# The Proposed Tubatse Strengthening Phase 1 - Senakangwedi B Integration Project, Limpopo Province

# Vegetation Assessment

Date: April 2014

*Report drafted on behalf of*

**Limosella Consulting**

*For:*


Nsovo Environmental Consulting

748 Richards Drive, Elite Park, Building C-FF

Halfway House, 1685

Tel: 011 312 5153 Cell: 071 6022369

Fax: 086 602 8821

Email: munyadzi@nsovo.co.za

Website: www.nsovo.co.za


*Report drafted by:*


Dimela Eco Consulting

Contact: Antoinette@dimela-eco.co.za *or*

DimelaEcoConsulting@gmail.com

**Indemnity**

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study. Therefore, the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although the author exercises due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

The Environmental Impact Assessment Regulations (Regulation 17 of Government Notice No. R543 of 2010), requires that certain information is included in specialist reports. The terms of reference, purpose of the report, methodologies, assumptions and limitations, impact assessment and mitigation (where relevant to the scope of work) and summaries of consultations (where applicable) are included within the main report. Other relevant information is set out below:

**Expertise of author:**

- Working in the field of ecology, and in specific vegetation related assessments, since 2007;
- Is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology (Reg. No. 400019/11); and
- Has been working with plants indigenous to South Africa since 1997.

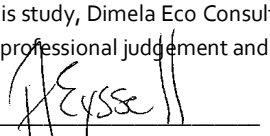
**Declaration of independence:**

Dimela Eco Consulting in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by Dimela Eco Consulting is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

**Disclosure:**

Dimela Eco Consulting undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during the course of this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.



_____ _____2014. 07.30____

Antoinette Eyssell Date

SACNASP Reg. No. 400019/11

## EXECUTIVE SUMMARY

Eskom proposed to establish a new Senakangwedi B substation (1 x 800MVA, 400/275kV and 2X500, 400/132kV) to the south of existing Senakangwedi substation, Steelpoort-area. The proposed development will also include:

- Loop in and out of Senakangwedi B the existing Arnot – Merensky 400kV line.
- Construction of Tubatse – Senakangwedi B 400kV line.
- Construction of Senakangwedi – Senakangwedi B 275kV line.
- 4 x 132kV feeder bays.
- 2 x 275kV feeder bays (Senakangwedi and Senakangwedi B).
- 3 x 400kV feeder bays.

Dimela Eco Consulting was contracted by Limosella Consulting to undertake a vegetation assessment. Three alternative sites were proposed for the new substation. Each alternative site has a set of proposed powerlines that will link the substation to the existing Senakangewdi substation as well as to the new 400kV line that will run parallel to the R555 road between Roosenekal and Steelpoort.

The terms of reference for this study were understood as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the sites proposed for the substation;
- Broad description of the vegetation groupings found on the alternative sites and along the accompanying powerline routes, compared to the expected natural state as listed in the national vegetation map;
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed "red data plants") and sensitive vegetation groups; and
- Where applicable, recommend mitigation measures and recommendations to limit the perceived impact(s) on vegetation.

The Tubatse Strengthening project was situated south of the town of Steelpoort. The powerlines are proposed to run from the Senakangewdi - substation which is located about 5.3km south-west of Steelpoort, directly north of the R555 road between Steelpoort and Roosenekal – to the proposed new substation. Three substation Alternative sites were proposed as well as three powerline corridors to each proposed substation site. The powerline corridors include a 1km buffer on either side of the proposed route alternative line, thus 2km in total.

The project area is situated in the Savana Biome; the substation alternative sites are situated within the Sekhukune Mountain Bushveld, while the most northern extent of the proposed powerlines are situated within the Sekhukhune Plains Bushveld. The Sekhukhune Plains Bushveld is classified as Endangered, while the Sekhukhune Mountain Bushveld is considered to not currently be of conservation concern. However, these vegetation types include a number of plants endemic to the

region which lead to local sensitivities where these and threatened plant species occur. In addition, all three the proposed substation sites, as well as the bulk of the powerline routes are situated within the Sekhukhune Mountainlands Ecosystem which is listed as an Endangered Ecosystems in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 32689, 2009).

The extent of the study area was historically situated within the Mpumalanga Province and thus included in the Mpumalanga Biodiversity Conservation Plan (MBCP). However, the study area has since been moved into the Limpopo Province, for which no provincial conservation plan is available yet. Therefore, as best practise, this report will refer to the extent of the area that the proposed development is situated in, in relation to the MBCP. As classified in the MBCP, all three of the substation alternative sites are located in areas that are of 'Least Concern' or have 'No Natural Habitat' remaining. On the other hand, the proposed powerlines will have an impact on some areas that are classified as 'Important and Necessary' as well as 'Highly Significant' in reaching conservation targets.

A list of fifteen plants of conservation concern that could occur within the area of the proposed development was compiled using various sources. Suitable habitat for the majority of these species exist along the proposed powerline corridors, while one Declining species, *Drimia altissima* was confirmed to occur at the substation Alternative 2 site. In addition to these species, provincially protected plants as well as nationally protected trees were confirmed to occur on the substation sites as well as along the proposed corridors. None of these plants may be removed or damaged without authorisation from the provincial conservation authority.

The substation Alternative 1 site was found to be of low sensitivity, while the substation Alternative 2 and 3 sites were of high and medium sensitivity. The Alternative corridors were assessed based on desktop studies as well as a scan of the general area that the line will traverse. The areas of sensitivity along the three powerline corridors were found to be more or less comparable. Much of the extent of the Alternative corridor 1 aligns with an existing powerline. This corridor also connects with the only substation site that was classified as being of low sensitivity (Substation Alternative 1). Alternative corridor 2 is comparable to Alternative corridor 1. However, this corridor connects to a substation site that was classified as being of high sensitivity. Alternative corridor 3 is the longest route and will traverse a potentially sensitive mountainous area north of the proposed substation Alternative 3 site. Therefore, Alternative corridor 1, with the substation Alternative 1 site is the preferred route, where after the Alternative 2 corridor, with the substation Alternative 2 site is the second preferred route.

# TABLE OF CONTENTS

# TABLES



## FIGURES



## PHOTOGRAPHS

# 1. INTRODUCTION

Eskom proposed to establish a new Senakangwedi B substation (1 x 800MVA, 400/275kV and 2X500, 400/132kV) to the south of existing Senakangwedi substation, Steelpoort-area. The proposed development will also include:

- Loop in and out of Senakangwedi B the existing Arnot – Merensky 400kV line.
- Construction of Tubatse – Senakangwedi B 400kV line.
- Construction of Senakangwedi – Senakangwedi B 275kV line.
- 4 x 132kV feeder bays.
- 2 x 275kV feeder bays (Senakangwedi and Senakangwedi B).
- 3 x 400kV feeder bays.

Dimela Eco Consulting was contracted by Limosella Consulting to undertake a vegetation assessment. Three alternative sites were proposed for the new substation. Each alternative site has a set of proposed powerlines that will link the substation to the existing Senakangewdi substation, as well as to the new 400kV line that will run parallel to the R555 road between Roosenekal and Steelpoort.

## 1.1 Terms of reference

The terms of reference were as follows:

- Field survey with specific reference to plants of conservation concern that could occur within the footprint of the sites proposed for the substation;
- Broad description of the vegetation groupings found on the alternative sites and along the accompanying powerline routes, compared to the expected natural state as listed in the national vegetation map (Mucina & Rutherford, 2006);
- Sensitivity mapping, including possible or confirmed localities of plants of conservation concern (previously termed "red data plants") and sensitive vegetation groups; and
- Where applicable, recommend mitigation measures and recommendations to limit the perceived impact(s) on vegetation.

## 1.2 Methodology

The assessment entailed a literature review which included short listing plants of conservation concern that could potentially occur on the sites and along powerline routes, a field survey of the proposed sites, the analysis of data collected and reporting The field survey was undertaken on 27 March 2014, while a scouting trip with Eskom was also undertaken in January 2014. The methodology used is listed in Appendix A.

In order to determine the sensitivity of the vegetation observed on the study site, weighting scores as listed below (Table 1; Appendix A) were applied. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity to the proposed development. Sensitive vegetation or

areas of conservation importance were classified based on the findings of the study and the criteria as listed in Appendix A.

**Table 1: Weighting scores**

| Scoring | 13-18 | 7-12 | 0-6 |
|---|---|---|---|
| Sensitivity | High | Medium | Low |

## 1.3 Assumptions and Limitations

Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. In the absence of guidance documents for biodiversity assessment in Limpopo, the Mpumalanga guidelines were used as best practise. According to the Mpumalanga Minimum Requirements for Biodiversity Assessment (Mpumalanga Tourism and Parks Agency, 2008):

> *"A floristic (plant) survey must be conducted during the growing season of all species that may potentially occur (this may require more than one season's survey in order to identify flowering species) with two (2) visits undertaken (November & February). Visits during other seasons will be determined by the flowering and fruiting times of species that do not occur during the summer."*

However, only one season survey was undertaken on the 27$^{th}$ of March 2014. Much of the vegetation on Alternative 3 and Alternative 2 was grazed and many grass species dormant. A portion of the substation Alternative 3 site was burnt at the time of the site visit. In addition, due to mining activities in proximity to Alternative 1, no access could be gained to the site. Surrounding vegetation and aerial images, as well as historical land use were used to describe the vegetation on Alternative 1.

# 2. BACKGROUND TO THE STUDY SITE

## 2.1 Locality

The Tubatse Strengthening project was situated south of the town of Steelpoort. The powerlines are proposed to run from the Senakangewdi - substation which is located about 5.3km south-west of Steelpoort, directly north of the R555 road between Steelpoort and Roosenekal – to the proposed new substation. The three alternative sites for the substation and associated powerlines are located as follows (Figure 1):

Substation Alternative 1 site: is situated 25.935km from the existing Senakangwedi substation and is situated directly west of the existing Uchoba substation. The R577 road to Lydenburg forms part of the northern and eastern boundary of the site, while a mine is situated south of the site. The Alternative 1 site will be linked to Senakangewdi substation and another 400kV that runs parallel to the R555 via the Alternative 1 powerline route (Figure 1).

Substation Alternative 2 site: is situated south of the R577 towards Lydenburg and 21.455km from the existing Senakangewdi substation. The Alternative 2 site will be linked to Senakangwedi substation and another 400kV that runs parallel to the R555 via the Alternative 2, as well as portions of the Alternative

1 powerline route (Figure 1).

Substation Alternative 3 site: is located east of a mining area and 26.227km from the Senakangwedi substation. The Alternative 3 site will be linked to Senakangwedi substation and another 400kV that runs parallel to the R555 via the Alternative 1, 2 and 3 powerline routes (Figure 1).

## 2.2 Topography and Hydrology

The area that the proposed development is situated in, comprises warm bushveld plains and valleys in between hills and small mountains. The mountainous area result in a number of drainage lines. The area also include non-perennial rivers as well as the perennial Steelpoort River (north of the Senakangewdi substation) and the Dwars River in the southern extent of the proposed development (Figure 2).

## 2.3 National Vegetation Map

The study site is situated within the Savanna Biome of South Africa (Mucina & Rutherford, 2006). The Savanna Biome is the largest Biome in southern Africa, occupying over one-third of the surface area of South Africa (Mucina & Rutherford, 2006). It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are locally known as Bushveld (Mucina & Rutherford, 2006). The vegetation includes wooded, shrubby hill slopes and grassy plains with scattered trees or bush-clumps. Diversity in savanna is provided by the variation in soil-type and topography; koppies, river lines and anthills (termitaria) provide localised changes in soil moisture and nutrients which create different habitats for plants and animals.

The Savanna Biome consists of various different vegetation types. The substation alternative sites are situated within the Sekhukune Mountain Bushveld, while the most northern extent of the proposed powerlines are situated within the Sekhukhune Plains Bushveld (Mucina & Rutherford, 2006) (Figure 3). These vegetation types are characterised by dry micro-phyllous species (e.g. *Acacia* species) and broad-leaved savanna (e.g. *Combretum* species) on hills and mountain slopes (Mucina & Rutherford, 2006).

Both vegetation types include a number of biogeographically important plant taxa as well as plants endemic to these vegetation types as well as endemic to the Sekhukhune area (i.e. these plants only occur within this vegetation type and / or area). The Sekhukune Mountain Bushveld vegetation type is not considered to be threatened although mining activities, cultivation and urbanisation have already transformed at least 15% of the current extent of the Sekhukhune Mountain Bushveld (Mucina & Rutherford, 2006). On the other hand, the Sekhukhune Plains Bushveld is considered to be Vulnerable to becoming completely transformed. Only about 2% of this vegetation type is conserved in reserves, while more than 25% has already been transformed by mining, urbanisation and cultivation. Furthermore, the soils are vulnerable to erosion and subsistence grazing has resulted in donga formation and the invasion of the vegetation by alien invasive plant species (weeds).

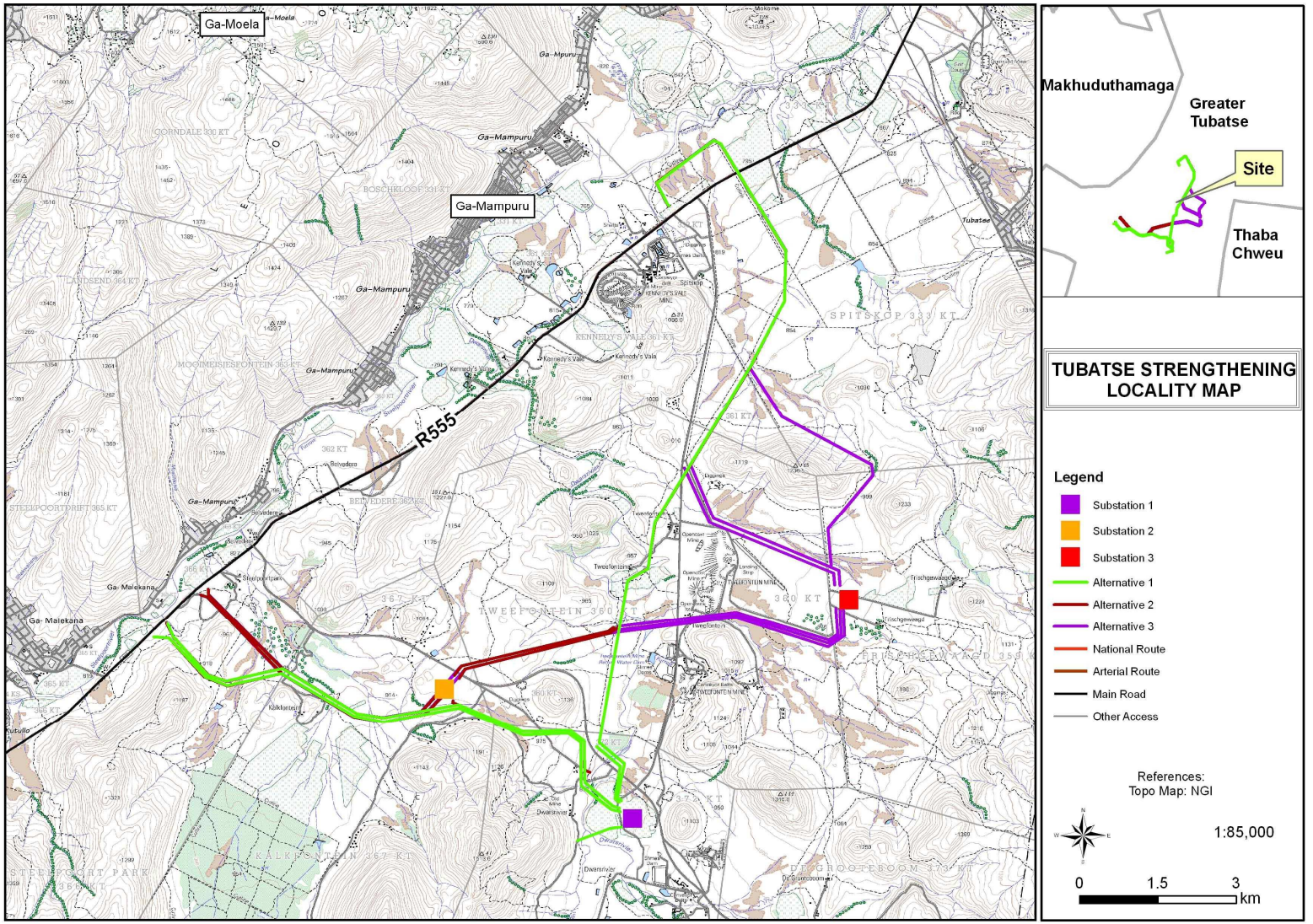



**Figure 1: Locality of the alternative substation sites and alternative powerline routes**

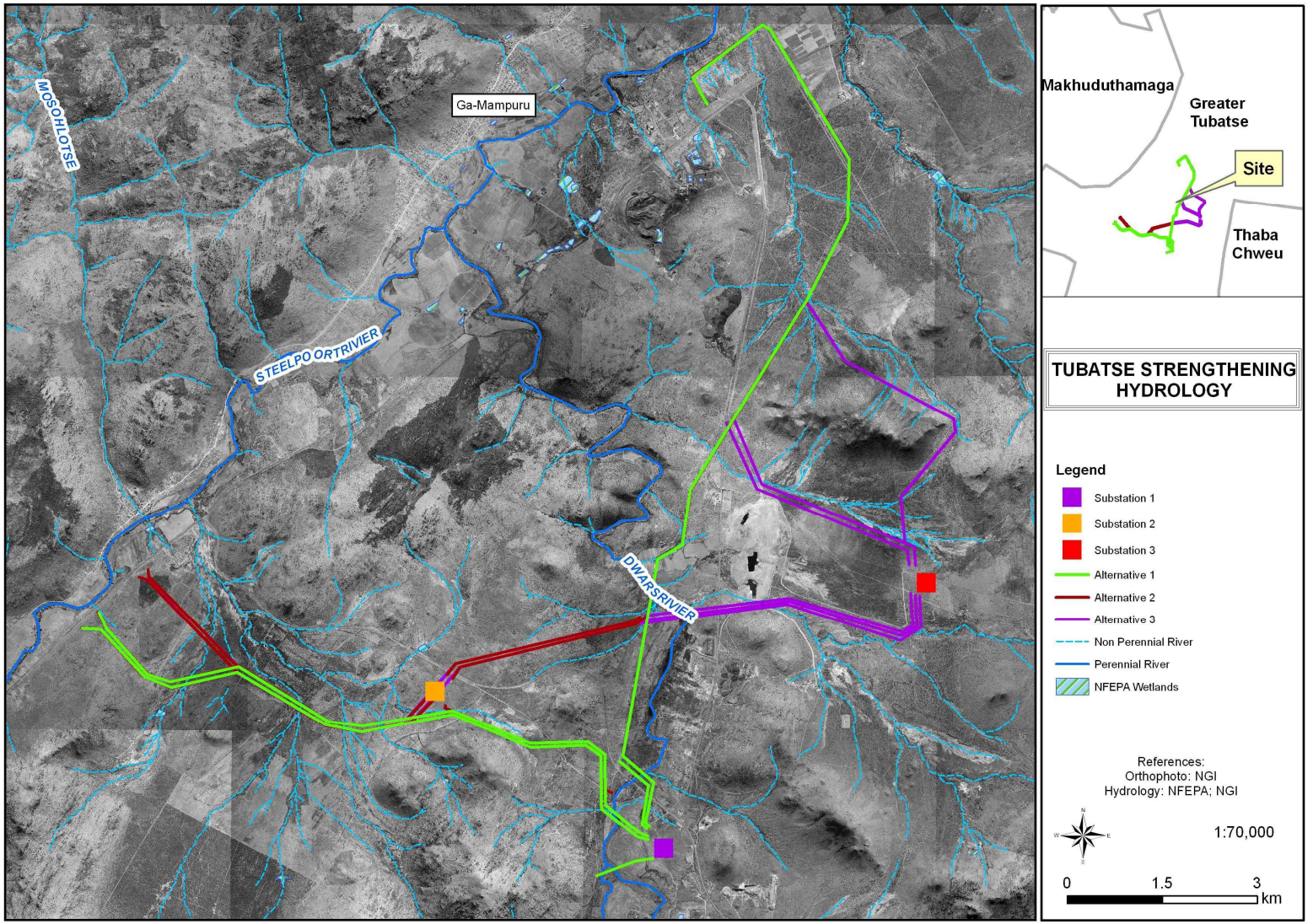



**Figure 2: Hydrology map (as per existing national spatial layers)**

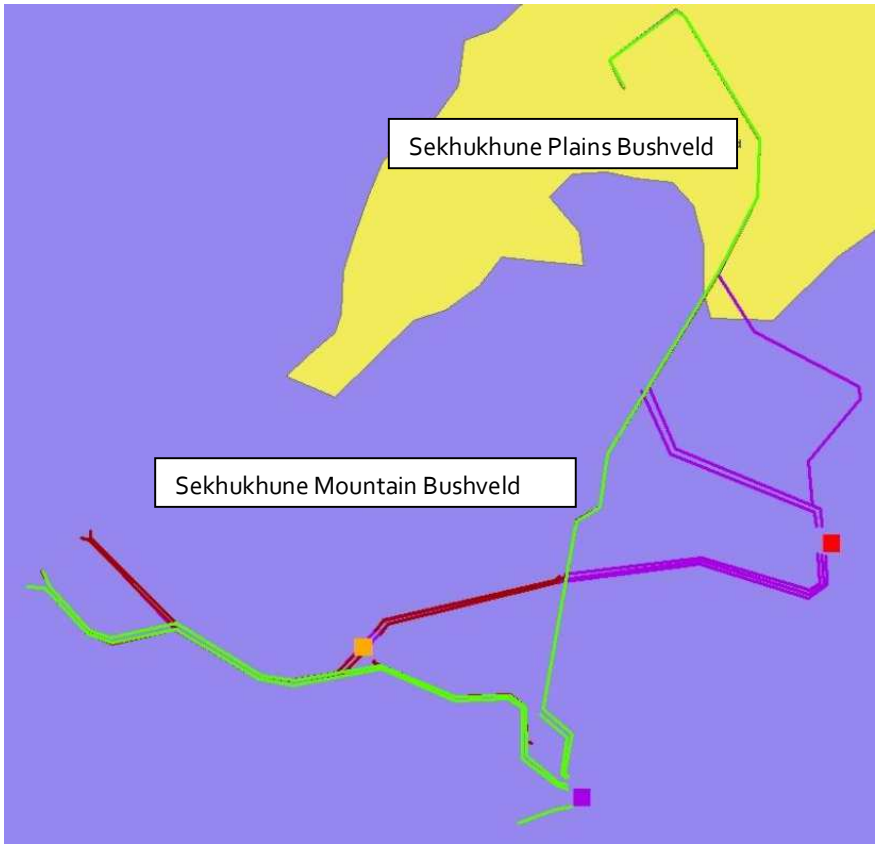



**Figure 3: Representation of the vegetation types that the proposed development is situated in**

*(note image not to scale)*

## 2.4 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: critically endangered (CR), endangered (EN), Vulnerable (VU) or Protected (Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). The ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems.

All three the proposed substation sites, as well as the bulk of the powerline routes are situated within the Sekhukhune Mountainlands Ecosystem which is listed as an Endangered Ecosystems in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 32689, 2009)(Figure 4). In addition, the study area is situated within the Sekhukhuneland Centre of Endemism with exceptionally rich biodiversity (Siebert *et al*, 2001). According to Victor *et al* (2005), mining activities in the region are causing some endemic species such as *Melhania randii* to be

threatened with extinction. Furthermore, there are 58 endemic and approximately another 70 near-endemic plant taxa in Sekhukhuneland (Victor *et al*, 2005).

## 2.5 Mpumalanga Biodiversity Conservation Plan (MBCP)

The extent of the study area was historically situated within the Mpumalanga Province and thus included in the Mpumalanga Biodiversity Conservation Plan (MBCP). However, the study area has since been moved into the Limpopo Province, for which no provincial conservation plan is available yet. Therefore, as best practise, this report will refer to the extent of the area that the proposed development is situated in, in relation to the MBCP. The Mpumalanga Biodiversity Conservation Plan (MBCP) groups the terrestrial biodiversity assets of Mpumalanga into six conservation categories, based on the measured distribution of hundreds of biodiversity and ecological features throughout the province which are analysed for rarity and response to the pressures of various forms of land-use that diminish them. The conservation categories are:

1. Protected areas currently under formal biodiversity protection;
2. Irreplaceable areas, in urgent need of Protected Area status;
3. Highly Significant areas, requiring strict land-use controls;
4. Important and Necessary areas, requiring special care;
5. Areas of Least Concern, providing areas for development; and
6. Areas with No Natural Habitat remaining, providing preferred sites for all forms of development.

In addition to the above conservation categories, important *ecological corridors* have also been delineated for the province. The purpose of the ecological corridors is to provide intact mega-pathways for long-term biological movement, and they are selected primarily along river lines and altitude gradients in order to provide for the natural retreat and advance of plants and animals in response to environmental change.

Substation alternatives:

All three of the substation alternative sites are located in areas that are of 'Least Concern' or have 'No Natural Habitat' remaining (Figure 5). It must be noted that Substation alternative 3 is situated in close proximity to areas classified as 'Important & Necessary' to reach conservation targets.

Powerlines:

The proposed powerlines will have an impact on some areas that are classified as 'Important and Necessary' as well as 'Highly Significant' in reaching conservation targets. It is thus advised that the powerlines with the least footprint within these areas (yellow and orange areas on Figure 4) take preference. In addition, the powerlines in proximity to the Steelpoort River falls within an Ecological Corridor around the Steelpoort River (Figure 5).

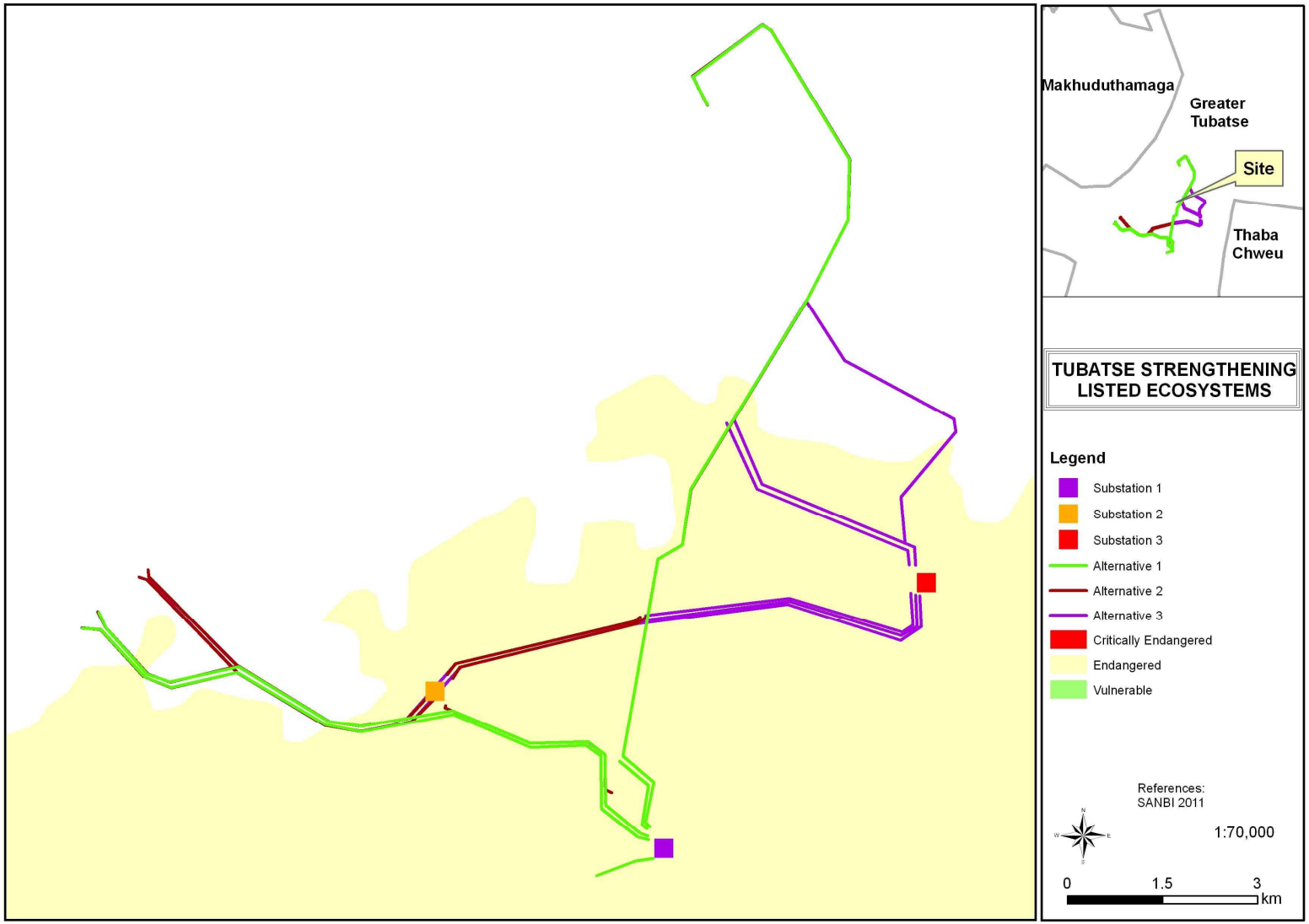



**Figure 4: The proposed development in relation to the Sekhukhune Mountainlands Ecosystem (listed as an Endangered ecosystem)**

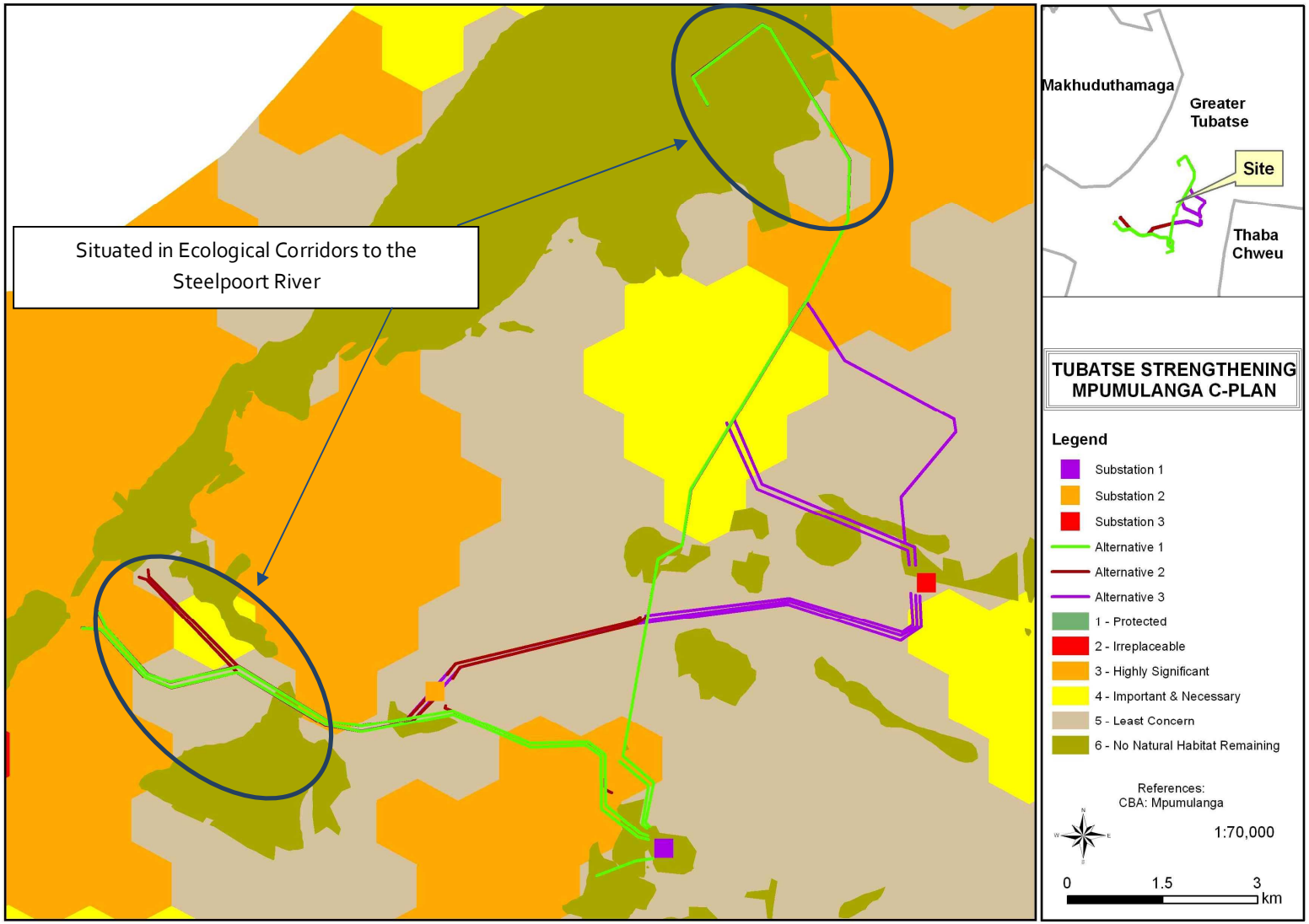



**Figure 5: The site in relation to the Mpumalanga Biodiversity Conservation Plans (MBCP), terrestrial categories**

Accompanying each of these conservation categories indicated above are broad land-use guidelines. Table 2 indicates the suitability of the biodiversity categories present along the powerline routes to the proposed linear development. *NOTE: – These guidelines apply only to untransformed land with natural vegetation cover.*

**Table 2: Types of land-use suited to each biodiversity conservation category present on site.**

| Types of Land Use | Highly Significant | Important and Necessary | Ecological Corridor | Least concern | No natural habitat |
|---|---|---|---|---|---|
| Linear Engineering Structures | R | R | R | R | R |

**Y** – Yes, permitted

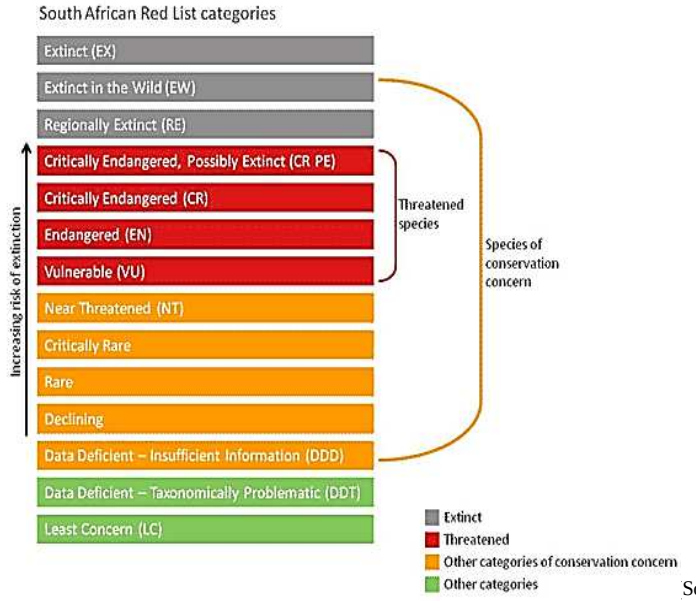
**N** – No, not permitted, actively discouraged activity

**R** – Restricted by compulsory, site-specific conditions and controls when unavoidable, not usually permitted

## 2.6 Plants of Conservation Importance

### 2.6.1 Nationally Protected Plants (Plants of Conservation Concern)

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining (Figure 6). These plants are also referred to as Red Listed plants. Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.




Source: http://redlist.sanbi.org/redcat.php)

**Figure 6: Threatened species and species of conservation concern**

A list of fifteen (15) plants of conservation concern that could occur within the area of the proposed development was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo *et al*, (2009), information from the Mpumalanga Tourism and Parks Agency (MTPA) and relevant literature pertaining to the area. The list is given in Table 3 as well as the plants likelihood of occurrence.

**Table 3: Red data / Plants of conservation concern that has historically been recorded within the areas proposed for the development**

| Species | Conservation status | Habitat and likelihood of occurrence |
|---|---|---|
| *Asparagus fourei* | Vulnerable | Mixed bushveld, on rocky, dolomite outcrops. Sekhukhuneland, Burgersfort to Penge. Highly likely to occur west of the substation Alternative 2 site within Alternative 1 and 2 corridors. |
| ***Searsia batophylla*** | **Vulnerable** | **Dry bushveld, in low-lying areas and along watercoures. 650-975 m. Sekhukhuneland. Locally common, but range restricted. Highly likely to occur, especially in the northern portion of the development area** |
| *Zanthedeschia jucunda* | Vulnerable | Sekhukhuneland, along the summit of the Leolo Mountains. Grassland, norite outcrops and cliffs. |
| *Zantedeschia pentlandii* | Vulnerable | Roossenekal to Dullstroom. Rocky hillsides. **Highly likely to occur north and east and west of the substation Alternative 3 site and within Alternative 3 corridor.** |
| *Dicliptera fruticosa* | Near Threatened | Savanna and open woodland, shady areas on rocky magnetite and dolomite slopes. |
| ***Elaeodendron transvaalense*** | **Near threatened** | **Savanna or bushveld, from open woodland to thickets, often grows on termite mounds. Likely to occur in the substation Alternative 1 area, not on site, but along the Alternative 1 corridor** |
| ***Jamesbrittenia macrantha*** | **Near threatened** | **Grassy slopes with other scattered shrubs, restricted to norites (Figure 7). Endemic to Sekhukhuneland, declining due to mine and infrastructure expansion. Highly likely to occur around the substation Alternative 3 site and in a southern and westerly direction towards substation Alternative 1 & 2** |
| ***Lydenburgia cassinoides*** | **Near threatened** | **Roossenekal to Strydpoort Mountains. Exposed norite bedrock and dolomite. Highly likely to occur, especially the northern portion of the corridors (e.g. north of substation Alternative 3 site), the whole of the Alternative 3 corridor on norite as well as around the substation Alternative 2 area (Figure 7).** |
| *Nerine gracilis* | Near Threatened | Occurs in moist grasslands. **Likely occurrence in the substation Alternative 1 area.** |
| ***Urginea lydenburgensis*** | **Near threatened** | **Rocky ledges, rock fissures and shallow depressions. Likely occurrence in the substation Alternative 1 area** |
| ***Drimia altissima*** | **Declining** | **Hot, dry bushveld and thicket. *Confirmed* to occur at the substation Alternative 2 site** |

| Species | Conservation status | Habitat and likelihood of occurrence |
|---|---|---|
| *Eulophia speciosa* | Declining | Various habitats including sand dunes, bushveld, thornveld and mountain grasslands. |
| *Euphorbia sekukuniensis* | Rare | Closed woodland and thicket. Plants grow in shallow soils on rocky outcrops among large boulders. Restricted to norite. 900-1300 m. Sekhukhuneland, Steelpoort River valley and along the summit of the Leolo Mountains as far as the Olifants River valley**. Highly likely to occur, as much of the eastern portion of the development is situated on Norite – see Figure 7.** |
| *Searsia sekhukhuniensis* | Rare | Sekhukhuneland, Roossenekal to Steelpoort. Rocky hillsides in bushveld, on pyroxenitic substrates of the eastern rim of Bushveld Igneous Complex. **Highly likely to occur, especially the northern portion of the corridors (e.g. north of substation Alternative 3 site)** |
| *Aloe parvibracteata (was Aloe burgersfortensis)* | Rare in Mpumalanga, LC nationally | Savannah. **Likely occurrence on the northern extent of the Alternative 1 corridor** |

A number of the plants with a high likelihood of occurrence, grows on norite, which underlays the eastern section of the proposed development, including substation alternative 1 and 3 (Figure 7).

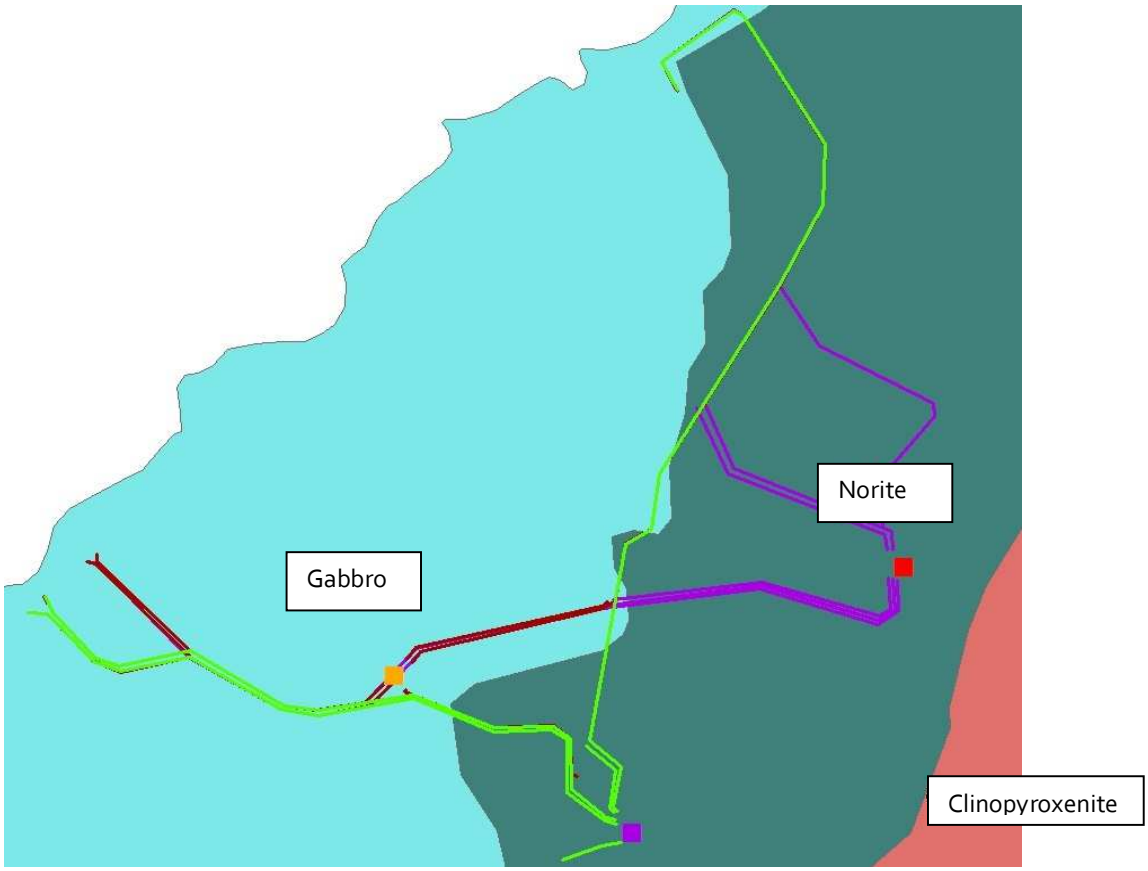



**Figure 7: Geology that underlay the proposed development** *(note image not to scale)*

## 2.6.2 Provincially Protected Plants

A number of plants are provincially protected by the Limpopo Environmental Management Act 2003 (Act 7 of 2003). These plants are not to be removed, damaged, or destroyed without a permit from the Limpopo Economic Development Environment and Tourism. Table 4 list the plants that are protected by this act and that are most likely to occur.

**Table 4: Some provincially protected plant species with a likelihood of occurrence**

| Species | Growth form |
|---|---|
| *Adenia fruticosa simpliciflora* | Succulent climber |
| *Boscia angustifolia var. corymbosa* | Tree |
| *Rhus batophylla* | Small tree |
| *Erythrophysa transvaalensis* | Tree |
| *Pterocarpus angolensis* | Tree |
| *Aloe castanea* | Aloe |
| *A. marlothii* | |
| *A. arborescens* | |
| *Brachystelma* spp | Succulent |
| *Huernia* spp | Succulent |
| Family Orchidaceae (all genus and species) | Orchid |
| *Freylinia tropica* | Shrub |
| *Zantedeschia jucunda* | Arum lilies |
| *Z.pentlandii* | |

### 2.6.3 Nationally Protected Trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. Table 5 lists the tree species confirmed to occur in the area studied.

**Table 5: National protected trees that could occur on the sites or along the route alignments**

| Tree species | Common Name |
|---|---|
| *Balanites mauahamii* | Torchwood |
| *Boscia albitrunca* | Shepherds Tree |
| *Curtisia dentata* | Assegai |
| *Elaeodendron transvaalensis* | Bushveld saffron |
| *Ptereocarpus angloensis* | Wild Teak |
| *Lydenburgia cassinoides* | Sekhukhuni Bushman Tea |
| *Pittosporum viridiflorum* | Cheesewood |
| *Sclerocarya birrea* subsp. *caffra* | Marula |
| *Sideroxylon inerme* subsp. *inerme* | White Milkwood |

# 3. RESULTS OF THE FIELD ASSESSMENT: SUBSTATION ALTERNATIVES

The vegetation and vegetation determinants for each alternative substation site are discussed below. Plant species identified at substation sites are listed in Appendix B. The discussed vegetation and ecological features are geographically represented in Figure 10, after the discussion on the powerline corridors (Section 4).

## 3.1 Substation Alternative 1 Site

### 3.1.1 Summary of background information: Substation alternative 1

Table 6 below summarises the determinants of the vegetation on site.

**Table 6: Summary of the background information of the substation alternative 1 site**

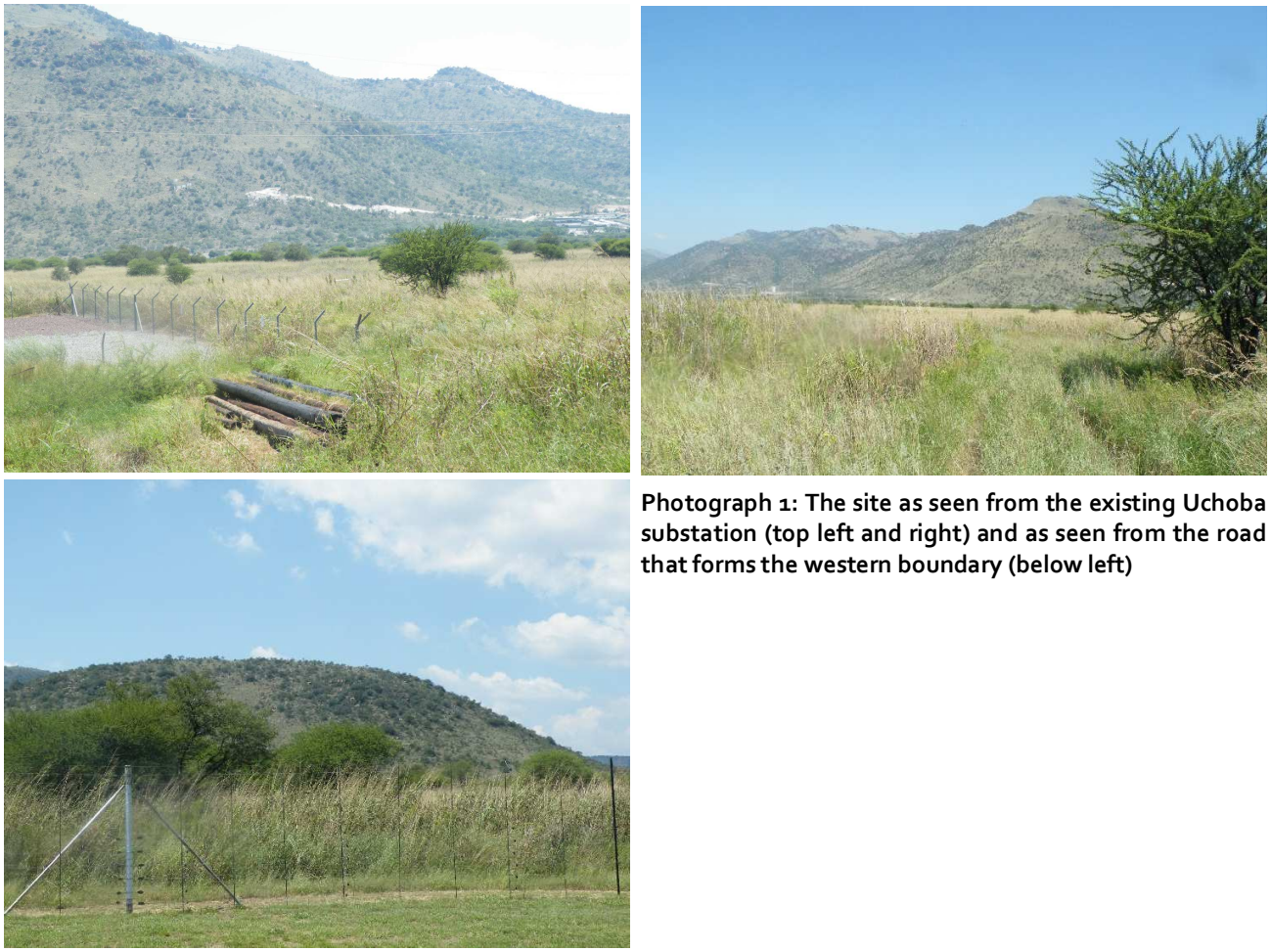
| | |
|---|---|
| **Land Use** | Topographic maps indicated that the Alternative 1 site was historically cultivated. At the time of the site visit, the land was dominated by grassland with some *Acacia* tree species. The land forms part of a mining area, but has not been mined. The Uchoba substation is situated adjacent to the south-eastern corner of this proposed substation site. |
| **Ecological features** | The Alternative 1 substation is positioned in open veld and slope gently from the south-eastern corner (930m) to the eastern boundary (920m). The Dwars River flows between 300 and 600m south and west of the site. A ridge / koppie is situated east of the site, across from the road to Lydenburg. |
| **Vegetation type** | Sekhukhune Mountain Bushveld – Least Threatened |
| **C-Plan** | The site is situated in an area classified as having "No Natural Habitat Remaining" and therefore have little conservation value. |
| **Listed ecosystem** | Situated within the Sekhukhune Mountainlands Ecosystem. However, the vegetation was historically disturbed and no longer in a primary state |

### 3.1.2 Vegetation groupings on site

The Alternative 1 site could not be accessed due to electrical fencing. The site is situated in a mining area which at the time of the site visit was using explosives and therefore access was denied. However, the site could be viewed from the road and from the existing Uchoba substation.

The site was dominated by a dense grass layer and an intermittent occurrence of *Acacia*-trees (Photograph 1). The grass layer included species such as *Hyparrhenia hirta* (Common Thatching Grass), *Heteropogon contortus*, *Aristida congesta* subsp *congesta* and *Sorghum* cf *bicolor* (Common Wild Sorghum). The dominant tree was *Acacia nilotica* (Scented-pod) which often colonises disturbed areas (Schmidt *et al,* 2007). Around the Uchoba substation, elevated soil moisture was noted. However, no obligate wetland plants (plants that must grow in saturated conditions) were observed from accessible areas and it is likely the clay soils present on the site holds moisture for longer periods, giving rise to seasonal elevated soil moisture.

Prior to the historic cultivation on the site, the vegetation would have comprised of bushveld vegetation with a higher diversity and density of trees species. After cultivation of the site ceased, it became colonised by pioneer species and could theoretically, through succession, become bushveld over time.



**Photograph 1: The site as seen from the existing Uchoba substation (top left and right) and as seen from the road that forms the western boundary (below left)**

### 3.1.3 Plants of conservation concern

It was evident that the species diversity on Alternative 1 site was lower than surrounding natural vegetation and that the site is unlikely to house plants species that are of conservation concern due to the historic cultivation.

### 3.1.4 Alien invasive plant species

The following invasive weeds were noted on Alternative 1 site: *Sesbania bispinosa* (Category 1 CARA), the naturalised *Tagetes minuata* (Khaki Bush), the grass *Sorghum halepense* (Category 2, CARA) and the invasive *Vicia sativa* (Purple Vetch) (Appendix B).

### 3.1.5 Vegetation sensitivity

The vegetation on the site was in a secondary state and comprised a lower species diversity than what can be expected from Sekhukhune Mountain Bushveld. No plants of conservation concern was observed and it is unlikely that any of the species listed in Table 3 occur on this site. Furthermore, the Mpumalanga Biodiversity Conservation Plan (MBCP) acknowledge that the site has no natural habitat remaining. Therefore, this report classifies the substation Alternative 1 site as being of low vegetation sensitivity and therefore suitable for the proposed substation development (Table 7).

**Table 7: Sensitive ranking: Alternative 1 site**

| Site | Conservation Status of regional Vegetation unit | Listed Ecosystem | Legislated protection | Plants of conservation concern | Ecological Function | Conservation Importance | Total Score out of max of 18 |
|---|---|---|---|---|---|---|---|
| **Alternative 1** | **N/A No natural veg** | **0** | **0** | **1** | **2*** | **2*** | **5 LOW** |

* This number is likely lower. However, the site could not be assessed and therefore the precautionary approach was taken

## 3.2 Substation Alternative 2 Site

### 3.2.1 Summary of background information: Substation alternative 2

Table 8 below summarises the determinants of the vegetation on site.

**Table 8: Summary of the background information of the substation alternative 2 site**

| | |
|---|---|
| **Land Use** | The R577 road forms the northern boundary to the site. Google Earth aerial images indicated that a small portion of the Alternative 2 site was historically cultivated. At the time of the site visit, the historically cultivated area was dominated by the small shrub and near endemic *Petalidium* cf *oblongifolium* and the indigenous encroacher *Dichrostachys cinerea*, while the remainder of the land was in a natural bushveld condition. A number of dirt roads exist and grazing was evident. |
| **Ecological features** | The Alternative 2 site sloped gently from the northern boundary (960m) to the south and south-eastern corner (946m) The site is situated about 400m east of an unnamed non-perennial river. |
| **Vegetation type** | Sekhukhune Mountain Bushveld – Least Threatened |
| **C-Plan** | The site is situated in an area classified as being of "Least Concern" to reach conservation targets and are therefore of limited conservation value. |
| **Listed ecosystem** | Situated within the Sekhukhune Mountainlands Ecosystem. Although a portion of the site was historically cultivated, much of the site remain in a semi natural to natural bushveld state |

### 3.2.2 Vegetation groupings on site

A portion of the Alternative 2 site was assessed. The site included a historically cultivated part which was dominated by what was perceived to be *Petalidium oblongifolium* (no flowers or seed were present). This small shrub is a near-enedimic to the region and seems to have benefited from the clearing of vegetation. In addition, the indigenous encroacher tree *Dichsrostays cinerea* (Sickle Bush) grew abundantly in the historically cultivated parcel (Photograph 1). The vegetation surrounding this disturbed patch was representative of the Sekhukhune Mountain bushveld and included trees such as *Acacia senegal*, *A. burkei* *Terminalia prunioides*, *Gymnosporia senegalensis*, *Boscia foetida* and *Commiphora africana* (Hairy Corkwood). Tall shrubs included *Euclea crispa*, *Tinnea rhodesiana*, *Grewia varinosa*, *Asparagus* species and the succulent *Aloe castanea*. The climber *Buttonia superba* and *Clematis brachiara* (Photograph 3) were noted growing over shrubs and small trees. The geophyte *Jatropha schlechteri* and the small succulent *Euphoria schinzii* were also noted.

**Photograph 2: A parcel of historically cultivated land on Alternative 2 site**

**Photograph 3: *Aloe castanea* and the climber *Buttonia superba* on Alternative 2 site**

### 3.2.3 Plants of conservation concern

Much of the site is in a natural state, with some impacts due to grazing. The bulb *Drimia altissima* was confirmed to occur. This plant is classified as Declining. In addition, the site also included an orchid, *Eulophia petersii* that grew abundantly around the previously disturbed patch as well as *Aloe castanea* (all orchids and Aloe species such as *A. castanea* are provincially protected) (Photograph 4).

**Photograph 4: the provincially protected orchid, *Eulophia petersii*, was confirmed to grow on the Alternative 2 site**

### 3.2.4 Alien invasive plant species

Around the historically cultivated area, the prohibited *Cereus hildmannianus* (Queen of the night cactus) grew in high numbers. This plant is prohibited by section 65(1) of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) and must be removed. No permits to retain or grow these plants will be granted.

### 3.2.5 Vegetation sensitivity

The vegetation on a parcel of the site (about 2,2ha of the 25ha site) was historically cultivated and comprised an almost homogenous layer of the shrub *Petalidium oblongifolium* and *Dichrostachys cinerea* The rest of the site comprised natural bushveld vegetation and the Declining bulb species (*Drimia altissima*), as well as provincially protected plants were observed. The species diversity is relatively high and the potential exist for more plants of concern to occur. However, as per the Mpumalanga Biodiversity Conservation Plan (MBCP) the site is situated in an area of Least Concern. The sensitivity ranking indicated that the site is of a high sensitivity (Table 9). It must be noted that the whole site was not surveyed and therefore the precautionary principle was applied in the ranking.

**Table 9: Sensitive ranking: Alternative 2 site**

| Site | Conservation Status of regional Vegetation unit | Listed Ecosystem | Legislated protection | Plants of conservation concern | Ecological Function | Conservation Importance | Total Score out of max of 18 |
|---|---|---|---|---|---|---|---|
| **Alternative 2** | **0** | **2** | **3#** | **2** | **3*** | **3*** | **13 HIGH** |

#listed ecosystem *likely lower, but the whole site was not assessed thus the precautionary approach applied.

## 3.3 Substation Alternative 3 Site

### 3.3.1 Summary of background information: Substation alternative 3

Table 10 below summarises the determinants of the vegetation on site.

**Table 10: Summary of the background information of the substation Alternative 3 site**

| | |
|---|---|
| **Land Use** | Topographical maps as well as historical aerial imagery (Google Earth) indicated that the northern and eastern portion of the site were cultivated (contour planting) in the past. A dirt road passed through the northern portion of the site and divides the site in a northern and southern section. The northern portion was recently burnt and heavily grazed by cattle and goats, while grazing pressure on the southern section was less. The area west of the site was enclosed by a game fence. |
| **Ecological features** | Eroded drainage lines is situated directly north of the site. The site is situated on the foot slope of a mountainous area west thereof. |
| **Vegetation type** | Sekhukhune Mountain Bushveld – Least Threatened |
| **C-Plan** | The site is situated in an area classified as being of "Least Concern" to reach conservation targets as well as having "No natural habitat remaining" (likely due to historic cultivation) and are therefore of limited conservation value. |
| **Listed ecosystem** | Situated within the Sekhukhune Mountainlands Ecosystem. Although a portion of the site was historically cultivated, much natural bushveld vegetation re-colonised the site. |

### 3.3.2 Vegetation groupings on site

A portion of the Alternative 3 site was assessed. The northern portion comprised a high frequency of the *Euclea crispa* subsp *crispa* as well as *Euclea linearis* (Photograph 5). *Euclea crispa* is an indigenous species that can encroach into disturbed areas ((Regulation 16of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)). The most prominent tree was *Bolosanthus speciosa* (Tree Wisteria), while *Acacia robusta, Ziziphus mucronata, Searsia lancea* and *Combretum* species were also noted. The northern portion of the site was overgrazed and the grass layer was grazed short or was absent. Herbaceous species included *Aptosimum lineare, Geigeria burkei*, a *Felicia* species, *Leucosphaera bainesii* and *Crabbea* cf *aucalis*. It is thought that the historic disturbances, followed by grazing, advanced the

encroachment of *Euclea* over much of the northern portion of the site. If grazing was to be restricted and provided that no additional negative impacts takes place, the secondary bushveld will likely become representative of the original vegetation that occurred prior to the disturbances.

### 3.3.3 Plants of conservation concern

The protected tree *Sclerocarrya birrea* subsp *caffra* (Marula) grew on the site. Although no other protected or threatened plants were observed, there is a high likelihood that these plants will occur on the south-western corner of the site where no prior disturbances were noted.

**Photograph 5: *Euclea crispa* re-sprouting after a fire (top lef and goats and cattle overgraze portions of the site (top rig and below)**

### 3.3.4 Alien invasive plant species

The invasive weed *Lantana camara* (Category 1B, NEMBA) was noted on site as well as *Solanum nigrum* (Nightshade) (naturalised weed) (Appendix B).

### 3.3.5 Vegetation sensitivity

A portion of the site was historically cultivated. However, bushveld vegetation re-colonised the site. Most of the northern section of the site was overgrazed and degrading further due to encroachment my *Euclea crispa* (indigenous bush encroacher). The (MBCP) classifies the site as being situated within an area of 'Least Concern' and 'No Natural Habitat Remaining'. However, the protected tree *Sclerocarya birrea* subsp *caffra* occurs on the site and there is a likelihood of threatened plant species occurring. The sensitivity ranking indicated that the site is of a medium sensitivity (Table 11). It must be noted that the whole site was not surveyed and therefore the precautionary principle applied in the ranking.

**Table 11: Sensitive ranking: Alternative 3 site**

| Site | Conservation Status of regional Vegetation unit | Listed Ecosystem | Legislated protection | Plants of conservation concern | Ecological Function | Conservation Importance | Total Score out of max of 18 |
|---|---|---|---|---|---|---|---|
| Alternative 2 | 1 | 2 | 3# | 2 | 2 | 2* | **12 MEDIUM** |

#listed ecosystem *likely lower, but the whole site was not assessed thus the precautionary approach applied.

## 4. RESULTS OF THE FIELD ASSESSMENT: POWERLINE ALTERNATIVES

Each powerline corridor was assessed mainly via desktop information. A powerline corridor comprises the proposed line plus a 1km buffer on either side (thus 2km in total) in which potential sensitivities are discussed and mapped.

### 4.1.1 Background Information

The powerline corridors traverse much of the same vegetation and land uses. Each Alternative is specific to an Alternative substation. However, some powerline corridors are similar for different Alternatives sites. The background information for all three powerline corridors is compared in Table 12. From Table 12, it is deduced that Alternative 1 is likely to have the smallest footprint on natural areas as it follows an existing powerline for much of its extent (Figure 10).

**Table 12: Summary of background information for the powerline corridor alternatives**

| Feature | Alternative 1 corridor | Alternative 2 corridor | Alternative 3 corridor |
|---|---|---|---|
| **Land Use** | From the existing Senakangwedi substation to the proposed Senakangwedi B substation, this corridor follows much of the *same alignment as an existing Eskom powerline*. Around the existing Senakangwedi substation, the area has been historically disturbed and the area was found to be overgrazed. Along the route, patchy disturbances due to mining activities, historic cultivation and high grazing pressure were noted. However, the vegetation comprised mainly of natural to semi-natural bushveld vegetation.<br><br>From the proposed Senekangwedi B to the approved Tubatse powerline along the R55, the route aligns westward through mostly natural bushveld with some localised disturbances evident. | From the existing Senakangwedi substation this corridor is the same as Alternative 1 for the first approximate 14km; hereafter Alternative 2 aligns westward through natural bush to the proposed Senakangwedi B substation, Alternative 2 site.<br><br>From the proposed Senekangwedi B to the approved Tubatse powerline along the R55, the route aligns westward through mostly natural bushveld with some localised disturbances evident – most of this route is the same as that of Alternative 1. | From the existing Senakangwedi substation this corridor is the same as Alternative 1 for the first 7km; hereafter an option of the corridor 3 aligns eastward through natural bushveld to the proposed Senakanwedi substation 3. A portion of this route aligns with an existing powerline.<br><br>From the proposed Senekangwedi B to the approved Tubatse powerline along the R55, the route aligns westward pass mining areas and natural bushveld where after the route joins up with the Alternative corridor 1 and 2 through bushveld with some localized disturbances. |
| **Rivers** | This corridor crosses numerous drainage lines/non-perennial rivers to the Steelporrt River. It also crosses the Dwars River 3 times in proximity to proposed substation Alternative 1 site (Figure 8). About 3km north-west of the substation Alternative 1 site, the corridor aligns parallel in close proximity to a drainage line / non-perennial river for about 2km. It is preferred that linear developments no align parallel with | This corridor crosses numerous drainage lines/non-perennial rivers to the Steelporrt River. It also crosses the Dwars River 3 times in proximity to proposed substation Alternative 1 site (Figure 8). | This corridor crosses numerous drainage lines/non-perennial rivers to the Steelpoort River. It also crosses the Dwars River 3 times in proximity to proposed substation Alternative 1 site (Figure 8). North east of the substation Alternative 2 site, the corridor aligns parallel in close proximity to a drainage line / non-perennial river for about 2km. it is preferred that linear developments no align parallel with watercourses. This drainage line |

| Feature | Alternative 1 corridor | Alternative 2 corridor | Alternative 3 corridor |
|---|---|---|---|
| | watercourses. It must be noted that this area is badly eroded. | | is badly eroded. |
| **Vegetation type** | Sekhukhune Plains Bushveld (Endangered) in its most northern portion of the corridor. Sekhukhune Mountain Bushveld (Least Threatened) for the bulk of the route (Figure 3). | Sekhukhune Plains Bushveld (Endangered) in its most northern portion of the corridor. Sekhukhune Mountain Bushveld (Least Threatened) for the bulk of the route (Figure 3). | Sekhukhune Plains Bushveld (Endangered) in its most northern portion of the corridor. Sekhukhune Mountain Bushveld (Least Threatened) for the bulk of the route (Figure 3). |
| **C-Plan (Mpumalanga)** | The corridors traverse large portions of "Least Concern" as well as "No natural habitat remaining". However, "Important" and "Highly Significant" areas are also traversed - these areas correspond greatly with mountainous areas (Figure 5). | The corridors traverse large portions of "Least Concern" as well as "No natural habitat remaining". However, "Important" and "Highly Significant" areas are also traversed - these areas correspond greatly with mountainous areas (Figure 5). | The corridors traverse large portions of "Least Concern" as well as "No natural habitat remaining". However, "Important" and "Highly Significant" areas are also traversed - these areas correspond greatly with mountainous areas (Figure 5). |
| **Listed ecosystem** | The southern portion of this corridor is situated within the Sekhukhune Mountainlands Ecosystem. | The southern portion of this corridor is situated within the Sekhukhune Mountainlands Ecosystem. | The southern portion of this corridor is situated within the Sekhukhune Mountainlands Ecosystem. |
| **Elevation / presence of hills/mountains (Slope >5%)** | This corridor will traverse foot slopes with a 5% or steeper slope (GDACE, 2001). The route does not traverse highest portions of the hills/mountains, while some of the foot slopes are somewhat degraded (Figure 9). | This corridor will traverse foot slopes with a 5% or steeper slope (GDACE, 2001). The route does not traverse highest portions of the hills/mountains, while some of the foot slopes are somewhat degraded (Figure 9). | This corridor will traverse foot slopes with a 5% or steeper slope (GDACE, 2001). The route does not traverse highest portions of the hills/mountains, while some of the foot slopes are somewhat degraded (Figure 9). |

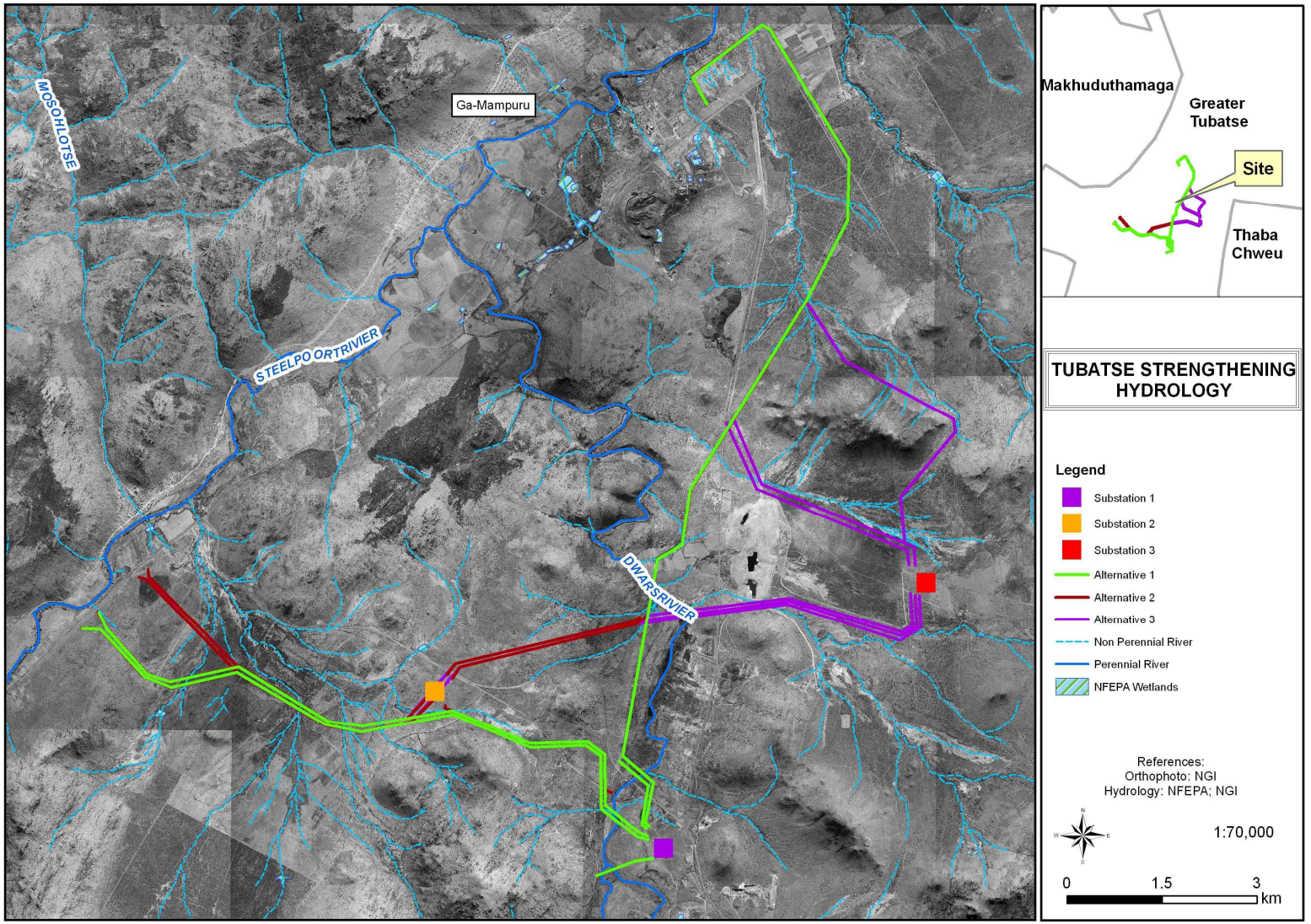



**Figure 8: Hydrology map of the area**

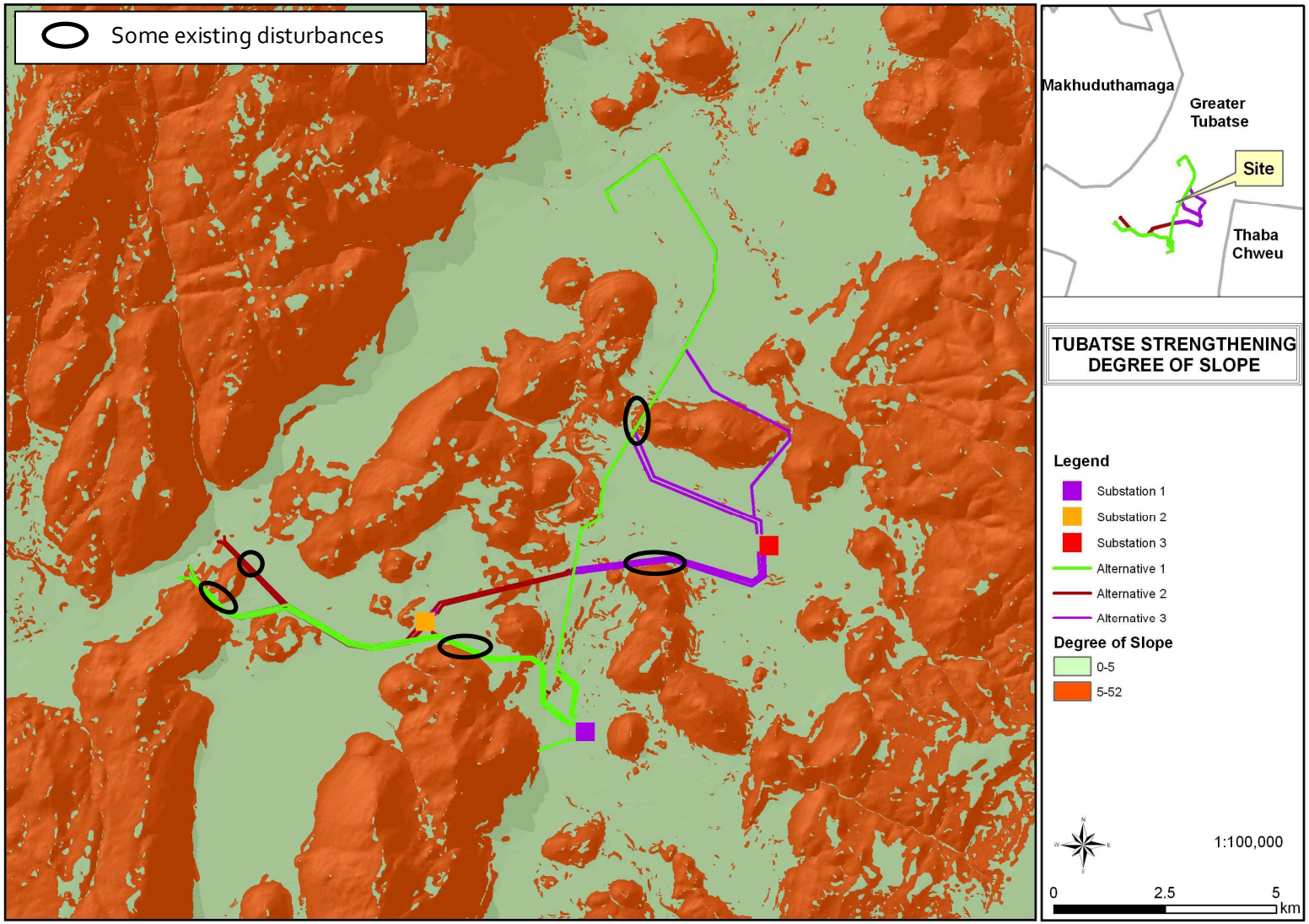



**Figure 9: Powerline corridors in relation to ridges and hills**

### 4.1.2 Sensitivity Ratings

At the time of the field survey, the exact powerline routes were not known. However, the general area was scanned and ecological features such as mountain, hills and rivers were discussed with the surveyors during a scouting trip. The proposed lines thus took these ecological concerns into account as far as possible. Due to the area covered by the proposed lines, including a 1km buffer on either side of the proposed route, each vegetation community along the three proposed routes were not mapped, especially as the lines were not ground-truthed. Therefore, the sensitivity mapping rules as per Table 13 were applied to each corridor (powerline route and 2km buffer). The resulting sensitivity map is presented in Figure 10.

**Table 13: Sensitivity along the proposed powerline corridors**

| Category | Rationale | Sensitivity |
|---|---|---|
| **Slopes higher steeper than 5%** | Slopes higher than 5% was considered a ridge/hill/kopppie/mountain as per the Gauteng Department of Agriculture, Conservation, Environment and Landcare (2001) guideline for ridges in Gauteng. Ridges are known to support a higher and more specialised species diversity and provide refuge for plant and animal species. Therefore their protection contributes to conservation of biodiversity. According to climate change modelling, level topography will be particularly sensitive to future climate change and major extinction in these areas can be expected (Rutherford *et al.*, 2001). As such, in a landscape affected by climate change chances for species survival will be higher on ridges (GDACEL, 2011). These areas likely include sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity with a high degree of connectivity with other ecological systems. | High |
| **C-plan "Important" and "Highly significant" areas** | The areas indicated in the Mpumalanga C-plan that are of conservation concern overlap greatly with the distribution of hills and ridges along the corridors. This sensitivity was thus incorporated into the slope assessment (above) | |
| **Watercourses: Wetlands, rivers and drainage lines** | All watercourses in South area is protected by law (Regulation 1199 of the National Water Act, 1998 (Act 36 of 1998). Activities within watercourses, within the associated protective buffer zones or within 500m of a wetland (Regulation 1199 of the National Water Act, 1998 (Act 36 of 1998) are subjected to strict mitigation measures and authorisation from the Department of Water Affairs (DWA) in order to protect and sustainably utilise South Africa's water resources. Riparian land is very valuable as it is the most fertile and productive part of a landscape (Land for Wildlife, 2002). The interaction between land and water in the riparian zone provides a range of micro-habitats that support a diverse range of flora and fauna. Highly fertile soils and moist conditions | High |

| Category | Rationale | Sensitivity |
|---|---|---|
| | increase the establishment and growth of a diverse range of plant species (Land for Wildlife, 2002). | |
| **Transformed** | These areas include land uses such as mines, quarries, diggings, cultivation and urbanisation. Degraded and highly disturbed vegetation with little ecological function and little or no conservation potential - usually species poor (most species are usually exotic). | Low |
| **Secondary bushveld, areas with where high grazing pressure was confirmed** | These areas were noted to have either been historically cultivated or were impacted by some disturbance. However, succession lead to re-colonisation of the area by pioneer bushveld species. In addition, areas where overgrazing was evident was also included as these areas still comprise a natural species composition, although it is in a cycle of degradation. This category has some connectivity with other ecological systems e.g. natural bushveld, rivers or hills. | Medium to low |
| **Semi-natural to natural areas** | The remaining vegetation was *assumed* to be in a semi-natural to natural state. The high level of endemism in the area, as well as the high likelihood of protected trees and plants of conservation concern (threatened or Red Data Plants) occurring within the corridors require that the precautionary principle be applied and these areas be classified as medium-high sensitivity until such time as a walk-down of a line can confirm the communities present. | Medium to high |

In addition, the areas (in hectares) per corridor that traverse areas of low sensitivity were calculated, as well as areas of high conservation concern as per the MBCP (Table 14).

**Table 14: Areas of sensitivities per corridors**

| Area in hectares (ha) | Total area of buffer | Mpumalanga C-plan | | | | Transformed |
|---|---|---|---|---|---|---|
| | | Highly significant | Important & Necessary | Least Concern | No Natural Habitat | |
| **Alternative 1** | 4893,16 | 1403,30 (28%) | 682,80 (14%) | 1651,30 (34%) | 1155,70 (24%) | 824,68 (17%) |
| **Alternative 2** | 5145,67 | 1445,90 (28%) | 701,40 (14%) | 1783,10 (35%) | 1215,20 (24%) | 853,17 (17%) |
| **Alternative 3** | 5855,85 | 918,30 (16%) | 749,50 (13%) | 2851,30 (48%) | 1336,60 (23%) | 943,69 (16%) |

Although Alternative 1 powerline is the second longest, the Alternative 1 corridor is the smallest corridor as the line into and out of the Alternative 1 site is situated more-or-less within the same corridor area. The Alternative 3 corridor comprises the largest area. Although Alternative 1 seemingly traverses the most areas of concern and the least areas of low sensitivity, the percentage is similar to that of Alternative 2. In addition, the areas within Alternative 1 corridor that are 'Highly Significant', include areas around the substation Alternative 1 site, which was found not to be in a primary state at

the time of the site visit. Alternative 3 traverses the smallest extent of concern (as per the MBCP). However, north of the substation Alternative 3 site, the Alternative 3 corridor traverse between mountainous areas, while Alternative 1 and 2 follows an existing line and disturbance areas.

The Alternative 1 powerline corridor impacts on the smallest area and much of its extent aligns with an existing powerline. In addition, this corridor connects to the only substation site of low sensitivity (substation Alternative 1), and are therefore the preferred route.

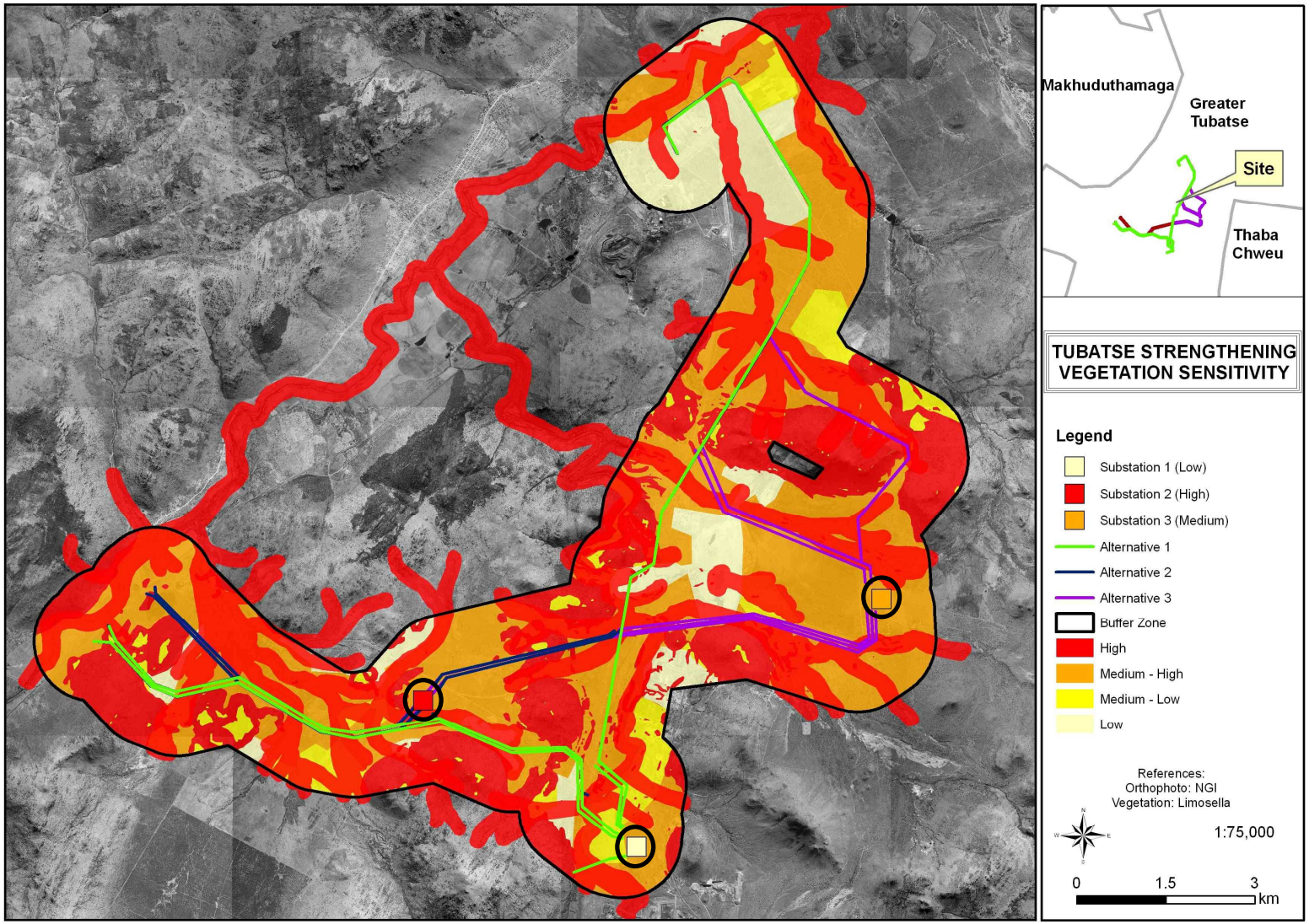



**Figure 10: Composite sensitivity map for the proposed corridors and substation alternative sites**

# 5. IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for a large number of ecological services provided for by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

## 5.1 Potential Impacts of Powerlines on Vegetation

The most significant impact of electrical powerlines are expected to occur during the construction phase, whereas the new pylons and powerlines, once in use, have relatively contained impacts on the vegetation and can successfully be mitigated to limit or even negate the negative impacts. Arguably the greatest threat to the rehabilitation of disturbed areas, are the potential of invasive plant species to colonise the disturbed soil and spread into adjacent natural areas. If remedial measures and monitoring is properly employed, (e.g. ESKOM's erosion guidelines and environmental policies as well as mitigation as set out by this report), the vegetation that will be disturbed during construction could rehabilitate well over time, and long term impacts on vegetation and faunal habitats could thus be minimal. Furthermore, where existing roads or servitudes are employed during construction and implementation, the impacts of these when compared with extensive agriculture, rural settlements or urbanisation, can be considered as medium to low.

## 5.2 Impact Assessment Criteria

The possible impacts, as described in the next section, were assessed based on the Significance Rating Matrix below.

The Significance of the impact is calculated as follows:

| **Significance = Consequence** (Magnitude+ Duration+ Extent + Reversibility) **X Probability** |
|---|

Wherein the following meaning applies:

The *Magnitude* of the impact is quantified as either:

- Low: Will cause a low impact on the environment;
- Moderate: Will result in the process continuing but in a controllable manner;
- High: Will alter processes to the extent that they temporarily cease; and
- Very High: Will result in complete destruction and permanent cessation of processes.

The *Duration* (Exposure) which indicates whether:

- The impact will be immediate;
- The impact will be of a short tem (Between 0-5 years);
- The impact will be of medium term (between 5-15 years);
- The impact will be long term (15 and more years); and
- The impact will be permanent.

*Reversibility/ Replaceability.* This refers to the degree to which the impact can be reversed or the lost resource can be replaced.

The *Probability*: which shall describe the likelihood of impact occurring and will be rated as follows:

- Extremely remote: Which indicates that the impact will probably not happen;
- Unusual but Possible: Distinct possibility of occurrence;
- Can Occur: there is a possibility of occurrence;
- Almost Certain: Most likely to occur; and
- Certain/ Inevitable: Impact will occur despite any preventative measures put in place.

| RANKING | MAGNITUDE | REVERSIBILITY | EXTENT | DURATION | PROBABILITY |
|---|---|---|---|---|---|
| 5 | Very high/ don't know | Irreversible | International | Permanent | Certain/inevitable |
| 4 | High | | National | Long term (impact ceases after operational life of asset | Almost certain |
| 3 | Moderate | Reversibility with human intervention | Provincial | Medium term | Can occur |
| 2 | Low | | Local | Short term | Unusual but possible |
| 1 | Minor | Completely reversible | Site bound | Immediate | Extremely remote |
| 0 | None | | None | | None |

| RANKING | 65-100 | 64-36 | 35-16 | 15-5 | 1-4 |
|---|---|---|---|---|---|
| SIGNIFICANCE | Very High | High | Moderate | Low | Minor |

## 5.3 Impacts Assessment

Table 14 list the activities that could impact on the vegetation as a result of the construction of the proposed powerline and Senakangwedi B substation, as well as impacts that may be associated with the operation and maintenance thereof. The impacts are assessed in Table 14 below and suitable mitigation measures are given in Section 5.4.

**Table 15: Assessment of impacts associated with the construction and operation of the powerline and substation (this is a general assessment for all three alternatives)**

| | Impact | Nature of Impact | Magnitude | Reversibility | Extent | Duration | Probability of occurrence | Ranking | Significance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Without Mitigation | With Mitigation |
| CONSTRUCTION PHASE | 1. Destruction of natural vegetation | • Clearing of vegetation for tower erection, access roads, substation footprint and construction camps<br>• Damage to vegetation in and adjacent to access roads and construction areas<br>• Illegal disposal and dumping of construction material such as cement or oil as well as maintenance materials during construction;<br>• Storage of metal structures within vegetation | High 4<br>Moderate 3 | Reversible 3<br>Reversible 3 | Local 2<br>Site bound 1 | Short term 2<br>Short term 2 | Certain 5<br>Can occur 3 | 50<br>27 | High | Moderate |
| | 2. Exposure of the soil to erosion and subsequent sedimentation of perennial and non-perennial rivers | • Removal of vegetation without proper rehabilitation | High 4<br>Moderate 2 | Reversible 3<br>Reversible 3 | Local 2<br>Site bound 1 | Short term 2<br>Short term 2 | Can occur 3<br>2 (if rehabilitated asap) | 33<br>18 | Moderate | Moderate |
| | 3. Possible destruction of plants of | • Construction activity where these plants potentially occur, especially within the route corridors as per Table 3 | High 4<br>Moderate 3 (if all | Irreversible 5<br>Reversible 3 | National 4<br>Local 2 | Long term 4<br>Medium | Almost certain 4<br>Can occur | 68<br>33 | Very high | Moderate |

| | Impact | Nature of Impact | Magnitude | Reversibility | Extent | Duration | Probability of occurrence | Ranking | Significance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Without Mitigation | With Mitigation |
| | conservation concern | | species can be avoided or removed & used for rehabilitation) | | | term 3 | 3 | | | |
| | 4. Spread of alien invasive vegetation | • Contaminated construction vehicles and tools; and<br>• Alien invasive species spread from current infestation into disturbed soils | Moderate 3<br>Low 2 | Reversible 3<br>Reversible 3 | Local 2<br>Site bound 1 | Medium term 3<br>Short term 2 | Can occur 3<br>Unusual but still possible 2 | 33<br>16 | Moderate | Moderate to low |
| | 5. ***Positive*** impact by removing alien invasive plants from the substation and power line route footprint, although care must be taken not to remove all vegetation at once, especially within the rainy season (could result in soil erosion and soil | • Removing of existing invasive alien vegetation in areas proposed for the development and within servitudes | 0 | 0 | 0 | 0 | 0 | 0 | Positive impact | |

| | Impact | Nature of Impact | Magnitude | Reversibility | Extent | Duration | Probability of occurrence | Ranking | Significance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Without Mitigation | With Mitigation |
| | loss). | | | | | | | | | |
| | 6. Disturbance to non-perennial and perennial rivers and loss of stabilising vegetation | • Construction activities within the buffer areas;<br>• Linear development such as access roads through the non-perennial rivers | High 4<br>Low 2 | Reversible 3<br>Reversible 3 | Local 2<br>Site bound 1 | Short term 2<br>Short term 2 | Almost certain 4<br>Can occur 3 | 48<br>27 | High | Moderate |
| | 7. Soil compaction | • The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation and inhibit re-vegetation. | High 4<br>Moderate 2 | Reversible 3<br>Reversible 3 | Local 2<br>Site bound 1 | Long term 3<br>Immediate 1 (provided rehabilitation was undertaken immediately and effectively | Almost certain 4<br>Can occur 3 | 48<br>27 | High | Moderate |
| | 8. Destruction of natural | • Maintenance vehicles driving within natural vegetation<br>• Altered fire regime-natural fire | High 4<br>Low 2 | Reversible 3<br>Reversible 3 | Local 2<br>Site | Short term 2 | Can occur 3 | 33<br>16 | Moderate | Moderate |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | vegetation | prevented. | | | bound 1 | Short term 2 | Unusual but can still occur 2 | | | |
| | 9. Possible increase in exotic vegetation | • Alien vegetation spreading from existing infestation into disturbed soil, especially in the absence of successful rehabilitation. | Moderate 3 Low 2 | Reversible 3 Reversible 3 | Local 2 Site bound 1 | Medium term 3 Short term 2 | Can occur 3 Unusual but can still occur 2 | 33 16 | Moderate | Moderate to Low |
| | 10. Bush encroachment which will reduce species diversity | • Degradation of natural bushveld vegetation that could lead to the increase of bush encroacher species – especially in rehabilitation efforts failed | Moderate 3 Low 2 | Reversible 3 Reversible 3 | Local 2 Site bound 1 (if timeous action is taken) | Medium term 3 Short term 2 if timeous action is taken) | Can occur 3 Unusual but can still occur 2 | 33 16 | Moderate | Moderate to low |

## 5.4 General Mitigation Measures

### A. Construction Phase

#### 5.4.1 Destruction of natural vegetation

The construction of the powerline route would inevitably require the removal of vegetation for the purpose of access roads, servitudes and the substation and pylon footprints. Areas where structures are stored would flatten vegetation that could be detrimental to the persistence of the vegetation. In addition, the illegal disposal of construction material such as oil, cement etc. could destroy natural vegetation.

Mitigation measures

- Corridors with the least sensitivities or the ones with the most existing infrastructure e.g. access roads should take preference.
- The route corridor with the potentially has the smallest footprint within sensitive areas / vegetation take preference. Sensitivities within this corridor should still be avoided (where possible) by the final route alignment. In most corridors, there is enough space to circumvent hills and to span pans and riparian areas. Where this cannot be done in a corridor, another one of the alternative corridors should be investigated.
- An independent Ecological Control Officer (ECO) should be appointed to oversee construction.
- A temporary fence or demarcation must be erected around the construction area (include the servitude, construction camps, areas where material is stored and the actual footprint of the development) to prevent access to sensitive environs.
- Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area.
- No open fires are permitted within naturally vegetated areas.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Maintain as much vegetation cover as possible.
- A vegetation rehabilitation plan should be implemented. Due to the dry climate, natural colonisation could take a long time, in which vegetation may degrade further. Therefore, timeous rehabilitation is imperative. Even in the event of good rains, annual pioneer plants are short-lived and therefore an effort must be made to keep as many shrubs in place as possible or to replace these as part of rehabilitation. As a start, runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler, *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006).
- Construction workers may not remove flora and neither may anyone collect seed from the plants without permission from the provincial conservation authority.

- No activities should take place during rainy events and at least 2 days afterwards.
- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any uncovered species of conservation concern are protected from destruction. Note that the species could be dormant until favourable conditions arise.
- It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.

### 5.4.2 Exposure to erosion

Much of the soils within the corridors comprise dispersive soils and the area is prone to erosion in the event of good rainfall. Furthermore, the removal of surface vegetation will expose the soils, which in rainy events could cause sedimentation of watercourses. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees, or unpalatable shrubs that reduce grazing capacity, can spread easily into these eroded soil. Raindrops on bare soils disperses the clay fraction in the soil that settles into or block the soil pores on the surface, sealing it so that water cannot penetrate (Esler, *et al,* 2006).

#### Mitigation measures

- The route impacting mostly on disturbed areas should take preference.
- Do not allow erosion to develop on a large scale before taking action.
- No construction / activities should be undertaken within the moist soils until a Water Use License was granted by the Department of Water Affairs (DWA).
- Make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005).
- Runoff from roads must be managed to avoid erosion and pollution problems.
- Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.
- Runoff water needs to be trapped by either the mechanical breaking of the soil surface to trap water, packing of stones, tyres or brush along contours to trap mulch, slow down water movement and reduce the impact on bare soil (Esler *et al,* 2006). Pitter basins work well on fine textured soil and must be orientated and shaped to face upslope. The basins trap seeds, organic matter and water which could lead to rapid colonisation after rains (Esler, *et al,* 2006).
- Mulch and brush also reduces the force of raindrops, limiting the dispersion of clay and the extent of mineral crusting (Esler *et al,* 2006). It also traps dust, sand and seeds to ensure plant establishment (Esler *et al,* 2006).
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.

### 5.4.3 Removal / Destruction of protected plants and plants of conservation concern

The construction of the powerline / substation could result in the removal of plant species of conservation concern, impact on their habitat, pollinators and inevitably the persistence of these. This could put further strain on the already declining or rare populations. This includes protected tree species as well as endemic species.

#### Mitigation measure

- Where possible, construction activities must be restricted to previously disturbed areas.
- A suitably qualified person (botanist / horticulturist) should survey the final route alignment and pylon footprints within the growing season of the plants (summer months, preferably between November and February), in order to confirm whether these plants will be impacted upon, prior to the finalisation of the route and commencement of construction.
- Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activity, the plants should be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority).
- Any disturbance to protected tree species (e.g. pruning) nor removal of such trees can only be undertaken one a permit authorising the contractor to do so has been granted by the Department of Agriculture, Forestry and Fisheries DAFF).
- Ideally, an on-site ecologist should be present when excavation takes place to ensure that any species not identified during the EIA phase, or the final walk down are protected from destruction. Note that the species could be dormant for some time until favourable conditions arise.
- It is recommended that the construction crew be educated about the sensitivities involved along the route as well as the potential sensitive species they could encounter.
- Construction workers may not tamper or remove these plants and neither may anyone collect seed from the plants without permission from the local authority.
- Cordon off the sensitive vegetation that house the protected plant species and the plants of conservation concern and protect from construction activities and vehicles.
- Slight deviations of access road / pylon alignments must be permitted, so as to avoid plant populations of conservation concern (DWAF, 2005).

### 5.4.4 Potential increase in invasive vegetation

The seed of alien invasive plant species that occur on and in the vicinity of the construction areas could spread into the disturbed and stockpiled soil. Also, the construction vehicles and equipment were likely

used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site.

Mitigation measures

- Alien invasive species that were identified within the study area and in specific along the final route alignment should be removed prior to construction-related soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.
- All alien seedlings and saplings must be removed as they become evident for the duration of construction.
- Manual / mechanical removal is preferred to chemical control.
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO.

### 5.4.5 Positive impact by removing alien invasive plants

By removing alien vegetation along the route alignment, within corridors and construction camps, the numbers of alien species, as well as the potential for these plants to spread into disturbed soil are reduced, provided that rehabilitation was successful.

Mitigation measures

- Compile and implement an alien invasive monitoring plan to remove alien invasive plant species along the chosen route alignments, prior to construction.
- Rehabilitate all areas cleared of invasive plants as soon as practically possible, utilising specified methods and species.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. Monitoring should continue for at least three years after construction is complete and form part of the maintenance activities.
- Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc.
- Ensure that only properly trained people handle and make use of chemicals.
- Dispose of the eradicated plant material at an approved solid waste disposal site.
- Only indigenous plant species naturally occurring in the area should be used during the rehabilitation of the areas affected by the construction activities.

### 5.4.6 Disturbance to non-perennial and perennial rivers

Removal of vegetation surrounding drainage lines and within riparian areas could result in a disturbance and potential loss of faunal habitat associated with the stream as well as loss of mature trees which could destabilise soil conditions. In addition, all watercourses (including non-perennial rivers) in South Africa are protected by legislation and must be classified as no-go areas along with protective buffer

zones. Note that any activities within the watercourses (non-perennial rivers and natural channels included) are subject to authorisation by the Department of Water Affairs (DWA) by means of a Water Use License.

Mitigation Measures

- No construction / activities can be undertaken within the riparian area unless a Water Use License (WUL) was granted by the Department of Water Affairs.
- Where access through drainage lines and rivers is unavoidable, only one road is permitted, constructed perpendicular to the drainage line. Avoid roads that follow drainage lines within the floodplain.
- Roads should be elevated above the non-perennial rivers so as to minimise the destruction of the drainage bed.
- After construction, compacted soil access roads should be rip, mechanically break the surface to increase water infiltration.
- Construction should take place outside of the rainy season when the flow of the non-perennial rivers is at a minimum.
- Do not permit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area.
- Linear infrastructure should span across the rivers. Where it is unavoidable to place the pylon footprint within the protective buffer zones, the construction activities must be restricted to as small a footprint possible and rehabilitation undertaken as soon as construction is complete.
- It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.

### 5.4.7 Soil compaction

The movement of heavy machinery will result in soil compaction that will modify habitats, destroy vegetation and inhibit re-vegetation. Soil compaction as a result of construction vehicles and traffic, could lead to a decrease of water infiltration and an increase of water runoff.

Mitigation measures:

- Construction (and maintenance) vehicles may not veer from the dedicated roads.
- Once construction is complete, obsolete roads should be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, while the natural species composition should be re-established.
- It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.

**B Operation Phase**

### 5.4.8 Destruction of natural vegetation

During the operational phase, maintenance vehicles could impact on rehabilitated and natural vegetation. In addition, the cleared servitudes could alter the fire regime.

Mitigation measures

- Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.
- Maintenance vehicles must not veer from dedicated access roads and activities should be restricted to the previously disturbed footprint.
- It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas.

### 5.4.9 Possible increase in exotic vegetation

If rehabilitation of the indigenous vegetation along the new powerline route is unsuccessful or is not enforced, exotic and invasive vegetation may increase.

Mitigation measures

- Implement an alien invasive plant monitoring and management plan whereby the spread of alien and invasive plant species into the areas disturbed by the construction of the powerline are regularly removed and re-infestation monitored.

### 5.4.10 Deterioration of natural vegetation and bush encroachment

The vegetation occurring along the constructed powerline could degrade over time if suitable rehabilitation of the disturbed soils as well as re-vegetation did not take place. Furthermore, maintenance work and vehicles could damage the vegetation along the route which could lead to soil erosion, habitat modification, trampling of vegetation as well as the destruction of protected plants and plants of conservation concern. Trees such as *Dichrostachys cinerea, Euclea cripsa, Termicalia sericea* and *Combretum apiculatum* occur along the proposed corridors and at the proposed substation localities. These species, in large numbers and dominant stands, are known as an indicator species of bush encroachment. Bush encroachment is the process which transforms whereby an indigenous tree species starts to dominate the vegetation to the expense of other species. This also leads to a change in vegetation structure e.g. open woodland with a well-developed grass layer can become close woodland with limited grazing potential. This is recognised as a very serious problem throughout Sub-Saharan Africa, as it means that large areas of grazing lands are lost (or reduced in capacity), and it transforms habitats and reduces species diversity.

Mitigation measures

- Leave as much natural vegetation as intact as possible during construction;

- Do not disturbed soil unnecessary during maintenance.
- Monitor rehabilitation and do not allow grazing to take place until such time that re-vegetation was found to be successful.
- After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction.
- Ensure that maintenance work does not take place haphazardly, but according to a fixed plan.
- Monitor rehabilitation and ensure that bush encroachers and alien invasive species are dealt with in accordance to the EMP.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- Delay the re-introduction of livestock (where applicable) to all rehabilitated areas until an acceptable level of re-vegetation has been reached.
- Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.

## 6. CONCLUSION

The substation Alternative 1 site was found to be of low sensitivity, while the substation Alternative 2 and 3 sites were of high and medium sensitivity. The Alternative corridors were assessed based on desktop studies as well as a scan of the general area that the line will traverse. The areas of sensitivity along the three powerline corridors were found to be more or less comparable. Much of the extent of the Alternative corridor 1 aligns with an existing powerline. This corridor also connects with the only substation site that was classified as being of low sensitivity (Substation Alternative 1). Alternative corridor 2 is comparable to Alternative corridor 1. However, this corridor connects to a substation site that was classified as being of high sensitivity. Alternative corridor 3 is the longest route and will traverse a potentially sensitive mountainous area north of the proposed substation Alternative 3 site. Therefore, Alternative corridor 1, with the substation Alternative 1 site is the preferred route, where after the Alternative 2 corridor, with the substation Alternative 2 site is the second preferred route.

## 7. REFERENCES

Bromilow, C, (2010): Problem Plants of Southern Africa. Third edition, first impression Briza Publications, Pretoria.

Ferrar, A.A. & Lötter, M.C. (2007): Mpumalanga Biodiversity Conservation Plan Handbook. Mpumalanga Tourism & Parks Agency, Nelspruit.

Gauteng Department of Agriculture, Conservation, Environment and Landcare (2001): Development guidelines for ridges. Updated April 2006.

Government Gazette No 32689, (2009): Draft National List of Threatened Ecosystems in terms of the National Environmental Management Act, 2004 (Act 10 of 2004). Department of Environmental Affairs Notice 1477 of 2009 in Government Gazette No 32689, 6 November 2009.

Henderson, L., (2001): Alien Weeds and Invasive Plants. A complete guide to declared weeds and invaders in South Africa. Plant Protection Research Institute Handbook No. 12. Agricultural Research Council, South Africa.

Land for Wildlife. (2002): Managing and rehabilitating riparian vegetation. Land for Wildlife, note 17.

Lötter, M.C., Ferrar, A.A., (2006): Mpumalanga Biodiversity Conservation Plan Map. Mpumalanga Parks and Tourism Agency, Nelspruit.

McMurtry, D., Grobler, L., Grobler, J. and Burns, S., (2008): Field guide to the Orchids of Northern South Africa and Swaziland. Umdaus Press. Hatfield, Pretoria

Mpumalanga Tourism and Parks Agency (MTPA), (2008): Requirements for assessing and mitigating environmental impacts of development applications.

Mucina, L. & Rutherford, M.C. (2006): The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19. South African National Biodiversity Institute*, Pretoria.

Onderstall, J. (1996): Sappi Wild Flower Guide: Mpumalanga and Northern Province.

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama P.A., (eds) (2009): Red List of South African plants 2009. *Strelitzea* 25, South African National Biodiversity Institute.

Rutherford, M.C., Midgley, G.F., Bond, W.J., Powrie, L.W. & Robelo, A.G. (2001): Vulnerability of the plant diversity of South Africa to projected climate change. Paper presented at the 27th annual conference of the South African Association of Botanists.

SANBI, (2009): Plants of Southern Africa. POSA version 3. June 2009. http://posa.sanbi.org. (Accessed March 2014)

Schmidt E., Lotter, M. & McCleland W. (2007): Trees and Shrubs of Mpumalanga and Kruger National Park. Revised and Updated. Jacana Media

Siebert, S.J., Van Wyk, A.E. & Bredenkamp, G.J. (2001): Endemism in the flora of ultramafic areas of Sekhukhuneland, South Africa. South African Journal of Science 97: 529-32

Threatened Species Programme, (2014): Red List of South African plants version 2013.1. SANBI. http://redlist.sanbi.org/. Accessed January 2014

Van Oudtshoorn, F., (2002): *A Guide to Grasses of Southern Africa.* Briza Publications,

Van Wyk, B. and Van Wyk, P., (1997): *Field Guide to Trees of Southern Africa*. Struik Publishers, Cape Town.

Van Wyk, B., Van Oudshoorn B., & Gericke N., (2005): Medicinal Plant of South Africa. Briza Publications, Pretoria.

Victor, J., Siebert, S., Hoare, D. and Van Wyk, B. (2005): Sekhukhuneland grasslands: a treasure house of biodiversity.

## GLOSSARY

| | |
|---|---|
| **Alien species** | Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity |
| **Biodiversity** | Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems |
| **Biome** | A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment. |
| **Buffer zone** | A collar of land that filters edge effects. |
| **Conservation** | The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity. |
| **Conservation concern (**Plants of..) | Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading. |
| **Conservation status** | An indicator of the likelihood that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on. |
| **Community** | Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment. |
| **Critically Endangered** | A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future. |
| **Decreaser Grass** | Grass species that decrease when veld is either overgrazed or underutilised. These species are usually preferred by grazers such as *Themeda triandra* and *Digitaria eriantha* |
| **Data Deficient** | There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. |
| **Declining** | A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al*, 2009). |
| **Ecological Corridors** | Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible |
| **Ecosystem** | Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space |
| **Edge effect** | Inappropriate influences from surrounding activities, which physically degrade habitat, endanger |

| | |
|---|---|
| | resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution |
| **Endangered** | A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future |
| **Endemic** | Naturally only found in a particular and usually restricted geographic area or region |
| **Exotic species** | Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity |
| **Forb** | A herbaceous plant other than grasses. |
| **Habitat** | Type of environment in which plants and animals live |
| **Increaser I Grass** | Grass species that occur abundantly in underutilised veld – can grow without defoliation. These are usually unpalatable grasses |
| **Increaser II Grass** | Grass species that increase in over utilised (overgrazed) veld, include pioneer and sub-climax species |
| **Increaser III Grass** | Grass species that are common in overgrazed veld. These are usually unpalatable grasses that outcompete the palatable grasses when overgrazed. |
| **Indigenous** | Any species of plant, shrub or tree that occurs naturally in South Africa |
| **In Situ** | "In the place" In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced. |
| **Invasive species** | Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas |
| **Mitigation** | The implementation of practical measures to reduce adverse |
| | Impacts |
| **Near Threatened** | A Taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al*, 2009). |
| **Plant community** | A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat *et al*, 2004) |
| **Protected Plant** | According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation. |
| **Threatened** | Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities |
| **Red Data** | A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. *Now termed Plants of Conservation Concern* |

| | |
|---|---|
| **Species diversity** | A measure of the number and relative abundance of species |
| **Species richness** | The number of species in an area or habitat |
| **Threatened** | Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al,* 2009) |
| **Transformation** | The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development.<br><br>Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes |
| **Vegetation Unit** | A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition". |
| **Vulnerable** | A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future(Raimondo *et al*, 2009) |
| **Water Course** | According to the National Water Act (Act No.36 of 1998), a watercourse means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows. |

## APPENDIX A: METHODOLOGY

*Literature Review:*

The description of the regional vegetation relied on literature from Mucina & Rutherford (2006). Plant names follow Onderstall, (1996), Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002), Schmidt (2007), Mc Murtry *et al* (2008) and Bromilow (2010). Aerial images (Google Earth) were assessed prior to the field survey in order to identify areas where disturbances took place, homogenous areas and areas where wetland conditions were likely to occur.

*Field survey:*

The field survey was undertaken on 27 March 2014, while a scouting trip with Eskom was also undertaken in January 2014. The field survey focussed on identifying natural and untransformed vegetation, unique features that could indicate local sensitivities such as threatened and protected plants, as well as sensitive ecological features such as wetlands, ridges and rivers that are essential for the maintenance of ecosystems and ecological processes.

Where sampling was possible, all identifiable species were recorded as well as their cover abundance. Transects concentrated on moving through environmental gradients encountered and was continued until few or no new species were encountered. Any additional information on any other feature thought to have ecological significance within the site, such as dominant species cover abundance, soil type, erosion, rocky cover, alien/exotic/invasive plants, as well as plant species of conservation concern and/or their habitat was also recorded. Plant identification and vegetation description relied on species recorded in the sampling areas along the walked transects.

*Vegetation Sensitivity*

The following criteria and weighting was used to determine the vegetation sensitivity, function and conservation importance:

1. The status of the regional vegetation that is expected to occur on the study site, only where natural vegetation is still remaining.

| Conservation status* | Scoring |
|---|---|
| Critically Endangered | 3 |
| Endangered | 2 |
| Vulnerable | 1 |
| Least threatened | 0 |

*This scoring is not applicable (N/A) for areas devoid of natural vegetation.

2. Whether the study area is situated within a Listed Ecosystem in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004).

| Listed Ecosystem* | Scoring |
|---|---|

| | |
|---|---|
| Primary state | 3 |
| Sub-climax state | 2 |
| Secondary state | 1 |
| No natural vegetation remaining | 0 |

3. Whether the vegetation or ecological feature is protected by legislation:

| Listed Ecosystem* | Scoring |
|---|---|
| National legislation | 3 |
| Provincial policies and guidelines | 2 |
| Municipal or other protection | 1 |
| No legislated protection | 0 |

4. The presence of suitable habitat for plants of conservation concern as well as the actual occurrence thereof.

| Suitable habitat / presence | Scoring |
|---|---|
| Confirmed presence | 3 |
| Confirmed presence of Declining species and<br>Suitable habitat and some likelihood of occurrence of Threatened species | 2 |
| Suitable habitat but unlikely to occur | 1 |
| No suitable habitat | 0 |

5. Ecological Function: areas important to ecological processes such as ecological corridors, hydrological processes and important topographical features such as ridges.

| Ecological function | Scoring |
|---|---|
| **High:** Sensitive vegetation communities with low inherent resistance or resilience towards disturbance factors; vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems. | 3 |
| **Medium to high:** Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with a high degree of connectivity with other ecological systems OR disturbed vegetation connected to an ecological and protected system e.g. ridge, wetland or river | 2 |
| **Medium:** Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree or limited connectivity with other ecological systems | 1 |
| **Low:** Degraded and highly disturbed vegetation with little ecological function | 0 |

6. Conservation Importance: indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area

(degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation.

| Ecological importance | Scoring |
|---|---|
| **High:** Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. OR protected ecosystems e.g. wetlands, riparian vegetation etc These areas should be protected | 3 |
| **Medium to high:** Ecosystems with intermediate levels of species with the possible occurrence of threatened species | 2 |
| **Medium:** Ecosystems with intermediate levels of species diversity without any threatened species. | 1 |
| **Low:** Areas with little or no conservation potential and usually species poor (most species are usually exotic). | 0 |

## APPENDIX B: PLANT SPECIES

The table below lists the plant species that were observed per substation Alternative site, while the last column indicate species likely to occur in the corridors. Note these are the minimum species likely to be present. Note that the species diversity is likely higher. An explanation on medicinal and alien invasive plant species are given after the plant list.

**M**=plants known to be used medicinally **P**=provincially / national protected plant **D**=declining plant species

**1**=species was observed in vegetation grouping – if no indication, then it is assumed to occur

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| **Herbaceous plants** | | | | | | |
| *Aloe castanea* | Katstertaalwyn / Cat's Tail Aloe | Dry rocky areas, bushveld | | | | |
| *Aloe cryptopoda* | | Bushveld, flat open space or rocky slopes | | | | 1 |
| *Aptosimum lineare* | Carpet Flower | Dry bushveld | | 1 | 1 | |
| *Argyrolobium species* | | | | | 1 | |
| *Asparagus intricatus* | | Open woodland, dry rocky hillsides | | | | 1 |
| *Asparagus laricinus* | Cluster-leaved Asparagus | Thicket or disturbed areas, waste places. Difficult to eradicate if encroaching into grassland | 1 | | 1 | 1 |
| *Berkheya insignis* | | Grassland, often on rocky outcrops | 1 | | 1 | |
| *Berkheya spinosum* | | Overgrazed areas | | | 1 | |
| *Blepharis species* | | | | | 1 | |
| *Blepharis integrifolia* | Rankklits | Grassland and bushveld | | | | 1 |
| *Comelina africana var krebsiana **(M)*** | | Grassland | 1 | 1 | 1 | 1 |
| *Crabbea species* | | | | | 1 | |
| *Dicoma anomala subsp circioides* | Maagbitterwortel | Common in stony grassland | | | 1 | |
| *Dicoma schinzii* | Fluweel-stekelsterretjie | Sandy soil | | | 1 | |
| *Drimia altissima **(D)*** | | Hot dry bushveld and thicket | | 1 | | 1 |
| *Elephantorrhiza praetermissa* | Elephant-root | Dry Bushveld | | | | 1 |

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| *Eulophia petersii* | | Orchid associated with granite boulders, grows in soil accumulation on or between rocks | | 1 | | |
| *Euphorbia schinzii* | Klipmelkbos | Rocky hillsides, rock fissures | | 1 | | |
| *Felicia specie* | | Thornveld | 1 | | | |
| *Geigeria burkei* | Vermeerbos | Common in overgrazed and disturbed areas | | | 1 | |
| *Gisekia africana* | | | | 1 | 1 | |
| *Grewia bicolor* ***(M)*** | White Raisin | Bushveld | | | | 1 |
| *Grewia flava* | Velvet Raisin | Bushveld and wooded grassland, often in drier areas and on Kalahari sand | 1 | 1 | | 1 |
| *Grewia vernicosa* | Glossy Raisin | Rocky soils, bushveld | | 1 | 1 | 1 |
| *Huernia stapelioides* | | | | | | 1 |
| *Jatropha schlechteri subsp. setifera* | | Bushveld | | 2 | | |
| *Kleinia longiflora* | Sjambokbos | Hot, dry areas, under trees | | | 1 | 1 |
| *Kyphocarpa angustifolia* | Silky Burweed | Grassland and disturbed areas. | | 1 | | |
| *Leucas sexdentata* | Bushveld tumbleweed | Sandy soils, shady places | | | | |
| *Leucosphaera bainesii* | Silwerbossie | Often in disturbed soil | | 1 | 1 | |
| *Melhania rehmannii* | | Bushveld | | | | 1 |
| *Ocimum cf americanum* | | | | 1 | | |
| *Pechuel-Loeschea leubnitziae* | Stinkbush | Open spaces, sandveld, riverbanks and disturbed places | | 1 | 1 | |
| *Psiadia punctulata* | | Bushveld, along dry sandy or rocky rivers, often under trees | | 1 | 1 | |
| *Sansevieria hyacinthoides* | Mother-in-law's-tongue | Thicket and woodland | | | | 1 |
| *Tinnea rhodesiana* | Brown Tinnea | Rocky hillsides and arid woodlands | | 1 | | |
| **Number of herbaceous species identified** | | | **5** | **15** | **17** | **14** |
| **GRASSES** | | | | | | |
| *Aristida congesta subsp congesta* | Tassel Three-awn | Disturbed, overgrazed or farmed land. Increaser II grass | 1 | 1 | | 1 |
| *Bothriochloa insculpta* | Pinhole Grass | Grows mostly in disturbed areas, also were water accumulates. Increaser II | 1 | | | 1 |

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| *Cymbopogon plurinoides (=C pospischilii)* | Narrow-leafed Turpentine Grass | Grassland. Not palatable, Increaser III | 1 | 1 | | 1 |
| *Diheteropogon amplectens* | Broad-leaved Bluestem | Open grassland as well as open areas within bushveld. Mostly in poor rocky slopes. Decreaser | 1 | | | 1 |
| *Enneapogon cenchroides* | Nine-awned Grass | Distrubed veld in sandy and rocky soils. Increaser II grass | | 1 | | 1 |
| *Heteropogon contortus* | Spear Grass | Rocky, sloped land and common on disturbed road reserves. Increaser II grass | 1 | 1 | | 1 |
| *Hyparrhenia hirta* | Common Thatching Grass | Well drained, rocky soil in open grassland and disturbed areas. Increaser I grass | 1 | 1 | | |
| *Loudetia simplex* | Common Russet Grass | Open grassland, poor sandy soil to rocky slopes and vlei's | | 1 | 1 | 1 |
| *Panicum maximum* | Guinea Grass | Grow in shade under trees, also in sun, moist to dry areas. | 1 | | | 1 |
| *Panicum repens* | Couch Panicum | Often grows where water accumulate in the rainy season. Decreaser grass | | | | 1 |
| *Paspalum distichum* | Water Couch | An exotic grass growing in or near permanent water. | | | | |
| *Setaria lindenbergia* | | | | | | 1 |
| *Schmidtia pappophoroides* | Sand Quick | Disturbed sandy and dry areas | | | | 1 |
| *Sorghum bicolor* | Common Wild Sorghum | Grows as weed in moist places or naturally along rivers, usually in clay | | | | |
| *Themeda triandra* | Red Grass | Undisturbed or disturbed open grassland. Decreaser Grass | 1 | 1 | 1 | 1 |
| *Tragus berteronianus* | Carrot Seed Grass | Disturbed, bare patches and compacted soils. | | | | |
| *Urochloa mosambicensis* | Bushveld Signal Grass | Disturbed areas such as farmland, also in compacted soils. Good grazing grass. Increaser II | | | | |
| **Number of grasses identified** | | | **8** | **7** | **2** | **12** |

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| **CLIMBERS** | | | | | | |
| *Buttonia superba* | Large Flowered Climbing Foxglove | Bushveld | | 1 | | 1 |
| *Clematis brahiata* | Traveller's Joy | Bushy hillsides, particulary rocky places | | 1 | | 1 |
| *Dregea macarantha* | | Climber, bushveld | | | 1 | 1 |
| *Sarcostemma verminale* | Cuastic Vine / Melktou | Vine in dry areas | | | | 1 |
| **Number of climbers identified** | | | **0** | **3** | **1** | **4** |
| **TREES** | | | | | | |
| *Acacia erioloba* ***(P)(D)*** | Camel-thorn | Bushveld and grassland, ususally in deep sandy soild along watercourses in arid areas. Protected tree. | | | | 1 |
| *Acacia karroo* | Sweet Thorn | Widespread, often proliferate in overgrazed areas | 1 | | | 1 |
| *Acacia nigrescens* | Knob Thorn | Bushveld | | 1 | | 1 |
| *Acacia nilotica* | Scented Thorn | Bushveld on sandy soils around pans and near riverbanks. Often colonising disturbed areas | 1 | | | 1 |
| *Acacia robusta* | Ankle Thorn | Bushveld and grassland | | 1 | 1 | 1 |
| *Acacia senegal* | Three-hook Thorn | Bushveld | | 1 | | 1 |
| *Acacia tortilis* | Umbrella Thorn | Bushveld and grassland. | 1 | | | 1 |
| *Balanites maughamii* | Groendoring / Green Thorn | Dry bushveld, sand forest and along riverbanks | | | | 1 |
| *Bolusanthus speciosus* | Tree Wisteria | Bushveld, often on heavy alkaline soils | | | 1 | 1 |
| *Boscia albirtrunca* ***(M)(P)*** | Shepherds' Tree | Occur in semi-desert areas and bushveld, often on termitaria | | | | 1 |
| *Boscia foetida subsp.rehmanniana* | Stink Shepard's Tree | Dry bushveld | | 1 | | |
| *Combretum apiculatum* | Red Bushwillow | Bushveld, often in low altitudes and in rocky places | | | 1 | 1 |
| *Combretum imberbe* ***(P)*** | Leadwood / Hardehout | Often along rivers and watercourses, in mixed woodland | | | | 1 |
| *Commiphora africana* | Hairy Corkwood | Hot, arid bushveld, often among tocks or in Kalahari sand | | 1 | | 1 |

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| *Croton gratissimus* | Lavender Fever Berry | Bushveld and wooded places in grassland | | | | 1 |
| *Ehretia rigida* | Puzzle Bush | Wooded grassland, bushveld | | 1 | | 1 |
| *Euclea crispa form A (Schmidt et al, 2007)* | Blue Guarri | Rocky slopes, kloofs, along rivers and forest margins | 1 | | 1 | 1 |
| *Euclea crispa subsp crispa* | Blue Guarri | Rocky slopes, kloofs, along rivers and forest margins | | 1 | 1 | 1 |
| *Euclea linearis* | Lance-leaved Guarri | Bushveld and river valleys | | 1 | 1 | 1 |
| *Grewia vernicosa* | Glossy Raisin | Bushveld and exposed hillsides | | 1 | 1 | 1 |
| *Gymnosporia senegalensis* | Red Spike-thorn | Bushveld | | | | 1 |
| *Hippobromus pauciflorus* ***(M)*** | False Horsewood | Forest margins, bushveld, scrub, rocky outcrops and riverine vegetation | | | | 1 |
| *Kirkia wilmsii* | River Indigo | Riverine forest, along forest margins and between rocks in grassland | | | | 1 |
| *Mundulea sericea* | Cork Bush | Grassland and bushveld, usually associated with rocky outrops | | 1 | 1 | |
| *Ozoroa sphaerocarpa* ***(M)*** | Currant Resin Tree | Bushveld, often on rocky hillsides | | | | 1 |
| *Pappea capensis* | Jacket-Plum | Bushveld and wooded grassland. | | 1 | 1 | 1 |
| *Pavetta zeyheri* | Grey-leaved brides-bush | Woodland, wooded grassland and bush clumps | | 1 | 1 | 1 |
| *Rhigozum brevispinosum* | Short Thorn Pomegranate | Shurb or small tree occuring in arid bushveld and semi-desert vegetation | | | | 1 |
| *Rhigozum obovatum* | Yellow Pomegranate | Karroid vegetation, valley bushveld and rocky places | | | | 1 |
| *Schotia brachypetala* | Weeping Boer-bean | Valley bushveld and wooded communities in dry broken country | | | | 1 |
| *Sclerocarya birrea subsp caffra* ***(P)(M)*** | Morula | Bushveld and woodland. | | | 1 | 1 |
| *Scolopia zeyheri* | Thorn Pear | Forest, forest margins, bushveld and near water | | 1 | | 1 |
| *Searsia lancea* | Karee | Grassland and bushveld | 1 | | | 1 |
| *Searsia sekhukhuniensis* | Sekhukhune Currant | Bushveld, on heavy metal soils - endemic | | | | 1 |

| Specie Name | Common Name | Relevant Notes | Altc1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| | | to the Steelpoort area | | | | |
| *Terminalia prunioides* | Purple-pod Cluster-leaf | Bushveld | | 1 | 1 | 1 |
| *Vitex obovata* ***(M)*** | Hairy Fingerleaf | Bushveld, rocky hillsides | | | | 1 |
| *Ziziphus mucronata* | Buffalo-thorn | Widespread, in various habitats | 1 | 1 | 1 | 1 |
| | | | | | | |
| **Total number of indigenous trees identified** | | | **6** | **15** | **13** | **35** |

### Medicinal Plant Species

Rising demand for medicinal plants has led to increased pressure on wild plant populations. This combined with shrinking habitats, means that many species in South Africa are now facing local extinction (Botha *et al,* 2004). The demise of medicinal plant species holds dire consequences both socially and ecologically. People stand to lose their medicine, and in the case of traditional healers and plant gatherers, their livelihoods (McKean, unknown). Medicinal plants that are highly utilised will soon become extinct as they are harvested from natural environments or destroyed by development and mining. The trade in medicinal plants is high and it is unlikely that, at current levels of exploitation, the sustainable supply of medicinal plants will ever meet the demand. Therefore it is important to be able to identify areas that could potentially support, or provide plants to the medicinal plant trade (Emery *et al*, 2002). A *minimum* of 7 plants known to be used medicinally were recorded on the site.

### Alien Invasive Plant 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 are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

#### Legislation

*National Environmental Management: Biodiversity Act (NEMBA)*

Alien and Invasive Species Regulations, as well as a 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. On 19 July 2013, a declared list of alien invasive species including prohibited, category 1a and category 1b species was published under the new NEMBA regulations

(Government Gazette No 36683, 19 July 2013). The species indicated as category 1a and 1b cannot be propagated, grown, bought or sold by the industry without a permit, while some species must be destroyed and are prohibited.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) – note that the new regulations published on 19 July 2013 only makes provision for category 1 invaders:
Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

*Conservation of Agricultural Resources Act (CARA)*
The amended Regulations (Regulation 15, as amended in March 2001) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) identifies three categories of problem plants:
Category 1 (Declared weeds): plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish plant, maintain, propagate or sell/import any category 1 plant species;
Category 2 (Declared invaders): are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and
Category 3 (Declared invaders): plants are ornamentally used and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30 m of a 1:50 year flood line and must be prevented from spreading.

Land users have to control these plants by means of the methods prescribed in the Act. Unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse.

The alien plant species identified on the study site are listed in the Table below. Category 1 species follow the new NEMBA regulations, while the remainder are in accordance with CARA.

| Species | Common Name | Category | Alt 1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| *Argemone mexicana* | Yellow-flowered Mexican Poppy | Category 1 (CARA) | | | | 1 |
| *Arundo donax* | Giant Reed | Category 1 (CARA) | | | | 1 |
| *Bidens pilosa* | Blackjack | Widespread weed. | | | | 1 |
| *Cereus hildmannianus / jamacaru* | Queen of the night | Prohibited by | | 1 | | 1 |
| *Datura ferox* | Large thorn Apple | Category 1 (proposed 1b in draft NEMBA list). | | | | 1 |
| *Lantana camara* | Lantana | Form dense impenetrable thickets, replacing indigenous vegetation. Declared Category 1b invasive | | 1 | | 1 |
| *Melia azedarach* | Syringa | Category 3 (CARA) | | | | 1 |
| *Nicotiana glauca* | Wild Tabaco | Category 1 (proposed 1b in draft NEMBA list) | | | | |
| *Opuntia species* | Sweet Prickly Pear | Catery 1 (CARA) | | | | 1 |
| *Senna didymobotyra* | Peanu Butter Cassia | Category 1b (NEMBA) | 1 | | | |
| *Sesbania bispinosa* | Spiny Sesbania | Occurs in moist places and disturbed areas | 1 | | | |
| *Sesbania punica* | Red Sesbania | Declared Weed Category 1 CARA | 1 | | | |
| *Shinus molle* | Pepper Tree | Not listed but was Proposed cat 1b weed that invades riverbanks, roadsides, | | | | 1 |

| Species | Common Name | Category | Alt 1 | Alt 2 | Alt 3 | Corridors |
|---|---|---|---|---|---|---|
| | | grassland and savanna. | | | | |
| *Sorghum halepense* | Johnson Grass | Category 2 (CARA) | 1 | | | |
| *Tagetes minuta* | Khaki Weed | Weed in disturbed places. Has become naturalised and due to the vast amount of seed set, difficult to control | | | | 1 |
| *Vicia sativa* | Broad-leaved Purple Vetch | Invasive species - not categorised yet | 1 | | | |
| *Prunus persicari* | Peach Tree | Becoming naturalised | | | | 1 |