetation and plants	2	1	2	2	2	2	18	-18	Low	Rehabilitation of disturbed and degraded areas by sowing indigenous grass. No plant species (except alien plants or weeds) may be removed.	2	1	2	2	2	2	18	-18	

Fauna - mammals and herpetofauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.	2	1	2	2	2	3	27	-27	Medium	Take care that no fauna species be trapped caught or killed	2	1	2	2	2	3	27	-27	
Cumulative																				
The WEF will only very slightly affect Broad-scale ecological processes	Transformation and presence of the facility will only slightly contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation	2	2	2	1	4	1	11	-11	Low	See mitigation measures above. If possible, avoid putting turbines in Valley Grassland, if not possible rehabilitate at turbines. Use existing roads as far as possible, construct minimum new roads. Use a minimum underground cabelling, to minimize trenches. The clearing of vegetation must be kept to a minimum and remain within the footprint development – leave the rest of the area with natural vegetation intact. · Remove alien invasive species wherever possible · Construction must be completed as quickly as possible · Disturbed open areas must be rehabilitated immediately after construction has been completed · During the construction phase workers must be limited to areas under construction and access to adjacent private areas must be strictly controlled · Rehabilitated areas must be monitored to ensure the establishment of re-	2	2	2	1	4	1	11	-11	Low

											vegetated areas. · Plant only indigenous grass – no alien species											

Table 7.3:Summary of impacts on biodiversity (Medium impacts highlighted)

	Construction phase		Operational phase	
Preferred	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
MTS 1 Highland Grassland	-33 Medium	-20 Low	-24 Medium	-22 Low
LILO 1 Highland Grassland	-30 Medium	-16Low	-36 Medium	-20 Low
LILO 1 Agricultural Area	-6 Low	-6 Low	-8 Low	-8 Low
LILO 1 Smaller Drainage lines	-16 Low	-16Low	-22 Medium	-22 Medium
Overhead Powerline 1 Sensitive Highland Grassland	-33 Medium	-27 Medium	-36 Medium	-20 Low
Overhead Powerline 1 Highland Grassland	-27 Medium	-16Low	-36 Medium	-20 Low
Mammals	-18 Low	-9 Low	-22 Low	-10 Low
Herpetofauna	-18 Low	-9 Low	-10 Low	-10 low
Suggested Alternatives				
MTS 2 Degraded Grassland and or Agricultural Field	-8 Low	-6 Low	-10 Low	-8 Low
LILO 2 Highland Grassland	-27 Medium	-16 Low	-22 Low	-20 Low
LILO 2 Degraded Grassland and Agricultural Area	-6 Low	-6 Low	-10 Low	-9 Low
Decommission Phase				
Vegetation and Plant species			-18 Low	-18 Low
Fauna: mammals and herpetofauna			-27 Medium	-27 Medium
Cumulative			-11 Low	-11 Low

From Table 7.3 it can be derived that:

- Only a single location for the MTS, a single alignment for the Loop In-Loop Out powerline and a single alignment for the Overhead Powerline were provided as the preferred. As the impacts on vegetation and plant species for the MTS and sections of the LILO and the entire Overhead Powerline are **Medium** an Alternative for the MTS and the LILO are suggested. It seems that there is no possibility for alternatives for the Overhead powerline.
- The impacts on biodiversity of the construction of the proposed MTS 1 will, without as well as with mitigation measures, be **Medium**, during the construction and the operational phases. This is because it is situated on **Highveld Grassland**, which is ecologically sensitive on Optimum Critical Biodiversity Area. (see Table 7.1 and 7.2 above).With mitigation the impact can be lowered.
- The suggested **alternative for the MTS (MTS 2)** is Agricultural Field or Degraded Grassland, located south of the preferred MTS 1. Here impacts on vegetation and plant species will be much lower.
- Where the **LILO 1** transects the **Highland Grassland** the impacts are Medium without mitigation, during the construction and operational phases. With mitigation the impacts can be lowered. Where the LILO 1 crosses Agricultural Fields or even smaller Drainage Lines, the impacts are Low.
- The suggested **alternative LILO 2** transects mainly Agricultural Fields and Degraded Grassland, where impact on vegetation and plant species will be Low.
- The impacts of the proposed **Overhead Powerline 1** on Highland Grassland or Sensitive Highland Grassland are mostly **Medium**. Both these two grassland types are located on ecologically sensitive grassland, which are Critical Biodiversity areas. It seems that there is no possibility for alternatives.
- The impacts of the developments on mammals and herpetofauna are Low.

It is concluded that from a biodiversity perspective, alternatives for the MTS 1 and the LILO 1 are preferred, should this be feasible.

7.3 Impact of other energy related developments within 35 km radius

A solar PV Facility (existing or proposed) is located at the Majuba power station, about 22 km (as the crow flies) from the Ujekamanzi Wind Energy Facility 1 (WEF 1)(Figure 7.3 below). This PV Facility is located very close to the boundary between the Amersfoort Highveld Clay Grassland and the Soweto Highveld Grassland. The latter vegetation type is located on flat terrain where almost 50% is used for cultivation, is highly transformed and is consequently regarded as being endangered (Mucina & Rutherford 2006, 2017). The remaining natural vegetation in this area is dominated by *Themeda triandra* with a much lower plant species richness than the vegetation of the undulating hills where the Ujekamanzi project is located. The vegetation in the vicinity of the Majuba power station, particularly towards the north, west and south, seems to be highly utilised and degraded .

It is furthermore suggested that at a solar PV facility the solar panels cover much more area, with greater impact on natural vegetation and plant species, than the turbines at a Wind (Enviro-Insight 2018). Energy Facility, where the turbines are about 500 m apart and much natural vegetation is left undisturbed.

It is suggested that the cumulative impact on vegetation, plants and fauna of the Ujekamanzi WEF, in relation to the Majuba solar PV, is rather low.

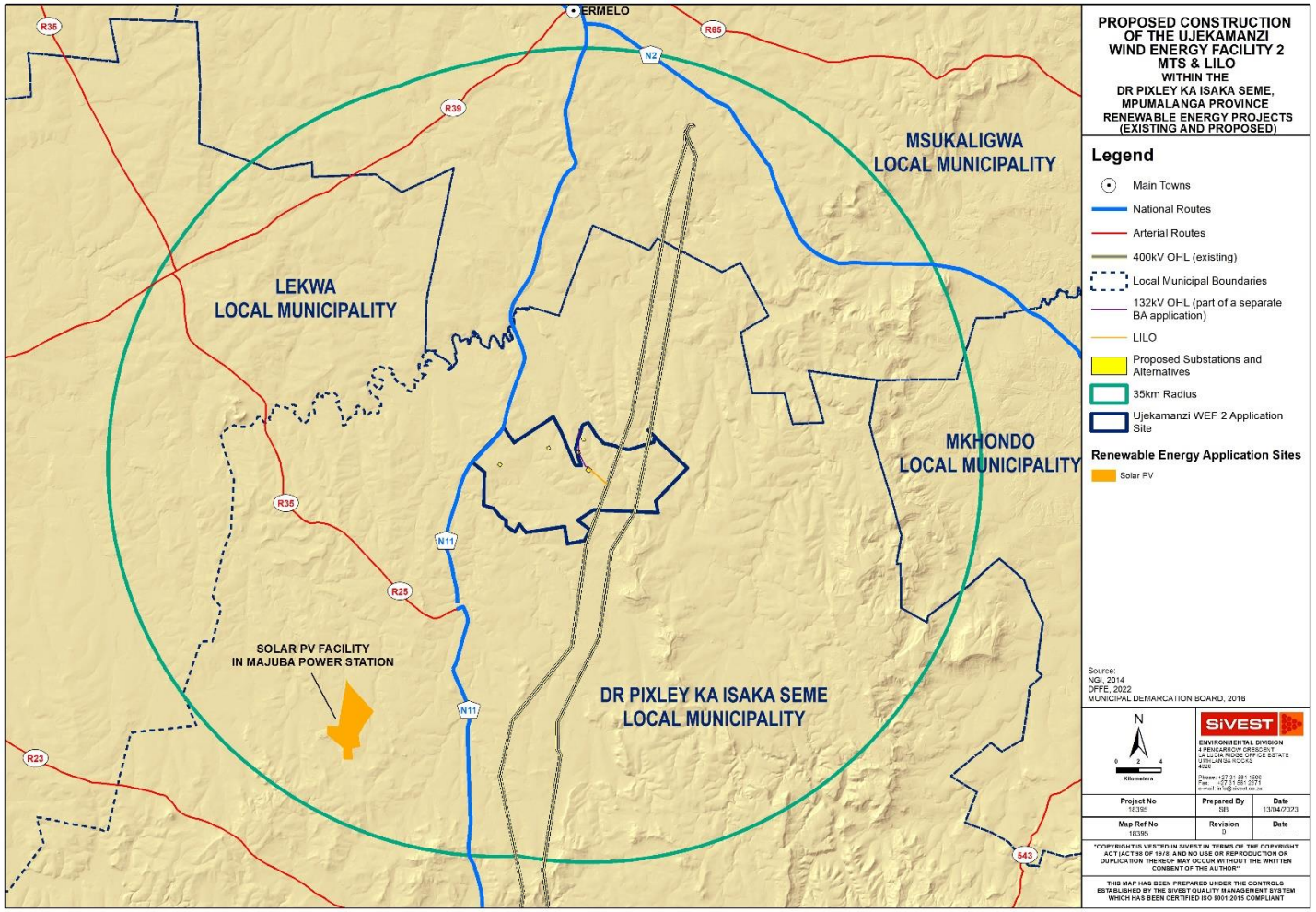

Figure 7.3: Renewable energy projects within 35 km radius from the Ujekamanzi WEF 2 area.

7.3 Comparative Assessment of the Alternative Main Transmission Stations (MTS), the Loop In-Loop Out powerlines (LILO) and the Overhead Powerlines

- Only a single location for the MTS, a single alignment for the Loop In-Loop Out powerline and a single alignment for the Overhead Powerline were provided as the preferred. As the impacts on vegetation and plant species for the MTS and sections of the LILO and the entire Overhead Powerline are **Medium** an Alternative for the MTS and the LILO are suggested. It seems that there is no possibility for alternatives for the Overhead powerline.

Key: MTS

PREFERRED – newly suggested MTS 2, if feasible	Located on the Degraded Grassland or Agricultural land mapping unit mapping unit with Medium-Low or Lowecological sensitivity
FAVOURABLE	-
LEAST PREFERRED MTS 1	Located on Highland Grassland with High to Very High plant species richness and Medium to Medium-High ecological sensitivity.
NO PREFERENCE	-

Alternative	Preference	Reasons (incl. potential issues)
MTS ALTERNATIVES		
MTS Option 1	Not Preferred	MTS 1 is located within the Highland Grassland mapping unit, which has Medium-High ecological sensitivity (Figures 5.3 and 5.4 above). This is natural primary grassland vegetation, therefore not preferred.
MTS Option 2	Preferred Alternative	MTS 2 is located on Degraded Grassland and Agricultural land , with Medium-Low or low ecological sensitivity (Figures 5.3 and 5.4 above).

Key: LILO

PREFERRED newly suggested LILO 2 if feasible	Located on the Degraded Grassland or Agriculture mapping unit mapping unit with Medium-Low and Low ecological sensitivity
FAVOURABLE	-
LEAST PREFERRED LILO 1	Located on Highland Grassland with High to Very High plant species richness and Medium to Medium-High ecological sensitivity.
NO PREFERENCE	-

Alternative	Preference	Reasons (incl. potential issues)
LILO ALTERNATIVES		
LILO Option 1	Not Preferred	LILO 2 is located on Highland Grassland, with Medium-High ecological sensitivity (Figures 5.3 and 5.4 above). This is natural primary grassland vegetation, therefore not preferred.
LILO Option 2	Alternative	LILO 2 is located within the Degraded Grassland and Agriculture mapping unit, which has Medium-Low or Low ecological sensitivity (Figures 5.3 and 5.4 above) and is therefore preferred.

Key: Overhead Powerline

PROPOSED ALTERNATIVE	The powerline will cross Sensitive Highland Grassland and Highland Grassland, which is not ideal but no alternative is possible.
FAVOURABLE	-
SUGGESTED ALIGNMENT: LEAST PREFERRED MTS 2-4	-
NO PREFERENCE	-

Alternative	Preference	Reasons (incl. potential issues)
OVERHEAD POWERLINE		
Option 1	Preferred	The powerline will cross Sensitive Highland Grassland and Highland Grassland, which is not ideal but no alternative is possible.

8. DISCUSSION AND CONCLUSION

ABO Wind renewable energies (Pty) Ltd is proposing to develop a renewable energy cluster, located south of Ermelo in the Mpumalanga Province. The cluster is collectively referred to as “ABO Wind Ujekamanzi Wind Energy Facilities”, consisting of 2 x Wind Energy Facilities (WEF’s 1 and 2) and associated Electrical Grid Infrastructure (EGI), A Main Transmission Substation (MTS) and a Loop-In-Loop-Out (LILO) for the grid connection.

This report is the **Biodiversity Impact Assessment for the proposed Main Transmission Stations (preferred and alternatives), the Loop In-Loop Out powerlines (preferred and alternatives), and the proposed Overhead Powerline (OHL) (no alternatives) for Ujekamanzi Wind Energy Facility 1 Area (WEF 2).**

The calculated size of the WEF 2 area investigated to determine suitable areas for the proposed cluster is approximately 12427 hectares. The proposed WEF 2 project is located

approximately 43 km south of Ermelo and 17 km north of Amersfoort, in the Dr Pixley Ka Isaka Seme Local Municipality, Gert Sibanda District, Mpumalanga Province. Eco-Agent CC was appointed by SiVEST to do an impact assessment on the biodiversity (fauna and flora) of the site.

This study was done in accordance with the National Environmental Management Act (Act 107 of 1998) Amendment of the Environmental Impact Assessment Regulations 2014, 7 April 2017. (GNR. 324, 325, 326 & 327: Listing Notices 1, 2, 3).

Furthermore, the results of the National Environmental Screening Tool (NEMA Government Notices 648 (2019) and 655 (2020)) indicate Very High sensitivity for Terrestrial Biodiversity and Medium for Animal Species sensitivity, Low to Medium sensitivity for Plant Species sensitivity.

The Terms of Reference for this assignment is interpreted as follows: Compile a study of the biodiversity, which includes the vegetation, flora and fauna (except avifauna and bats) on the site, as indicators of ecological sensitivity, and then perform an **Impact Assessment** of the proposed MTS 1, LILO 1 and OHL in accordance with the requirements of relevant national and provincial environmental authorities.

Vegetation

The relevant literature and databases were used to obtain data regarding threatened, protected, alien invasive and medicinal plant species, also regional vegetation, threatened status of vegetation types, protected and conservation areas, critical biodiversity areas, wetlands and water courses.

Standard methods for vegetation surveys were applied. Plant communities were mapped and described including total floristic composition per pant community. Both the literature and field data were applied in analyses to determine ecological sensitivity and conservation status per plant community.

SANBI and DEAT (2009) and NEMBA, Government Notice 1002 (2011) and Government Notice 689 (2022) indicate that the Amersfoort Highveld Clay Grassland and Wakkerstoom Montane Grassland are not listed as threatened ecosystems.

Irreplaceable CBAs occur in the central-northern parts of the area mostly restricted to high-altitude grassland. These areas of the study site are the most important for conservation, **CBA Optimal sites** occur widespread in the western and central parts of the site. These areas are natural grassland of conservation importance, with some upper reaches of west-flowing drainage lines occurring in these areas. **Other Natural Areas** also representing grassland occur as scattered patches over the site. Local **ESA corridors** occur mainly in the western parts of the site. All the grasslands are highly fragmented by cultivation areas and are often disturbed/degraded, classified as Highly or Moderately modified.

The general vegetation of the study area, particularly the crests and higher slopes, is **dense grassland** that occurs on dark clayey soil derived from dolerite. This grassland is mostly dominated by *Eragrostis curvula*, *Eragrostis chloromelas* and *Eragrostis plana,* indicating a high degree of grazing. Many other grass and forb species occur, particularly on these higher-lying areas in the undulating landscape. Eight plant communities were identified,

mapped and floristically described while a further two units are mapped and briefly mentioned.

Due to its very high plant species richness, the **Sensitive Highland Grassland** is associated with **Irreplaceable Critical Biodiversity Area** (CBA) and consequently has High ecological sensitivity and a high conservation status.

Due to its very high plant species richness, **Highland Grassland** is associated with the **Optimal Critical Biodiversity Area** (CBA), identified within the study site. This vegetation has a lower conservation status than the Sensitive Highland Grassland, which is classified as an Irreplaceable CBA. In terms of biodiversity sensitivity the Highland Grassland is consequently placed between High and Medium sensitivity. The reason for this relatively lower sensitivity is particularly because it is classified as an Optimal CBA and not an Irreplaceable CBA. This implies a lower status than Irreplaceable, but nevertheless a Critical Biodiversity Area. The patches of Highland Grassland occupy large in the western and central parts of the study site.

Considering the nature of the proposed development with several widely spaced wind turbines (500-600 m apart), each with a relatively small footprint (<1 ha), and therefore with large tracks of natural undisturbed veld, it is suggested that development can be supported in **Sensitive Highland Grassland** and the **Highland Grassland**, on condition that a strip of Sensitive Highland Grassland immediately east of the Rocky Scarps and Ridges be included in the **No-go** area. Large areas will be then kept undeveloped for conservation purposes and will still be available for grazing by livestock and/or wildlife. **This will imply that a large area within the Sensitive Highland Grassland** and the **Highveld Grassland will be available for the wind turbines**.

Due to their situation in the lower-lying valleys and flatter terrain **Degraded Grasslands** had been utilised more intensively over many years and consequently some varying degrees of disturbance resulted in loss of some plant species and lower plant species richness. The resulting ecological sensitivity, based on biodiversity, was calculated as **Medium-Low**. These areas are, from a biodiversity sensitivity point of view, suitable for the proposed developments.

All **transformed** areas, cultivated lands, old fields, farmyards, patches of alien trees etc have **Low** biodiversity sensitivity with low conservation value and is suitable for the proposed developments.

Fauna

The study site contains three of the four natural mammal and herpetofauna habitats, namely terrestrial, rupicolous and wetlands. The study site has important and sensitive topographical features in the form of drainage lines and ridges. The drainage lines provide an important movement corridor for various animals.

It is estimated that 59 mammal species (excluding bats) may from time to time occur on or near the study site area and 10 were confirmed on or close to the site. Most of the species of

the resident diversity are common and widespread (viz. aardvark, rock hyrax, scrub hare, African mole-rat, yellow mongoose, black-backed jackal, blesbok, common duiker, African mole rat, multimammate mouse and Highveld gerbil).

Data from various sourced indicate that 14 listed threatened mammal species may occur in the area of the study site. Of these at least four were confirmed by sight records or reports from local people.

None of the mammal species predicted to visit the area of the site, will be threatened by the construction or the during the operational phase of the planned Wind Energy Facility. These mammal species are all quite motile and if present in the way of the construction, will easily move away from the danger.

Of the 50 reptile species that may occur on the study site, two were confirmed during the site visit and of the possible 17 amphibian species which may occur on the study site, two were confirmed during the site visit. The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity are common and widespread for example. leopard tortoise, common house snake, mole snake, common egg eater, Mozambique spitting cobra, tree agama, puff adder, striped skink, common dwarf gecko, Van Son's gecko, Boettger's caco, bubbling kassina, guttural toad and eastern olive toad.

Three listed Red Data herpetofauna species, the coppery grass lizard, the striped harlequin snake and plain stream frog may occur on the site. Two species with no national conservation status but with Mpumalanga Conservation status, the spotted harlequin snake and many-spotted snake can also occur on the site.

From a mammal and herpetological perspective, there is no objection against the proposed development if the mitigation measures are adhered to and no development occurs on the rocky ridges or near the drainage lines.

Impact Assessment

The Impact Assessment was done according to the methods prescribed by SiVest. The impact tables were compiled by applying the prescribed Excel spread sheet. Impacts were determined on the vegetation and species of all plant communities.

Only a single location for the MTS, a single alignment for the Loop In-Loop Out powerline and a single alignment for the Overhead Powerline were provided as the preferred. As the impacts on vegetation and plant species for the MTS and sections of the LILO and the entire Overhead Powerline are **Medium** an Alternative for the MTS and the LILO are suggested. It seems that there is no possibility for alternatives for the Overhead powerline.

The impacts on biodiversity of the construction of the proposed MTS 1 will, without as well as with mitigation measures, be **Medium**, during the construction and the operational phases. This is because it is situated on **Highveld Grassland**, which is ecologically sensitive on Optimum Critical Biodiversity Area. (see Table 7.1 and 7.2 above).With mitigation the impact can be lowered.

The suggested **alternative for the MTS (MTS 2)** is Agricultural Field or Degraded Grassland, located south of the preferred MTS 1. Here impacts on vegetation and plant species will be much lower.

Where the **LILO 1** transects the **Highland Grassland** the impacts are Medium without mitigation, during the construction and operational phases. With mitigation the impacts can be lowered. Where the LILO 1 crosses Agricultural Fields or even smaller Drainage Lines, the impacts are Low.

The suggested **alternative LILO 2** transects mainly Agricultural Fields and Degraded Grassland, where impact on vegetation and plant species will be Low.

The impacts of the proposed **Overhead Powerline 1** on Highland Grassland or Sensitive Highland Grassland are mostly **Medium**. Both these two grassland types are located on ecologically sensitive grassland, which are Critical Biodiversity areas. It seems that there is no possibility for alternatives.

The impacts of the developments on mammals and herpetofauna are Low.

It is concluded that from a biodiversity perspective, alternatives for the MTS 1 and the LILO 1 are preferred, should this be feasible.

It is suggested that the **cumulative impact** on vegetation, plants and fauna of the Ujekamanzi WEF, in relation to the Majuba solar PV, is rather low.

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10. CURRICULA

10.1 Abridged Curriculum Vitae: Prof George Johannes Bredenkamp

Born: 10 February 1946 in Johannesburg, South Africa.
Citizenship: South African
Marital status: Married, 1 son, 2 daughters

Present work address
EcoAgent CC
Ecological, botanical and biodiversity consultants
PO Box 25533, Monument Park, 0105, South Africa
Tel: (27)(12) 460 2525
Cell 082 5767046
E-Mail: ecoagent@mweb.co.za

Previous work address:
Extra-ordinary Professor
Department of Plant Sciences, University of Pretoria, Pretoria, 0002, South Africa

Qualifications:
1963 Matriculation Certificate, Kempton Park High School
1967 B.Sc. University of Pretoria, Botany and Zoology as majors,
1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.
1969 H.E.D. (cum laude) Pretoria Teachers Training College.
1975 M.Sc. University of Pretoria, Plant Ecology .
1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:

MSAIE&ES	South African Institute of Ecologists and Environmental Scientists - 1989-1990 Council member
MGSSA	Grassland Society of Southern Africa - 1986 Elected as Sub-editor for the Journal - 1986-1989 Serve on the Editorial Board of the Journal 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa - 1993 Elected as professional member
Pr.Sci.Nat.	South African Council for Natural Scientific Professions **Reg No 400086/83** 1993-1997 **Chairman** of the Professional Advisory Committee:Botanical Sciences - 1993-1997: **Council** Member - 1992-1994: Publicity Committee - 1994-1997: Professional Registration Committee 2017-2020: Council Member

Professional career:

• Teacher in Biology 1970-1973 in Secondary Transvaal Schools
• Lecturer and senior lecturer in Botany 1974-1983 at University of the North
• Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
• Professor in Plant Ecology 1988-2008 at University of Pretoria.
• Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

Academic career:

• Students:
- Completed post graduate students: M.Sc. 57; Ph.D. 16.

• Author of:
- about 200 scientific papers in refereed journals
- >150 papers at national and international congresses
- >1000 scientific (unpublished) reports on environment and natural resources
- 17 popular scientific papers.
- about 45 contributions in books

• Editorial Committees of
South African Journal of Botany,
Journal Grassland Society of Southern Africa,
Bulletin of the South African Institute of Ecologists.
Journal of Applied Vegetation Science.(Sweden)
Phytocoenologia (Germany)
• Highest FRD evaluation category: C1 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

Membership:

• International Association of Vegetation Science.
• International Society for Ecology (Intecol)
• Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).
• South African Association of Botanists (SAAB)
1988-1993 Elected to the **Council** of SAAB.
1989-1990 Elected as **Chairman** of the Northern Transvaal Branch
1990 Elected to the Executive Council as **Vice-President**
1990 Sub-editor Editorial Board of the Journal
1991-1992 Elected as **President** (2-year period)
1993 **Vice-President** and Outgoing President
• Wildlife Management Society of Southern Africa
• Suid-Afrikaanse Akademie vir Wetenskap en Kuns
(=South African Academy for Science and Art).
• Wildlife Society of Southern Africa
1975 - 1988: Member
1975 - 1983: Committee member, Pietersburg Centre
1981 - 1982: **Chairman**, Pietersburg Centre
• Dendrological Society of Southern Africa

1984 - present: Member
1984 - 1988: Committee member, Western Transvaal Branch
1986 - 1988: **Chairman**, Western Transvaal Branch
1987 - 1989: Member, Central Committee (National level)
1990 - 2000: Examination Committee

• Succulent Society of South Africa
1987 - present: Member

• Botanical Society of South Africa
2000 – present: Member
2001- 2008: Chairman, Pretoria Branch
2009-present Committee member Pretoria Branch
2002 – 2015: Chairman, Northern Region Conservation Committee
2002- 2007: Member of Council
2017-2017 President of Council

Special committees:
• Member or past member of 10 special committees re ecology, botany, rangeland science in South Africa.
• Member of the International Code for Syntaxonomical Nomenclature 1993-1996.

Merit awards and research grants:
1968 Post graduate merit bursary, CSIR, Pretoria.
1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.
1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.
1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.
1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.
1991-present Research Grant, National Research Foundation , Pretoria.
Research Grant, Water Research Commission.
1999-2003 Research Grant, Water Research Commission.
2006 South African Association of Botanists Silwer Medal for outstanding contributions to South African Botany

Abroad:
1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom
Visits to Israel, Italy, Germany, United Kingdom, Portugal.
1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.
Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.
1990 Travel Grant, FRD.
Visit to Japan, Taiwan, Hong-Kong.
1991 Travel Grant, FRD.
Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.
1993 Travel Grant, University of Pretoria.
Visits to the USA, Costa Rica, Czech Republic, Austria.
1994 Travel Grant FRD.
Visits to Switzerland, The Netherlands, Germany, Czech Republic.
1995 Travel Grant FRD, University of Pretoria

Visits to the USA
Travel Grant, University of Pretoria, Visit to the UK.
Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria
Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden
Travel Grant, University of Pretoria, Visit Hungary, Spain, USA
Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.
Travel Grant, NRF, Visit Brazil
2006 German Grant Invited lecturer in Rinteln, Germany

Consultant
Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC
Since 1988 **>1000** reports as consultant on environmental matters, including:
Game Farm and Nature Reserve planning,
Environmental Impact Assessments,
Environmental Management Programme Reports,
Vegetation Surveys,
Wildlife Management,
Veld Condition and Grazing Capacity Assessments,
Red data analysis (plants and animals).

10.2. Abridged Curriculum Vitae: Jacobus Casparus Petrus (Jaco) Van Wyk

Identity number	680804 5041 08 4
Gender	Male
Date of birth	4 August 1968
Nationality	South African
Home languages	Afrikaans, fluent in English

Postal address P.O. Box 25085, Monument Park, Pretoria, 0105.

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E-mail **jcpvanwyk@absamail.co.za**

Present position Co-Department Head, Environmental Education & Life Sciences, Hoërskool Waterkloof

Consultant Specialist Environmental Assessments, EIAs, writing, photo-recording

Qualifications **B.Sc**. (U.F.S.) **B.Sc. (Hon.)** (U.F.S.), **H.E.D** (U.F.S.), **M.Sc.** (U.F.S.)

Honours Foundation of Research Development bursary holder

Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400062/09

Notable Research Contribution In-depth field study of the giant bullfrog

Formal Courses Attended Outcomes Based Education, University of the South Africa (2002)

Introductory Evolution, University of the Witwatersrand (2008)

OBE, GET & FET training, 2002-2008, Education Department

Employment history

2009 – Present Vertebrate surveys for different Environmental Companies.

2000 – 2018 Co-Department Head for Environmental Education & Life Sciences, Hoërskool Waterkloof, Pretoria.

1995 - 1999 Teaching Biology (Grades 8 – 12) and Physics / Chemistry (Grades 8 – 9) at the Wilgerivier High School, Free State. Duties included teaching, mid-level management and administration.

July 1994 – Dec 1994 Teaching Botany practical tutorials to 1st year students at the Botany & Zoology Department of the Qwa-Qwa campus of the University of Free State, plant collecting, amphibian research

1993 - 1994 Mammal Research Institute (University of Pretoria) research associate on the Prince Edward Islands: topics field biology and population dynamics of invasive alien rodents, three indigenous seals, invertebrate assemblages, censussing king penguin chicks and lesser sheathbills, and marine pollution

1991 - 1993 Laboratory demonstrator for Zoological and Entomological practical tutorials, and caring for live research material, University of the Free State

1986 - 1990 Wildlife management and eco-guiding, Mt. Everest Game Farm, Harrismith

Professional Achievement

Research: Author and co-author of 52 scientific publications in peer-reviewed and popular subject journals, and >350 contractual EIA research reports. Extensive field work and laboratory experience in Africa

Public Recognition: Public speaking *inter alia* radio talks, TV appearances

Hobbies: Popular writing, travel, marathon running, climbing (viz Kilimanjaro), photography, biological observations, public speaking.