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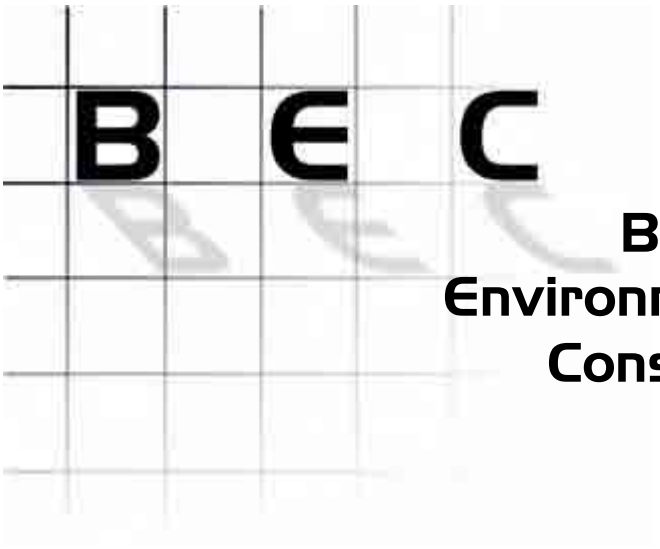
Strategic Biodiversity Impact Assessment of the proposed Matimba B – Marang 400kV Power line & Marang Sub Station Upgrade

submitted by



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SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

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DECLARATION

All specialist investigators, project investigators and members of companies employed for the purpose of conducting this particular investigation declare that:

- we consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions;
- at the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development as outlined in this document, except for financial compensation for work done in a professional capacity;
- we will not be affected in any manner by the outcome of the environmental process of which this report forms part of, other than being part of the general public;
- we do not have any influence over decisions made by the governing authorities;
- we do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience; and
- should we consider ourselves to be in conflict with any of the above declarations, we will formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.

1 Executive Summary

This biodiversity investigation forms part of an environmental impact assessment of the proposed Matimba B – Marang 400kV Power line and Marang Sub Station Upgrade.

ESKOM has appointed PBA International to undertake the Environmental studies for this project. Bathusi Environmental Consultants has been appointed, on behalf of PBA International, to conduct a strategic impact evaluation of the biological environment that will be affected by the proposed development. This assessment is partly based on results obtained from the Scoping Investigation. Faunal Specialists Incorporated (FSI) conducted the faunal assessment while BEC conducted the floristic assessment, provided the ecological interpretation and compiled the impact evaluation.

In addition to these assessments, cognisance was taken of comments received from the review of the Scoping Report, as presented by Frauke Münster (ERM, February 2007) as well as from Dr. Sandie Sowler (Baker Sheperd Gillespie, January 2007) and issues were addressed as far as possible.

1.1 Floristic Attributes

The aim of the floristic assessment is to present the reader with a description of the flora that characterises the study area, providing insight into the floristic diversity and variations and how these relate to the environmental attributes. Red Data flora status and probabilities as well as the inherent floristic sensitivities of the plant communities is determined and ultimately incorporated into the ecological impact evaluation.

Strategic sampling was conducted within areas that exhibit biophysical attributes of high sensitivity. These areas contain the following biophysical attributes:

- Areas of surface water (rivers);
- Areas of high slopes (ridges); and
- Selected areas of natural regional vegetation.

The vegetation of ridges present within the study area is regarded as pristine. Grazing pressure, utilization intensity and proximity to populated areas generally determine the floristic status of this habitat type. These areas are furthermore also suitable for the presence of Red Data flora species. No Threatened flora species were observed during the site investigation, but the Red Data tree species *Dombeya rotundifolia* var *rotundifolia* as well as the protected tree species *Sclerocarya birrea* was observed in several localities.

Two major riparian variations were recognised in the study area, namely Woodland Riparian habitat and Reedbed Riparian habitat. The woody component of the former represents the major physiognomic attribute. The vegetation structure of the open Reedbed Riparian habitat is characterised either by the presence of *Phragmites australis*, or open banks where the transitional zone between the aquatic and terrestrial zone is relative narrow. The species composition of these areas is generally low. Due to the

aquatic nature of this habitat type, several declared invasive plant species occur, contributing to a loss of habitat quality. No Red Data flora species were observed within these areas and the habitat is not considered particularly suitable for the presence of these species.

The floristic status of these areas varies between low and moderate as a result of the current impacts that affect the vegetation adversely. Proximity to populated areas has a strong influence on the floristic status of this habitat type. It should however be noted that high environmental sensitivity is attributed to aquatic habitat (legal status – RAMSAR Convention).

Natural regional vegetation is present throughout the study area and is largely representative of the regional vegetation types. Natural encroachment of woody species, as a result of over utilisation has resulted in the extremely dense status of the woody layer and a moderate floristic status is attributed to the natural vegetation of the study area.

The Red Data tree species *Dombeya rotundifolia* var *rotundifolia* was observed in several localities. *Dombeya rotundifolia* var *rotundifolia* has a Not Threatened status, implying that this species is no longer included in any of the threatened categories due to an increase in the population size or the discovery of more individuals or populations. It is encountered throughout the study area.

The protected tree species *Sclerocarya birrea* was observed in several localities. Protected tree species do not have a Red Data status, but has a legal (provincial) protected status and should be afforded consideration during the construction and operational phases of the project.

Species of importance that were observed in the study area are considered well represented in the general region outside the study area. Although the presence of these species will not influence the outcome of this impact assessment, specific recommendations are made to protect individuals and their habitat that will be affected by the proposed development.

Vegetation that is encountered in areas where the proposed upgrade of the Marang Substation will take place constitutes degraded regional vegetation and does not contain any floristic aspect of significance.

1.2 Faunal Attributes

The aim of this faunal investigation is to present the reader with a description of the faunal attributes of the study area in terms of available habitat, Red Data probabilities and the inherent faunal sensitivity. Results of this faunal assessment will ultimately be integrated with results of the floristic assessment in order to present an ecological overview of the study area. Results will ultimately be incorporated into the biodiversity impact assessment. Please note that the avifaunal component is addressed in a separate document and were therefore not included in this assessment.

Available habitat in the study area conforms to the natural regional habitat types and is generally well represented in the surrounding region. Atypical habitat types are generally regarded as sensitive and are represented by ridges and riparian habitat, which is present throughout the area in the form of perennial and non-perennial rivers and streams. These habitat types were identified during the scoping phase of this project and were assessed for the suitability for Red Data fauna species during this part of the investigation.

The following fauna species are known to occur in the study area:

- twenty-seven frog species;
- sixty-seven reptile species; and
- eighty-eight free-roaming mammal species.

Of these animals, one frog, three reptiles and three mammals are restricted to one or two Provinces of South Africa. Extremely little is known of the invertebrate component of the region.

The largest extent of the faunal assemblages of any region is normally encountered in the more common habitat, which is represented by the various savanna variations in the study area. These are not regarded as sensitive in terms of faunal attributes and diversity and are furthermore adequately represented in the general region. These habitat types were therefore not included in the assessment, but general observations were nonetheless made in order to identify any area of significance.

The status of sensitive habitat types, in terms of faunal sensitivity, is strongly associated with the density of human occupation. Areas of human occupation, located in close proximity to towns and settlement areas are generally degraded and constitute sub-optimal faunal habitat.

Atypical habitat types generally represent sensitive faunal habitat, although not always containing a high diversity of fauna species. Ridges contain a multitude of micro habitat that is highly suitable for the presence of Red Data fauna species and these habitat types that could potentially be affected by the proposed development will undoubtedly contain some of these species. High faunal sensitivities are therefore attributed to these habitat types. Similarly, riparian zones, beit perennial rivers, or smaller non-perennial streams, are considered highly suitable for the presence of sensitive fauna species. Red Data fauna

species that are likely to occur in the study area are strongly associated with either of these habitat types and cannot exist without the habitat provided by these ecological units. If Data Deficient Red Data fauna species are excluded from the assessment, most Red Data fauna species associated with either wetlands or ridges. Only the Pangolin, SA Hedgehog, Honey Badger and Rusty Bat are not specifically linked to restricted habitat such as wetlands or ridges and are found in natural savanna habitat.

Red Data fauna species that are likely to occur in the study area include the following disciplines:

- one invertebrate;
- one frog;
- one reptile; and
- twenty-six free-roaming mammals.

Impacts associated with the construction and operation of a power line within a ridge environment are considered significant and will result in significant impacts on Red Data fauna species that are likely to occur within this habitat type. This statement is supported by the habitat requirements of the rare and restricted species that are likely to be present within the study area. The transformation and associated impacts on sensitive habitat types furthermore lead to an increase in the isolation and fragmentation.

Likely impacts within the riparian environment are regarded as less significant since physical damage does not constitute likely impacts. Faunal species associated with riparian environments are generally tolerable to impacts associated with this type of development. Generic mitigation measures are considered sufficient in limiting likely impacts within this habitat type.

Natural regional habitat that occur in the study area are regarded as sub-optimal faunal habitat as a result of over-grazing and subsequent bush-encroachment, which has led to a decline in faunal diversity. The clearing of excessively dense areas could therefore be regarded as a positive impact in these parts. The loss of natural regional habitat will be minimal and the transformed habitat underneath power lines does not represent a significant obstacle to terrestrial animals.

Causal observations made in the areas of the proposed upgrade of the Marang Substation revealed the presence of degraded habitat and surrounding areas are regarded more suitable for a higher faunal diversity. Available habitat within these areas is not considered suitable for the presence of any Red Data fauna species.

1.3 Ecological Impact Evaluation

The following impacts were identified that will result in degradation of biological attributes or habitat that are considered sensitive in terms of biological attributes:

- Destruction of threatened species and habitat;
- Destruction of sensitive habitat types (outcrops, riparian fringes, non-perennial streams, river, etc.) and areas of high biodiversity;
- Destruction of pristine habitat;
- Changes to the biodiversity as a result of habitat transformation; and
- impacts on surrounding natural habitat and species.

These impacts are, in most cases, of high significance prior to the implementation of mitigation measures as they will result in the degradation of biological attributes that are considered sensitive.

In the case of ridges, these significant impacts can be avoided by realigning the proposed routes to circumvent sensitive ridges. In the selected cases where no alternatives are available, the limitation of physical damage to the vegetation structure is recommended. While riparian systems are considered extremely sensitive, the construction methods normally implemented is not expected to result in significant impacts on this ecological habitat type. Thus, while impacts are considered highly significant, successful mitigation can be achieved with ecological sensible construction methods that are already implemented in riparian regions.

Areas of natural regional habitat types are adequately represented in the general surrounds and the impact of the proposed development is not expected to result in significant impacts within this environment. Most unforeseen or localised impacts could be avoided by means of simple realignment recommendations during the walk-through phase.

Generic mitigation measures are considered sufficient in limiting the largest extent of likely impacts. Specific mitigation measures include, but are not necessarily limited to:

- Realignment of lines to avoid ridges;
- Limited maintenance activities, no severe impact on habitat;
- Implementation of rehabilitation, monitoring & control programmes;
- Final recommendations during walk-through survey;
- Remove threatened and protected plant species (obtain relevant permits); and
- Avoid surface impacts in riparian systems - 30m buffer zones.

It is the conclusion of this assessment that the loss of natural regional habitat and other impacts in general natural habitat types present in the study area are acceptable with regards to ecological sensitive attributes. However, the loss and potential degradation of habitat of restricted habitat types such as wetlands and ridges are unacceptable and site specific mitigation measures need to be implemented.

TABLE OF CONTENTS

2 INTRODUCTION

ESKOM is planning the construction of a 400kV line from the Matimba B Power Station (Limpopo Province) to the Marang Substation, situated approximately 12km east north-east of Rustenburg.

ESKOM has appointed PBA International to undertake the Environmental studies. Bathusi Environmental Consultants has been appointed as independent specialist investigators, on behalf of PBA International, to conduct a strategic impact assessment of the biological environment that will be affected by the proposed development. Faunal Specialists Incorporated (FSI) conducted the faunal assessment while BEC conducted the floristic assessment, provided the ecological interpretation and compiled the impact evaluation.

3 AIMS & OBJECTIVES

This strategic biodiversity impact evaluation aims to present the client with broad descriptions of floristic and faunal elements encountered within the study area and to highlight sensitive biological and environmental attributes that might be affected adversely by the proposed development. The expected impacts will be evaluated and pertinent mitigation actions will be recommended.

The Terms of Reference for the floristic assessment are as follows:

- Incorporate results obtained from the Scoping Assessment into this assessment;
- Obtain all relevant PRECIS and Red Data flora information from SANBI;
- Survey sensitive areas for floristic diversity (general floristic diversity, Red Data flora species and alien and invasive plant species);
- Assess the potential presence of Red List flora species according to the list provided by SANBI during the growing season;
- Describe sensitive floristic habitat in terms of physical attributes;
- Describe the status and importance of any primary vegetation;
- Map all relevant aspects; and
- Integrate results of the floristic assessment into the biodiversity impact assessment.

The Terms of Reference for the faunal assessment are as follows:

- Obtain all relevant Red Data fauna information;
- Survey identified sites for potential faunal diversity by means of broad observation methods;
- Assess the potential presence of Red Data fauna species;
- Describe the status of available habitat in identified sensitive areas; and
- Integrate results of the faunal assessment into the ecological impact assessment.

4 METHODOLOGY

All methods implemented during this investigation are based on accepted scientific investigative techniques and principles and was performed to acceptable standards and norms, taking the limitations of this investigation into consideration. The Precautionary Principle was applied throughout these assessments.

4.1 General Floristic Attributes

Results obtained from the Scoping Assessment (Floristic Scoping Assessment of the line variants of the proposed Matimba – Marang 400kV Transmission Line, May 2006) were implemented in the identification and sampling of sensitive areas. Aerial images of the study area were obtained from Google Earth (www.googleearth.com) and georeferenced with ARCVIEW 3.2 Georeferencing Tool.

The vegetation assessment is based on a variation of the Braun-Blanquet method whereby vegetation is stratified on aerial images with physiognomic[1] characteristics as a first approximation. These initial stratifications are then surveyed for floristic and environmental diversity during a site investigation.

Maps were produced on Arcview GIS 3.2 utilizing data and images from various sources.

A floristic survey was conducted during February 2007 and cognisance was taken of the following environmental attributes and general information:

- biophysical environment, i.e. geology, land type units, topography, etc that is generally accepted to be driving forces behind vegetation development; including:
  - slope;
  - aspect;
  - topography;
  - rockiness; and
- holistic/ regional vegetation;
- the current status of available habitat forms;
- Red Data habitat suitability;
- digital photographs; and
- GPS reference points.

Phytosociological data accumulated include the following:

- general floristic diversity and growth forms;
- dominant plant species;
- cover abundance values; and
- samples or digital images of unidentified plant species.

[1] Physiognomy refers to the visual appearance of vegetation in terms of different growth classes, biomass, height, etc.

Sample sites are subsequently described in terms of floristic species composition and dominance as well as driving (developmental) environmental parameters. Preliminary results and species lists that are provided should be interpreted with normal project limitations in mind.

4.2 Floristic Sensitivity

The method implemented to estimate the floristic sensitivity is considered effective in highlighting floristically significant attributes and is based on subjective assessments of floristic attributes and is rated across the spectrum of communities that typify the study area. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human impacts, size, fragmentation are important in assessing the floristic sensitivity of the various communities.

Criteria employed in assessing the floristic sensitivity may vary between different areas, depending on location, type of habitat, size, etc. For the purpose of this analysis the following factors were considered significant in determining the floristic sensitivity of this particular area:

- Habitat availability, status and suitability for the presence of Red Data species;
- Landscape or habitat sensitivity;
- Current floristic status;
- Floristic diversity; and
- Ecological performance/fragmentation.

Floristic Sensitivity Values are expressed as a percentage of the maximum possible value and placed in a particular class, namely:

High	80	–	100%
Medium – high	60	–	80%
Medium	40	–	60%
Medium – low	20	–	40%
Low	0	–	20%

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological sustainable manner. These areas can be compared to nature reserves and even well managed farms. Low Sensitivity Index Values indicate areas of poor ecological status or importance in terms of floristic attributes, including areas that have been negatively affected by human impacts or poor management.

Each vegetation unit is subjectively rated on a scale of 1 to 10 (**Sensitivity Values**) in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasises the importance/ triviality that the individual Sensitivity Criteria have on the status of each community.

Ranked Values are then added and expressed as a percentage of the maximum possible value (**Floristic Sensitivity Value**) and placed in a particular class, namely:

High	80% – 100%
Medium – high	60% – 80%
Medium	40% – 60%
Medium – low	20% – 40%
Low	0% – 20%

The Precautionary Principle is applied throughout this investigation.

4.3 Red Data Flora Assessment

Baseline PRECIS data for the ¼ degree grids in which the study area is situated was obtained from SANBI (email application and response, November, 2006) and was compared to the Interim Red Data List of South African Plant Species (Threatened Species Programme, 2004) to compile a list of Red Data flora species that could potentially occur within the study area.

A snapshot investigation of an area represents severe limitations in terms of locating and identification Red Data flora species. Hence, particular emphasis was placed on the identification of habitat deemed suitable for the potential presence of Red Data plant species by associating available habitat to known habitat types of Red Data flora species. The verification of the presence/ absence of these species from the study area are not perceived as part of this investigation as a result of project limitations.

4.4 Faunal Diversity

Due to severe project limitations, no physical sampling was conducted in identified areas. However, available habitat was scrutinised for attributes that are deemed suitable for high faunal diversity, sensitive and Red Data fauna species. The following disciplines were included in the investigation:

- Invertebrates;
- Frogs;
- Reptiles; and
- Mammals.

Sensitive habitat, as identified during the Scoping Assessment, was investigated in order to highlight areas that are deemed suitable for a high diversity of these disciplines.

Please note that the avifaunal component is addressed in a separate document and were therefore not included in this assessment.

4.5 Faunal Habitat Sensitivities

An estimation of the sensitivity of available habitat is calculated, taking the following parameters into consideration:

- Habitat status - The status or ecological condition of available habitat in the study area is assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water quality plays a major role);
- Habitat linkage - Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area; and
- Red Data likelihood of occurrence – areas that exhibit characteristics that are suitable for the potential presence of Red Data fauna species area considered sensitive.

4.6 Biodiversity Impact Evaluation

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue/ impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

A rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Extent

- National 4
- Regional 3
- Local 2
- Site 1

Duration

- Permanent 4
- Long term 3
- Medium term 2
- Short term 1

Intensity

- Very high 4
- High 3
- Moderate 2
- Low 1

Probability of Occurrence

- Definite 4
- Highly probable 3
- Possible 2
- Impossible 1

Criteria for the classification of an impact:

Nature

A brief description of the environmental aspect being impacted upon by a particular action or activity is presented.

Extent (Scale)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

Site	Within the construction site
Local	Within a radius of 2 km of the construction site
Regional	Provincial (and parts of neighbouring provinces)
National	The whole of South Africa

Duration

Indicates what the lifetime of the impact will be

Short-term	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
Medium-term	The impact will last for the period of the construction phase, where after it will be entirely negated
Long-term	The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter
Permanent	The only class of impact which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient

Intensity

Describes whether an impact is destructive or benign.

Low	Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
Medium	Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way
High	Natural, cultural and social functions and processes are altered to extent that they temporarily cease
Very high	Natural, cultural and social functions and processes are altered to extent that they permanently cease

Probability

Describes the likelihood of an impact actually occurring

Improbable	Likelihood of the impact materialising is very low
Possible	The impact may occur
Highly probable	Most likely that the impact will occur
Definite	Impact will certainly occur

Significance

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

Using the scoring from the previous section, the significance of impacts is rated as follows:

Low impact	4-7 points (No permanent impact of significance. Mitigatory measures are feasible and are readily instituted as part of a standing design, construction or operating procedure)
Medium impact	8-10 points (Mitigation is possible with additional design and construction inputs)
High impact	11-13 points (The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment)
Very high impact	14-16 points (The design of the site may be affected. Intensive remediation as needed during construction and/or operational phases. Any activity which results in a “very high impact” is likely to be a fatal flaw)

Status

Denotes the perceived effect of the impact on the affected area

Positive (+)	Beneficial impact
Negative (-)	Deleterious or adverse impact
Neutral	Impact is neither beneficial nor adverse

It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented.

5 Limitations of this Investigation

Rare and endemic flora and fauna species do not normally occur in great densities and because of customary limitations in the search and identification of red data species, the detailed investigation of the presence of these species within the study area was not perceived as within the scope of this investigation. Estimations provided in this document only provide an indication of the Probability of the Occurrence of these species as the low levels of biological and distributional information inherently associated with Red Data species create large gaps in such estimations. These gaps can only be lessened by intense sampling conducted over long periods of time. However, all areas that were sampled during the site investigation were thoroughly investigated for the presence of these species and results obtained from these surveys were then extrapolated to present opinions for the remainder of the proposed areas.

This investigation, although based on proper scientific methods and performed to accepted standards and norms, was performed by means of stratified sampling of ecological attributes of the study areas and not on the detailed or long-term investigation of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. Additional information may therefore come to light during a later stage of the process or development for which no allowance can be made at this stage of the investigation. No definite conclusions may therefore be drawn with regards to biological diversity or conservation strategies as far as the proposed areas are concerned.

6 THE BIOPHYSICAL ENVIRONMENT

Detailed descriptions of the biophysical attributes of the study area are presented in the Scoping Document (Floristic Scoping Assessment of the line variants of the proposed Matimba – Marang 400kV Transmission Line, May 2006). Only biophysical elements that proved to be significant in determining likely impacts of the proposed line on the biological environment will be highlighted in this document.

6.1 Location

The proposed variants of the Transmission line from Matimba B to the Marang substation stretch across the Limpopo and North-West province, approximately 270km in length (Figure 1). The northern point of the route is located close to Lephalale (Matimba B), a central point at the Spitskop Substation and the southern point (Marang Substation) approximately 12km east north-east of Rustenburg.

The regional location of the proposed lines is presented in Figure 1.

6.2 Surface Water

The route variants are situated within the Limpopo Primary Catchment area. Major rivers that will be crossed by the proposed route variants are the Krokodil and Moretele Rivers. However, numerous perennial and non-perennial streams will also be crossed (Figure 2).

All areas of surface water are afforded a high sensitivity value and representative areas were surveyed during the site investigation

6.3 Contours & Slopes

The maximum altitude that the line variants are expected to reach is approximately 1,400m.

An analysis of slopes revealed that selected portions of the route variants will cross areas where the general slopes exceed 5% (Figure 3). This slope is considered significant due to the association between high slopes and Red Data species

All areas where the general slope exceeds 5% are afforded a high sensitivity value and representative areas were surveyed during the site investigation.

Figure 1: Location of the study area

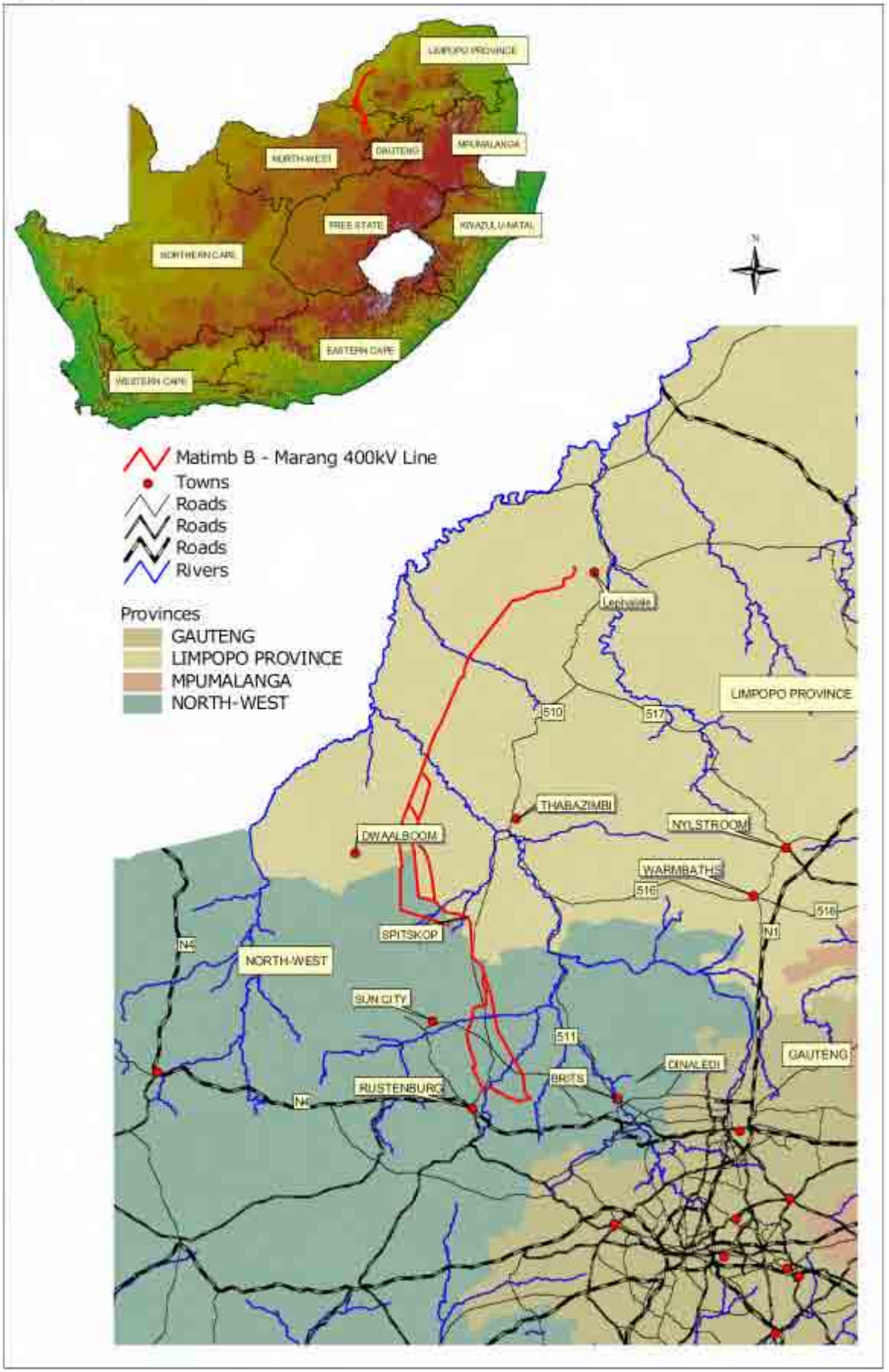


Figure 2: Areas of surface water in the study area

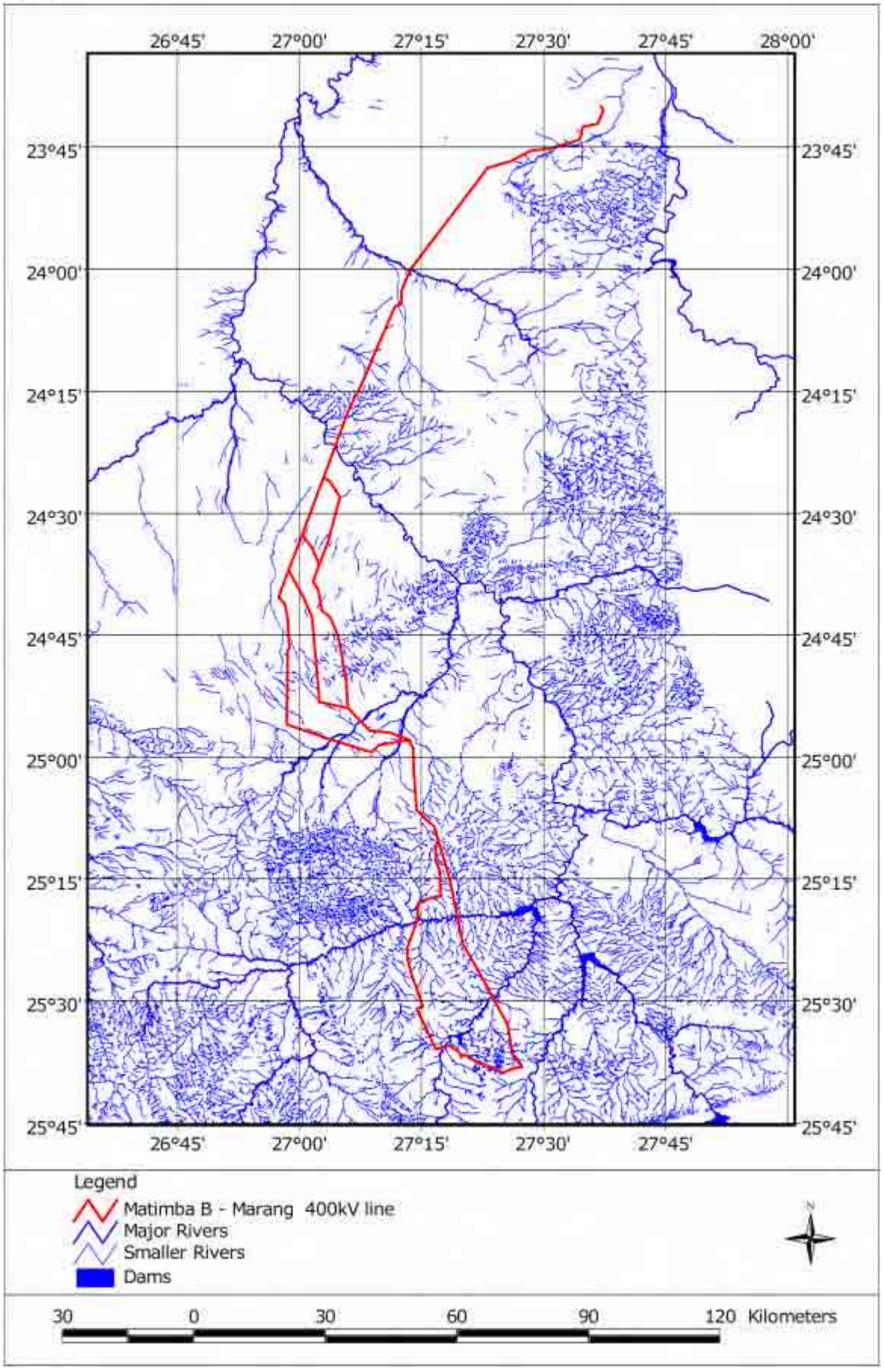
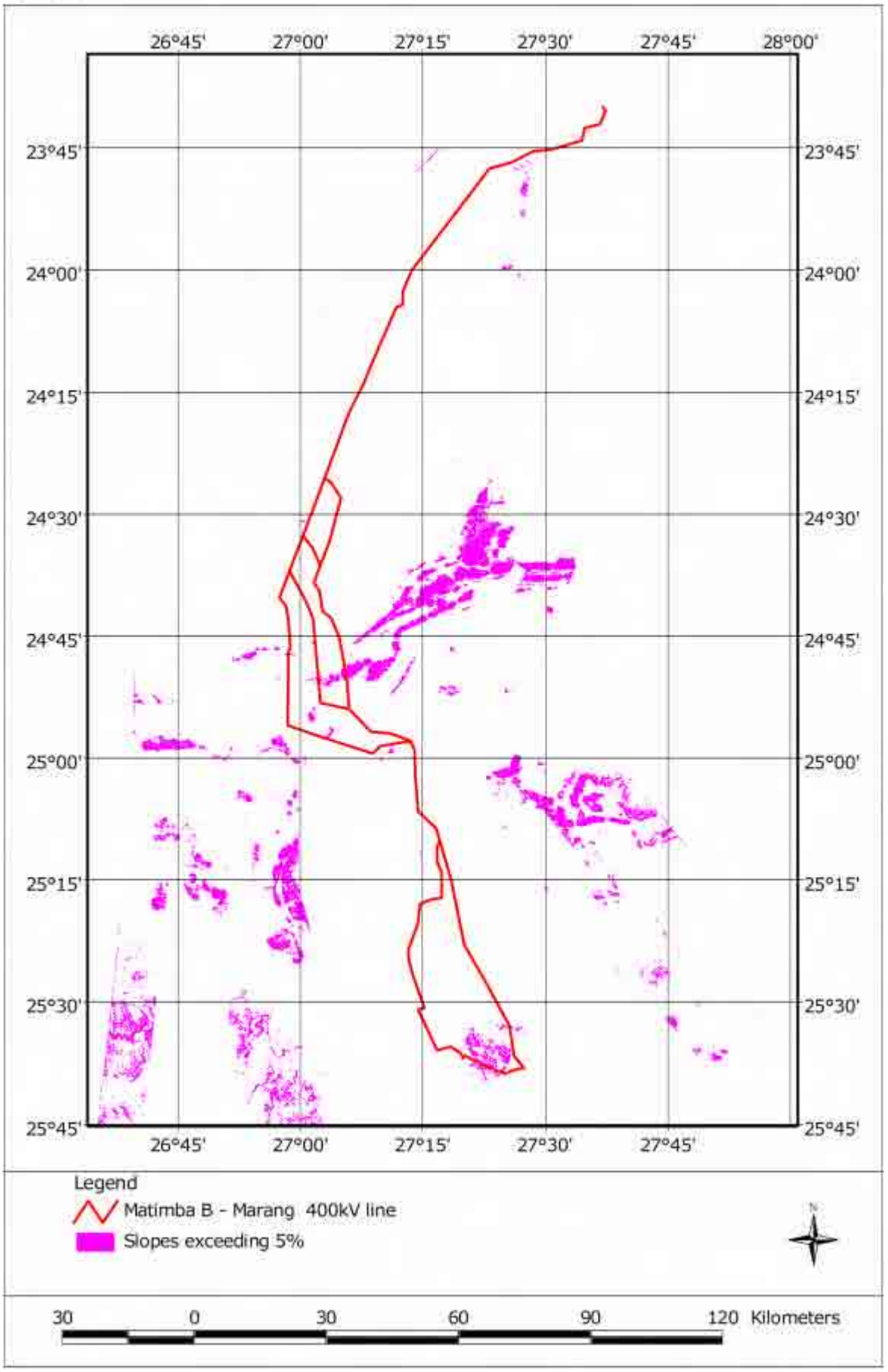


Figure 3: Areas of high slopes in the study area



6.4 Regional Vegetation – Low & Rebelo

The following Low and Rebelo vegetation types are included in this proposed development (Figure 4):

- Waterberg Moist Mountain Bushveld;
- Clay Thorn Bushveld;
- Sweet Bushveld; and
- Mixed Bushveld.

All of these vegetation types represent variations of the Savanna Biome, which is the largest biome in Southern Africa, occupying more than 46% of its area, and over one-third of the area of South Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants.

Environmental factors delimiting the biome are complex: altitude ranges from sea level to 2,000m; rainfall varies from 235 to 1,000mm per year; frost may occur and almost every major geological and soil type occurs within the biome. A major factor delimiting the biome is the lack of sufficient rainfall which prevents the upper layer from dominating, coupled with fires and grazing, which keep the grass layer dominant. The shrub layer may vary from 1 to 20m in height, but in Bushveld typically varies from 3 to 7m. The shrub-tree element may come to dominate the vegetation in areas which are being overgrazed. Summer rainfall is essential for the grass dominance, which, with its fine material, fuels near-annual fires. However, almost all species are adapted to survive fire, usually less than 10% of plants, both in the grass and tree layer, are killed by fire.

Conservation of the Savanna Biome is food in principle, mainly due to the presence of the Kruger and Kgalakgadi Transfrontier Parks and various other large reserves in neighbouring countries. However, this high area conserved in South Africa, belies the fact that half of savanna vegetation types are inadequately conserved, in having less than 5% of their area in reserves. However, much of the area is used for game farming and can thus be considered effectively preserved.

6.4.1 Waterberg Moist Mountain Bushveld

Waterberg Moist Mountain Bushveld occurs on sandstone and quartzite of the Waterberg Mountains. The tree layer is dominant, consisting of a composition of *Faurea saligna, Acacia caffra, Burkea africana, Terminalia sericea* and *Peltophorum africanum* on deep, sandy areas, with *Kirkia acuminata, Englerophytum magalismontanum, Protea caffra, Croton gratissimus, Combretum apiculatum, Albizia tanganyikensis* and *Combretum molle* characteristic of the rocky slopes. The shrub- and grass layer is moderately to well developed, depending on the intensity of the grazing component, which, together with fire, are important driving forces behind vegetation development. Aspect also plays an important role in the distribution of plant species.

Approximately 8.6% is formally conserved in the Marekele National Park and many private conservation areas and game farms such as Lapalala Wilderness, Touch Stone, Kwalata, Doorndraai Dam Nature Reserve, Emaweni Nature Reserve, Hans Strijdom Dam Nature Reserve and Mabalingwe Nature Reserve.

6.4.2 Clay Thorn Bushveld

Clay Thorn Bushveld, as described by Low and Rebelo, is widely distributed on flat plains with black or red vertic clay soils derived from basalts. The vegetation is dominated by various *Acacia* species, including *A. tortilis, A. nilotica, A. karroo, A. tenuispina, A. gerrardii, A. nigrescens* and *A. robusta*. Other woody species often encountered include *Ziziphus mucronata, Dichrostachys cinerea* and *Grewia flava*. The principal grass species, in a dense sward, are *Ischaemum afrum, Sehima galpinii, Setaria incrassata* and *Panicum coloratum*.

Overgrazing and deterioration of the grass sward causes a serious increase on cover of the woody species, with an associated dominance of *Bothriochloa insculpta, Aristida bipartita, Brachiaria eruciformis* and *Sorghum versicolor.* Representative portions of this vegetation type are conserved in Nylsvley, Mosdene, Potgietersrus and Warmbaths Nature Reserves, making up approximately 0.93% of the total area. Approximately 60% is considered to be transformed by cultivation and livestock farming.

6.4.3 Sweet Bushveld

The appearance of Sweet Bushveld is mostly a short and shrubby vegetation type, situated in the dry and hot Limpopo River valley. The distribution and structure of the vegetation is determined by the low rainfall and grazing. Sandy areas are dominated by trees such as *Terminalia sericea, Rhigozum obovatum, Grewia flava* and *Acacia tortilis* with the dominant grasses *Eragrostis pallens, Schmidtia pappophoroides, Eragrostis trichophora, Brachiaria nigropedata, Loudetia simplex* and *Aristida stipitata.* On shallower and drier soils, *Commiphora pyracanthoides, Grewia flava, Boscia albitrunca* and *Combretum apiculatum* are more prominent, and dense, impenetrable thickets of *Acacia erubescens, Acacia mellifera* and *Dichrostachys cinerea* are often encountered. Grasses, including *Panicum maximum, Panicum coloratum, Cenchrus ciliaris, Anthephora pubescens Enneapogon scoparius* and *Urochloa mossambicensis* may be dominant.

It is estimated that only 2.34% is conserved.

6.4.4 Mixed Bushveld

Mixed Bushveld, as is deduced from the name, represents a great variety of plant communities, with many variations and transitions. The vegetation varies from a dense, short bushveld to a rather open tree savanna. On shallow soils *Combretum apiculatum* dominates, occurring together with *Acacia caffra, Dichrostachys cinerea, Lannea discolour, Sclerocarya birrea* and various *Grewia* species. The grazing is sweet and the herbaceous layer is dominated by the grasses *Digitaria eriantha, Schmidtia pappophoroides, Anthephora pubescens, Stipagrostis uniplumis* and various *Aristida* and *Eragrostis* species. On deeper and more sandy soils *Terminalia sericea* becomes dominant, with *Ochna pulchra, Grewia flava, Peltophorum africanum* and *Burkea africana* often prominent species. The grass sward is scanty with *Eragrostis pallens* and *Perotis patens* characteristic. The structure of this vegetation type is determined by fire and grazing.

Representative areas (3.05%) are conserved in various smaller provincial nature reserves, private game farms and conservation areas, such as Ben Alberts, Mabula, Vaalkop Dam, Rust de Winter Dam, Roodeplaat Dam, Loskop Dam, Nylsvley, Rustenburg and Pietersburg, Percy Fyfe and Ben Lavin Nature Reserves.

6.5 Regional Vegetation – VEGMAP

The distribution of VEGMAP vegetation units is presented in Figure 5. The following units are included in the study area:

- Limpopo Sweet Bushveld;
- Western Sandy Bushveld;
- Dwaalboom Thornveld;
- Subtropical Alluvial Vegetation;
- Madikwe Dolomite Bushveld;
- Zeerust Thornveld;
- Central Sandy Bushveld;
- Norite Koppie Bushveld; and
- Marikana Thornveld;

A summary of the threatened status, as presented by VEGMAP[2] is presented in Table 1 The Central Sandy Bushveld are attributed a moderately sensitive status.

[2] Remaining area and percentage remaining refer to the remaining area untransformed by croplands, mining, urban development and roads. The percentage of the original area currently under protection was calculated based on Type 1 protected areas only. The biodiversity target refers to the percentage of the original areas required to capture 75% of the species occurring in each vegetation type. Ecosystem status is based on the percentage of the original area remaining untransformed in relation to the biodiversity target and a threshold for ecosystem functioning (CE: Critically Endangered; EN: Endangered; VU: Vulnerable, LT: Least Threatened). Protection level is based on the % of the biodiversity target conserved in Type 1 protected areas.

Table 1: VEGMAP vegetation units conservation status					
VEGMAP UNIT	**% Remaining**	**% Conserved**	**Target %**	**Ecosystem Status**	**Protection level**
Limpopo Sweet Bushveld	95%	1%	19%	LT	Hardly protected
Western Sandy Bushveld	96%	6%	19%	LT	Poorly protected
Dwaalboom Thornveld	86%	6%	19%	LT	Poorly protected
Subtropical Alluvial Vegetation	84%	74%	31%	LT	Well protected
Madikwe Dolomite Bushveld	99%	18%	19%	LT	Moderately protected
Central Sandy Bushveld	**76%**	**3%**	**19%**	**VU**	**Poorly protected**
Zeerust Thornveld	84%	3%	19%	LT	Poorly protected
Norite Koppie Bushveld	89%	0%	24%	LT	Not protected
Marikana Thornveld	52%	0%	19%	EN	Hardly protected

6.6 Natural Environmental Features

The distribution of natural environmental features that occur in the study area is presented in Figure 6. The following types of natural environmental features are present in the study area:

- Dolomite – water rich areas; and
- Norite rich areas.

These features are attributed a high environmental sensitivity.

Protected areas are present within the general region of the proposed lines, but will not be affected by the proposed development.

6.7 Condensation of Biophysical Sensitivity

Areas that contain biophysical attributes that are generally regarded as sensitive in terms of ecological attributes are indicated in Figure 7. Sampling of the floristic and faunal components was conducted within these areas, as indicated on Figure 7.

Figure 4: Low & Rebelo Vegetation units

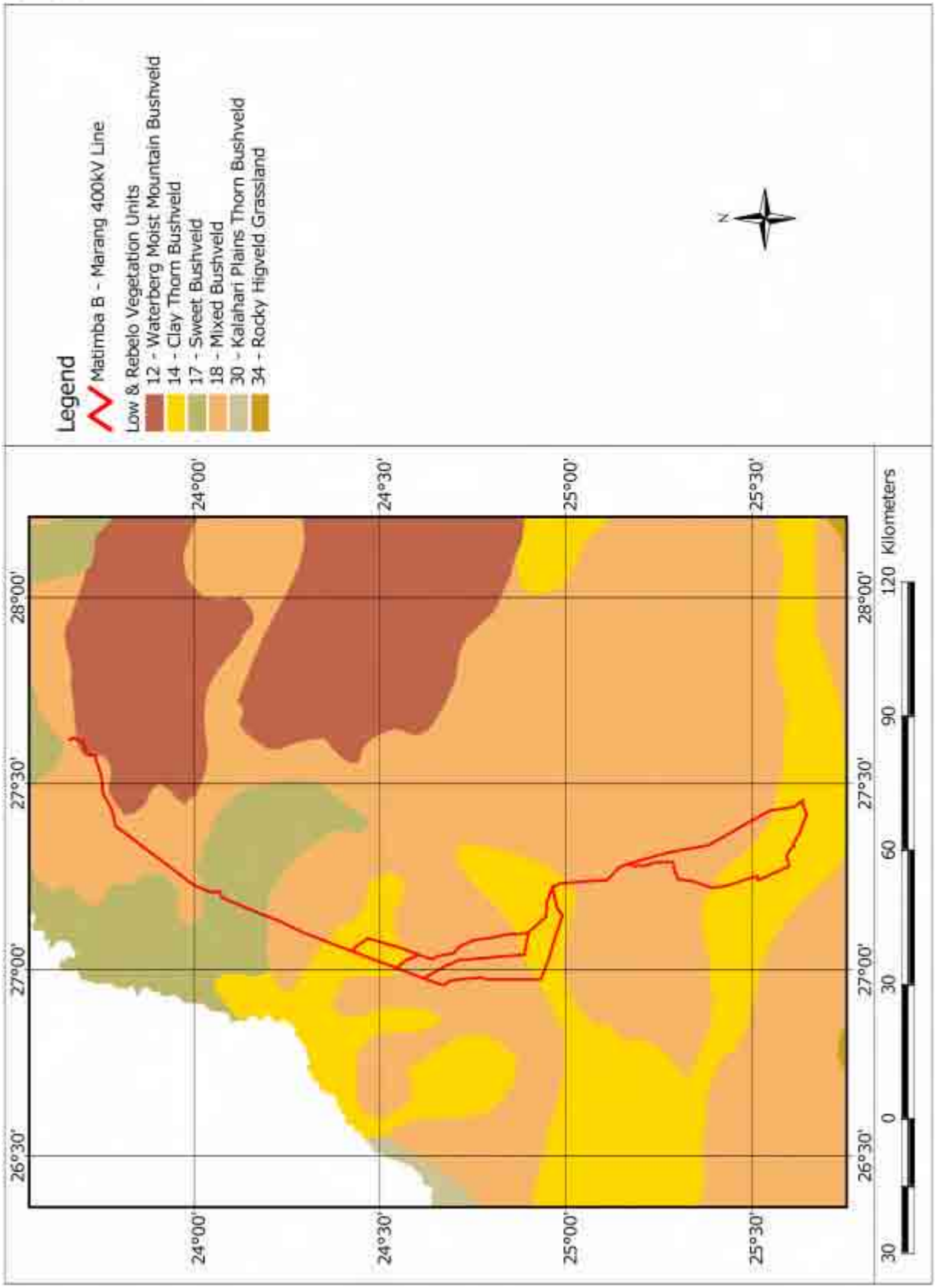


Figure 5: VEGMAP Vegetation Units

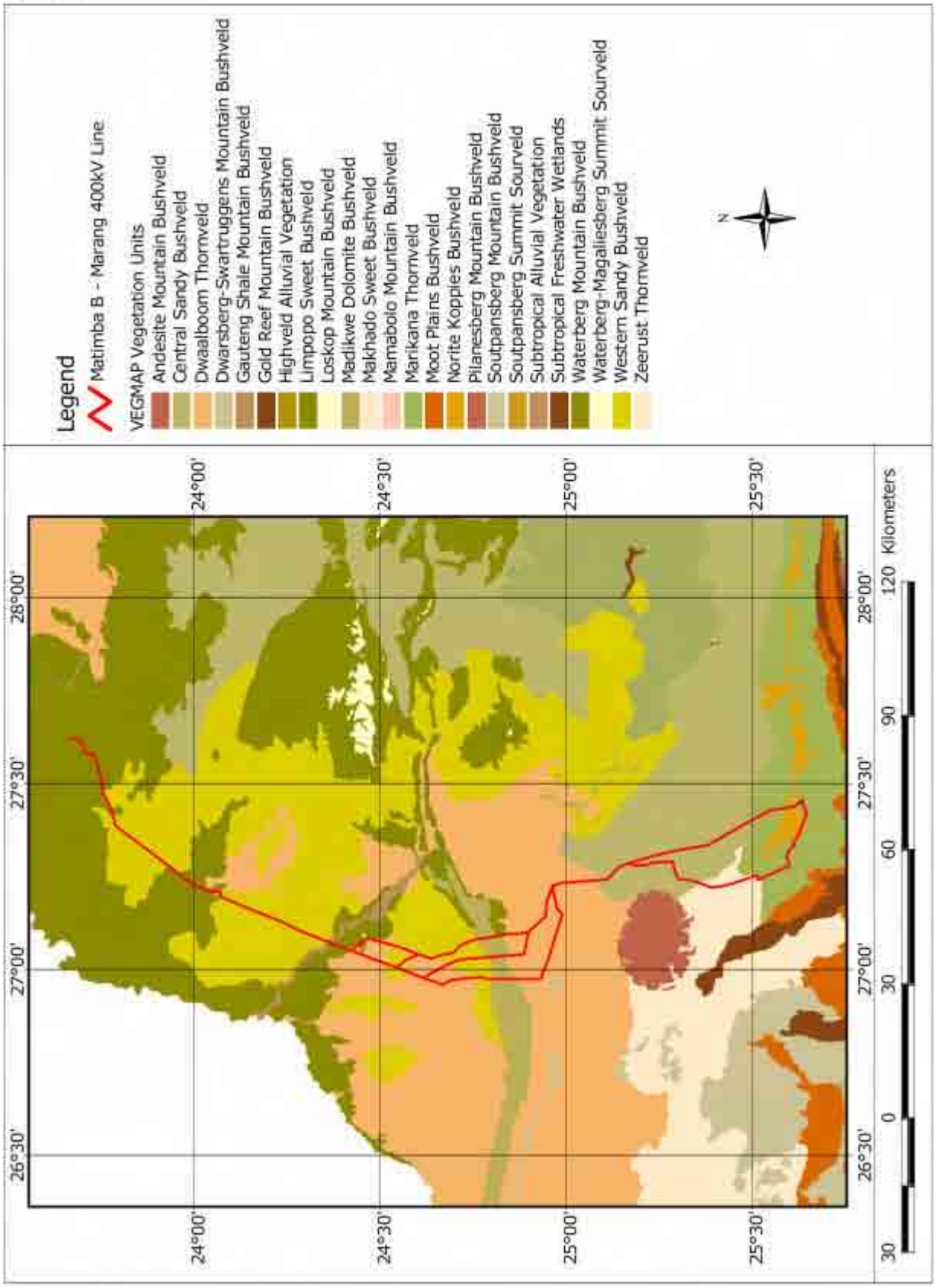


Figure 6: Natural features within the study area

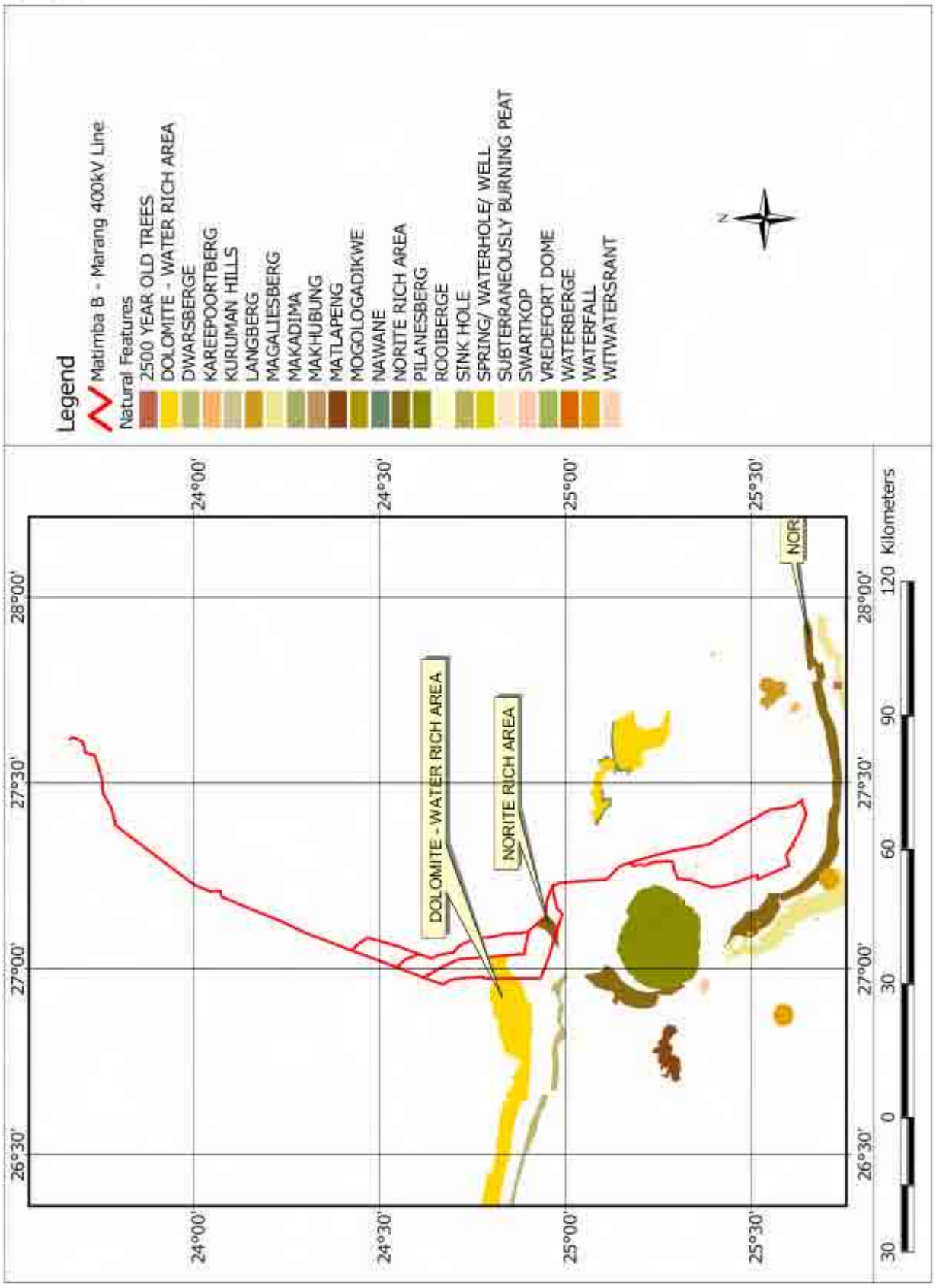
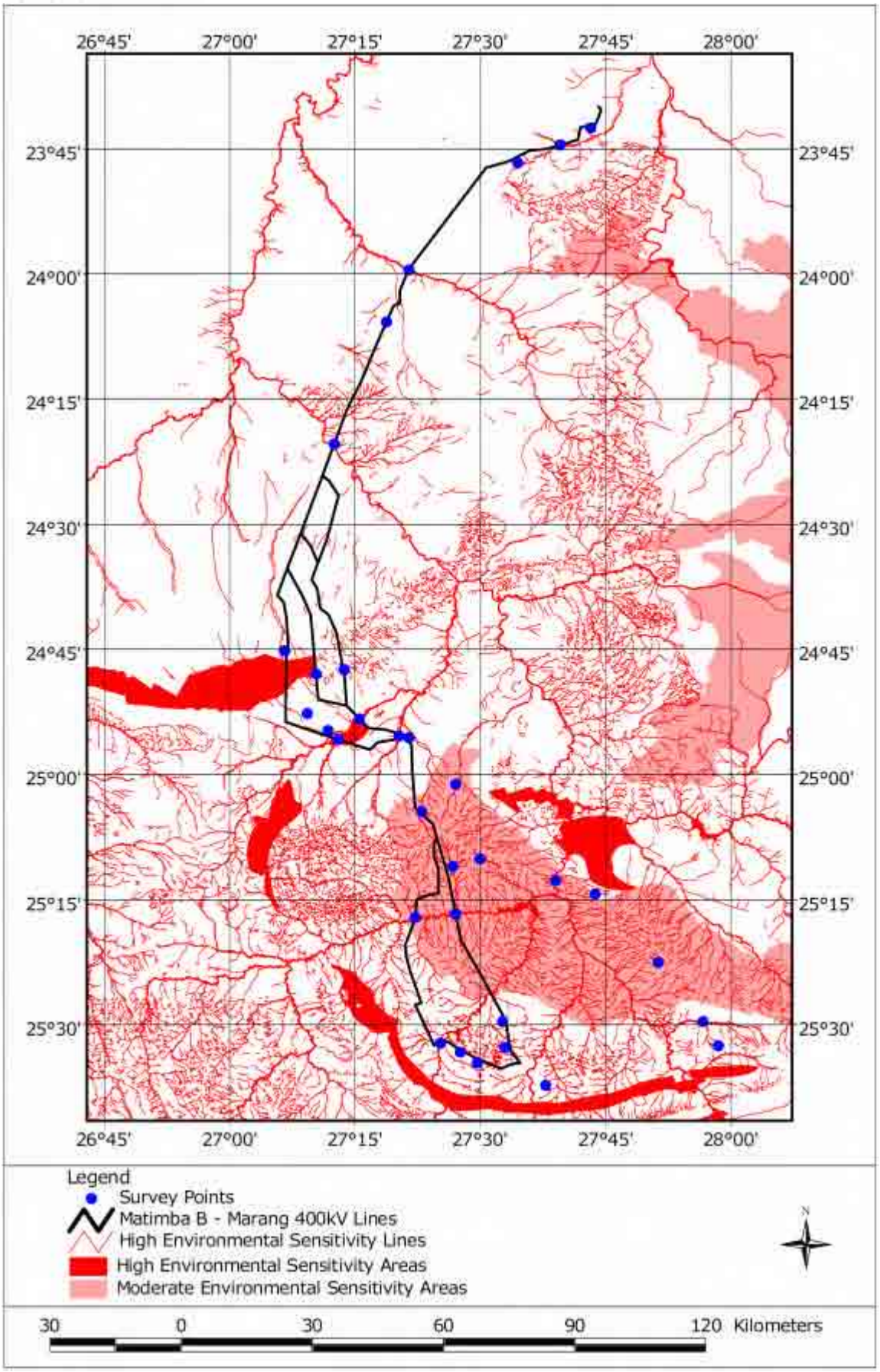


Figure 7: Sensitive biophysical attributes within the study area



7 FLORA OF THE STUDY AREA

Strategic sampling was conducted within areas that exhibit biophysical attributes of sensitivity, as well as specific areas of impact, as indicated in Figure 7. Sensitive areas exhibit the following biophysical attributes:

- Areas of surface water (rivers); or
- Areas of high slopes (ridges)

In addition to these areas, sampling was also conducted within the following areas:

- Selected areas of natural regional vegetation; and
- Areas of proposed Substation upgrades.

Cognisance of other sensitive biophysical attributes will be taken into consideration e section dealing with the biological impact evaluation.

7.1 Floristic Species Diversity of the Region

PRECIS information presented by SANBI (email application) indicates the presence of 795 plant species. Due to the size of the dataset, it is not included in this report, but can be presented separately on request. An examination of the known floristic diversity of the respective ¼ degree grids is indicated in Table 2. The average number of species per ¼ degree grid is 108 species, with the highest being 341 and the lowest 5 species, indicating that poor knowledge exist of the flora of certain areas.

A list of species observed during the site investigation is presented in Appendix 1.

Table 2: Floristic diversity of relevant ¼ degree grids

Grids	Number of species
2327CC	33
2327CD	39
2327DA	302
2426DB	18
2426DD	5
2427AA	27
2427AC	26
2427CA	?
2427CC	?
2527AA	341
2527AB	22
2527AC	253
2527AD	121
2527CA	?
2527CB	?
Average	**108**

7.2 Sensitive Floristic Habitat Types

7.2.1 Ridges

The vegetation of ridges that will potentially be affected by the proposed development is regarded as pristine and extremely few degraded areas were observed, even in areas that are located in close proximity to densely populated areas. The dominance of the woody layer is the major physiognomic attribute and a moderate grass and forb diversity is noted. A total of 48 plant species were observed in this habitat type and the species composition indicate few transitional, pioneer-, or other species that indicate a seral condition (Table 3). Common environmental parameters include surface rockiness (generally exceeding 25%), shallow top soils and high slopes (>5%).

Grazing pressure, utilization intensity and proximity to populated areas generally determine the floristic status of this habitat type. High slopes and areas of high rockiness are generally less accessible for cattle and are subsequently subjected to lower grazing pressure than surrounding areas where the vegetation is also more palatable. Hence, vegetation that characterises these parts is more pristine, characterised by a moderately diverse and well developed herbaceous layer.

In contrast, high grazing pressure in surrounding areas results in selective grazing and species changes results due to the plastic and elastic characteristics of the communities being exceeded. These changes are characterised by the disappearance of palatable grass species that are non-competitive and non-stress-tolerant and the proliferation of forbs and grasses that have a competitive advantage under conditions of high stress. The increase in cover of invasive woody species is also a significant attribute of degraded areas. Furthermore, these species changes are regarded as permanent and a change to the original pristine condition is not perceived as possible under the current management strategies.

In addition to the presence of pristine vegetation, these areas are considered suitable for the presence of Red Data flora species. No Threatened flora species were observed during the site investigation, but the Red Data tree species *Dombeya rotundifolia* var *rotundifolia* as well as the protected tree species *Sclerocarya birrea* was observed in several localities. *Dombeya rotundifolia* var *rotundifolia* has a Not Threatened status, implying that this species is no longer included in any of the threatened categories due to an increase in the population size or the discovery of more individuals or populations. It is encountered throughout the study area. Protected tree species do not have a Red Data status, but has a legal (provincial) protected status and should be afforded consideration during the construction and operational phases of the project. It is emphasised that, in the case of unavoidable impacts on individuals of these species, permits need to be submitted by the client prior to these individuals being damaged or removed.

The association of ridges and mountains with Red Data and threatened plant species has been proven extensively. This is mainly a result of atypical habitat conditions that are created by rockiness and high slopes.

Areas that will be affected by the proposed development are mainly situated in the southern part of the study area. Fortunately, these areas are not extensive and can be avoided by means of realignment. Impacts resulting from construction within these environments will result in the transformation of the physiognomy and species composition.

SENSITIVITY ASPECTS

- These areas are generally regarded as sensitive;
- Vegetation of these areas is pristine;
- Extremely few declared invasive plant species are present;
- Moderate species diversity is observed;
- The floristic status of these areas is HIGH;
- No threatened flora species were observed within this habitat type;
- The Red Data tree species *Dombeya rotundifolia* var *rotundifolia* (NT) was observed in several localities;
- The protected tree species *Sclerocarya birrea* was observed in several localities;
- Suitability of available habitat for Red Data flora species is MEDIUM-HIGH;
- The floristic sensitivity of this habitat types is HIGH; and
- Likely impacts on the floristic environment will be significant on a local scale.

Table 3: Floristic Species list for some rocky outcrops

Species Name	Growth Form	Family
Acacia caffra	Tree	Mimosaceae
Acacia nilotica	Tree	Mimosaceae
Acacia tortilis	Tree	Mimosaceae
Aloe greatheadii	Succulent	Liliaceae
Aristida canescens	Grass	Poaceae
Berchemia zeyheri	Tree	Rhamnaceae
Bothriochloa insculpta	Grass	Poaceae
Brachiaria serrata	Grass	Poaceae
Clerodendrum glabrum	Tree	Verbenaceae
Combretum apiculatum	Tree	Combretaceae
Combretum molle	Tree	Combretaceae
Corchorus confuses	Forb	Tiliaceae
Croton gratissimus	Tree	Euphorbiaceae
Cussonia paniculata	Tree	Araliaceae
Cyphostemma species	Climber	Vitaceae
Dichrostachys cinerea	Tree	Mimosaceae
Diheteropogon amplectens	Grass	Poaceae
Diospyros lycioides	Tree	Ebenaceae
Dombeya rotundifolia	**Tree**	**Sterculiaceae**
Eragrostis superba	Grass	Poaceae

Euclea crispa	Tree	Ebenaceae
Euphorbia cooperi	Tree	Euphorbiaceae
Euphorbia ingens	Tree	Euphorbiaceae
Ficus species	Tree	Moraceae
Gnidia capitata	Forb	Thymelaeaceae
Grewia flava	Shrub	Tiliaceae
Grewia monticola	Shrub	Tiliaceae
Gymnosporia buxifolia	Tree	Celastraceae
Haemanthus species	Geophyte	Amaryllidaceae
Heteropogon contortus	Grass	Poaceae
Jatropha species	Forb	Euphorbiaceae
Lannea discolor	Tree	Anacardiaceae
Loudetia flavida	Grass	Poaceae
Mundulea sericea	Tree	Fabaceae
Pappea capensis	Tree	Sapindaceae
Pellaea calomelanos	Fern	Adianthaceae
Peltophorum africanum	Tree	Ceasalpiniaceae
Phyllanthus reticulates	Tree	Euphorbiaceae
Polygala hottentotta	Forb	Polygalaceae
Rhoicissus tridentate	Climber	Vitaceae
Rhus leptodictya	Tree	Anacardiaceae
Sclerocarya birrea	**Tree**	**Anacardiaceae**
Senecio venosus	Forb	Asteraceae
Setaria species	Grass	Poaceae
Themeda triandra	Grass	Poaceae
Vangueria infausta	Tree	Rubiaceae
Vepris lanceolata	Tree	Rutaceae
Ziziphus mucronata	Tree	Rhamnaceae

7.2.2 Riparian Vegetation Types

Different riparian vegetation types were recognised, including major perennial rivers and the smaller non-perennial streams and drainage lines. Only the major perennial rivers were included in the site investigation.

Two variations were recognised within the Riparian Vegetation Type, namely Woodland Riparian habitat and the Reedbed Riparian habitat. The woody component of the former represents the major physiognomic attribute. The vegetation structure of the open Reedbed Riparian habitat is characterised either by the presence of *Phragmites australis*, or open banks where the transitional zone between the aquatic and terrestrial zone is relative narrow.

The species composition of these areas is generally low; a total of 48 species were observed within the sample plot areas (Table 4). Due to the aquatic nature of this habitat type, several declared invasive plant species occur, contributing to a loss of habitat quality. No Red Data flora species were observed within these areas and the habitat is not considered particularly suitable for the potential presence of these species.

The floristic status of these areas varies between low and moderate as a result of the impacts that affect the vegetation. Proximity to populated areas has a strong influence on the floristic status of this habitat type. It should however be noted that high environmental sensitivity is attributed to all habitat that is associated with aquatic systems, beit degraded or pristine.

Impacts within the respective Reedbed and Woodland habitat will differ significantly; little effect is expected to result in the open Reedbed habitat while transformation of the woody component of the Woodland Riparian habitat is regarded as a significant impact on the biological environment.

SENSITIVITY ASPECTS

- Aquatic habitat are generally regarded as sensitive;
- Vegetation of these areas is moderately pristine;
- Some declared invasive plant species are present;
- Low species diversity is observed;
- The floristic status of these areas is MEDIUM;
- No Red Data flora species were observed within this habitat type;
- Suitability of available habitat for Red Data flora species is LOW;
- The floristic sensitivity of these habitat types is MEDIUM-HIGH; and
- Likely impacts on the floristic environment will be significant on a local scale.

Table 4: Species list for some riparian areas

Species Name	Growth Form	Family	Alien Status
Acacia karroo	Tree	Mimosaceae	
Acacia mellifera	Tree	Mimosaceae	
Acacia tortilis	Tree	Mimosaceae	
Aloe greatheadii	Succulent	Liliaceae	
Asparagus species	Shrub	Liliaceae	
Buddleja salviifolia	Tree	Buddlejaceae	
Celtis africana	Tree	Ulmaceae	
Combretum erythrophyllum	Tree	Combretaceae	
Combretum hereroense	Tree	Combretaceae	
Cynodon dactylon	Grass	Poaceae	
Cyperus species	Sedge	Cyperaceae	
Diospyros lycioides	Tree	Ebenaceae	
Eragrostis capensis	Grass	Poaceae	
Eragrostis chloromelas	Grass	Poaceae	
Eragrostis lehmanniana	Grass	Poaceae	
Eragrostis rigidior	Grass	Poaceae	
Euclea divinorum	Tree	Ebenaceae	
Eustachys paspaloides	Grass	Poaceae	
Geigeria burkei	Forb	Asteraceae	
Gomphocarpus fruticosus	Shrub	Asclepidaceae	
Gomphrena celosioides	Forb	Amaranthaceae	
Grewia flava	Shrub	Tiliaceae	

Grewia flavescens	Shrub	Tiliaceae	
Gymnosporia buxifolia	Tree	Celastraceae	
Heteropogon contortus	Grass	Poaceae	
Hyperthelia dissoluta	Grass	Poaceae	
Ledebouria revoluta	Geophyte	Liliaceae	
Leersia hexandra	Grass	Poaceae	
Melia azedarach	Tree	Meliaceae	Category 3
Melinis repens	Grass	Poaceae	
Panicum maximum	Grass	Poaceae	
Peltophorum africanum	Tree	Ceasalpiniaceae	
Phragmites australis	Hydrophilic	Poaceae	
Phragmites mauritianus	Hydrophilic	Poaceae	
Rhus lancea	Tree	Anacardiaceae	
Rhus pyroides	Tree	Anacardiaceae	
Ricinus communis	Shrub	Euphorbiaceae	Category 2
Salix babylonica	Tree	Salicaceae	Category 2
Schmidtia pappophoroides	Grass	Poaceae	
Solanum panduriforme	Forb	Solanaceae	
Tarchonanthus camphoratus	Shrub	Asteraceae	
Themeda triandra	Grass	Poaceae	
Typha capensis	Hydrophilic	Typhaceae	
Urochloa mosambicensis	Grass	Poaceae	
Ziziphus mucronata	Tree	Rhamnaceae	

7.3 Other Areas

7.3.1 Natural Regional Vegetation

Large tracts of natural regional habitat are present in the study area and were found to be largely representative of the regional vegetation types (see Section 6.4). No specific sampling was conducted in these areas as the impacts are considered similar across the region and no aspect of sensitivity was identified during the site investigation.

The vegetation is fairly representative of the regional vegetation (Savanna Biome) and management styles of the general area determine the status of the woodland. It would appear as if fire is not a frequent occurrence in most areas and it would explain the extreme dominance of the woody layer. The canopy cover in most areas of natural vegetation exceeds 50%, implying a strong shade effect and the establishment of an herbaceous stratum that is characterised by relative poor diversity.

The status of the savanna vegetation observed within the study area is not considered high. Natural encroachment of woody species, as a result of over utilisation has resulted in the extremely dense status of the woody layer. Furthermore, the exclusion of fire for prolonged periods of time, sometimes exceeding 10 years, contributes to this problem. Although the species composition of the natural communities and variations could still be considered normal, phytosociological changes result due to the sub-optimal environmental

conditions. A moderate floristic status is attributed to the natural vegetation of the study area.

7.3.2 Marang Substation Upgrades

Vegetation encountered in these areas constitutes degraded regional vegetation and does not contain any floristic aspect of significance. The vegetation conforms to savanna habitat that was subjected to frequent clearing operations for a prolonged period of time, resulting in the establishment of a dominant grass layer and a poorly developed forb component. The woody layer constitutes small shrubs, mostly *Acacia* species.

Available habitat within these areas is not considered suitable for the presence of Red Data or protected flora species.

SENSITIVITY ASPECTS

- Areas of natural vegetation are not regarded particularly sensitive;
- Invasive plant species are present extensively;
- Low floristic diversity is observed;
- The floristic status of these areas is LOW;
- No Red Data flora species were observed within this habitat type;
- Suitability of available habitat for Red Data flora species is LOW;
- The floristic sensitivity of this habitat types is LOW; and
- Likely impacts on the floristic environment will be insignificant on a local scale.

7.4 Species of Importance

PLEASE NOTE:

1 Use of Red Data species information is restricted exclusively to this report and may not be used for any other purpose.

2 Red Data information may not be published anywhere.

3 Red Data information may not be copied, either as a hard or electronic copy.

4 Red Data information is to remain confidential. Any report containing Red Data information must be supplied as an appendix to the main document, marked confidential **and may not be attached to any document available for public perusal.** The main document may only indicate the number of Red Data species recorded on the site and their statuses, *i.e.* the species names may not appear in the main document.

The World Conservation Organisation (IUCN) has three threatened categories, namely Critically Endangered, Endangered and Vulnerable. Species that have been evaluated according to the IUCN criteria and do not fall into one of the threatened categories can be classified as Least Concern, Near Threatened or Data Deficient. Species classified as Least Concern have been evaluated and do not qualify for the Critically Endangered, Endangered, and Vulnerable or Near Threatened categories. Species that are widespread and abundant are normally included in this category.

Species are classified as Near Threatened when they do not meet the criteria for the threatened categories, but are close to classifying as threatened or will likely be classified as threatened in the near future. A species is classified as Data Deficient when there is a lack of appropriate data on the distribution and/ or population status of the species. The species may well be studied, and the biology known, but data on the abundance and/ or distribution is not available. The category indicates that more data is needed and that there is a possibility that the species may be classified into one of the threatened categories in the future. Vulnerable species are facing a high risk of extinction in the wild, Endangered a very high risk and Critically Endangered an extremely high risk (Minter et al, 2004).

Plant species data received from the South African National Biodiversity Institute (SANBI) has been classified according to the old IUCN Red Data categories of 1986. The categories used in the old Red Data classification are Extinct, Endangered, Vulnerable, Rare, Indeterminate, Insufficiently Known, Not Threatened and No Information. Endangered taxa are taxa in danger of extinction and are unlikely to survive if the current situation continues. Vulnerable species are taxa that are likely to move into the Endangered category in the near future if the factors causing the decline continue to be present.

Rare taxa are taxa with small populations that are not classified as Endangered or Vulnerable, but are at risk as an unexpected threat may cause a decline in the population. Indeterminate taxa are taxa known to be in one of the four above categories, but insufficient information is available to determine which of the four categories. Insufficiently Known taxa are suspected to belong to one of the above categories, but this is not known for certain as there is a lack of information available on the species (Hilton-Taylor, 1996).

Not Threatened taxa are taxa that are no longer included in any of the threatened categories due to an increase in the population size or the discovery of more individuals or populations. No Information includes taxa without any information available. The Rare category is seen as similar to the Near Threatened category in the new classification and the Insufficiently Known category seems to be similar to the Data Deficient category in the new classification.

PRECIS data indicate the known presence of 29 Red Data flora species within the respective ¼ degree grids in which the study area is situated (Table 5).

Table 5: Red Data flora species for the relevant ¼ degree grids

Taxon	Threatened Status	Description
Acalypha angustata	nt	Not threatened
Adenium oleifolium	nt	Not threatened
Asclepias eminens	R	Rare
Asclepias fallax	R	Rare
Barleria mackenii	nt	Not threatened

Barleria macrostegia	nt	Not threatened
Barleria rehmannii	K	Insufficiently known
Boscia foetida ssp *minima*	R	Rare
Cleome maculata	nt	Not threatened
Craterostigma plantagineum	nt	Not threatened
Erythrophysa transvaalensis	R	Rare
Euphorbia waterbergensis	V	Vulnerable
Gossypium herbaceum ssp *africanum*	nt	Not threatened
Ochna glauca	K	Insufficiently known
Pavetta zeyheri ssp *zeyheri*	nt	Not threatened
Tristachya biseriata	K	Insufficiently known

Seasonal and project limitations placed severe restrictions on the location and identifying of these species. No Threatened species were observed during the site investigation, but available habitat in the study area, particularly the Ridges habitat, is considered suitable for some of these species. The Red Data tree species *Dombeya rotundifolia* var *rotundifolia* was observed in several localities, although not recorded on the SANBI database of species for these respective 1/degree grid areas. This is a reflection of undersampling of these areas, rather than the true absence of this species. *Dombeya rotundifolia* var *rotundifolia* has a Not Threatened status, implying that this species is no longer included in any of the threatened categories due to an increase in the population size or the discovery of more individuals or populations. It is frequently encountered throughout the study area.

The protected tree species *Sclerocarya birrea* and *Combretum imberbe* were observed in several localities. Protected tree species do not have a Red Data status, but has a legal (provincial) protected status (The National Forests Act, 1998) and should be afforded consideration during the construction and operational phases of the project. In the case of unavoidable impacts on individuals of these species, permits need to be obtained by the client prior to these individuals being damaged or removed.

Species of importance that were observed during the site investigation are considered well represented in the general region outside the study area. Although the presence of these species will not influence the outcome of this particular assessment, specific recommendations will be made to protect individuals that will be affected by the proposed development.

Taking the variety of Red Data flora species that are known to occur in the region into consideration, all natural habitat that is in a pristine condition is considered suitable for the presence of these species. It should be noted that this might be a reflection of the sampling that was historically done in the region. Areas of low accessibility are generally excluded from general sampling. The likelihood of encountering Red Data flora species within sensitive environments, such as ridges, is considered higher than for the surrounding areas.

7.5 Floristic Sensitivity Analysis

Calculation of the Floristic Sensitivity Analysis is presented in Table 6.

The pristine nature of vegetation associated with ridges and the confirmed presence of Red Data and protected tree species renders vegetation in these parts highly sensitive. In contrast, despite a general high environmental sensitivity, the moderate diversity and mostly degraded status of vegetation within the riparian habitat renders the vegetation of these areas moderately sensitive.

Vegetation encountered in the natural regional habitat is considered moderately sensitive, mainly as a result of the moderate levels of over-utilisation.

Vegetation encountered in the general vicinity of the proposed Substation upgrade sites does not exhibit any attributes of floristic sensitivity.

Table 6: Floristic Sensitivity Calculation								
Criteria	**RD species**	**Landscape sensitivity**	**Status/Ecological quality**	**Species composition**	**Functionality/ fragmentation**	**TOTAL**	**SENSITIVITY INDEX**	**SENSITIVITY CLASS**
Community	**Criteria Ranking**							
Ridge Habitat	10	10	8	8	8	266	92%	HIGH
Riparian Habitat	5	10	7	6	8	200	69%	MEDIUM-HIGH
Regional Vegetation	3	3	5	6	10	121	42%	MEDIUM
Substation Upgrade Sites	1	1	2	3	2	46	16%	LOW

8 FAUNAL ASSESSMENT

Please note that the avifaunal component is addressed in a separate document and is therefore not included in this assessment.

8.1 Faunal Habitat

Available habitat in the study area conforms to the natural regional habitat types and is generally well represented in the surrounding region. Atypical habitat types are represented by ridges, which are situated mostly in the southern part of the study area, and riparian habitat, which is present throughout the area as perennial and non-perennial rivers and streams. These habitat types were identified during the scoping phase of this project and were assessed for the suitability for Red Data fauna species during this part of the investigation.

8.1.1 Ridges

The status of this habitat types is dependent on proximity to populated areas. Areas of human occupation, located in close proximity of towns and settlement areas are generally degraded and constitute sub-optimal faunal habitat.

Atypical habitat types generally represent sensitive faunal habitat, although not always containing a high diversity of fauna species. Ridges contain a multitude of micro habitat that is highly suitable for the presence of Red Data fauna species and these habitat types that could potentially be affected by the proposed development will undoubtedly contain some of these species. A high faunal sensitivity is therefore attributed to this habitat type.

Impacts associated with the construction and operation of a power line within a ridge environment are considered significant and will result in significant impacts on Red Data fauna species that are likely to occur within this habitat type. This statement is supported by the habitat requirements of the rare and restricted species that are likely to occur within the study area. The transformation and associated impacts on this habitat type furthermore lead to an increase in the isolation and fragmentation of available habitat.

8.1.2 Wetlands

Riparian habitat, beit perennial rivers, or smaller non-perennial streams, are considered highly suitable for the presence of sensitive fauna species. Red Data fauna species that are likely to occur in the study area are strongly associated with either of these habitat types and cannot exist without the habitat provided by these ecological units. If Data Deficient Red Data fauna species are excluded from the assessment, most Red Data fauna species associated with either wetlands or ridges.

Likely impacts within the riparian environment are regarded as less significant since physical damage does not constitute a significant part of the likely impacts. Faunal

species associated with riparian environments are generally tolerable to impacts associated with this type of development.

8.1.3 Natural Regional Habitat

The largest extent of the faunal biodiversity of a region is normally encountered in the more common habitat, which is represented by the various savanna variations that are present throughout the study area. Due to the fairly low significance of impacts expected to result from the construction of power lines in this habitat type, no physical sampling was conducted, but general observations were nonetheless made in order to identify any localised area of significance.

No areas of significance were observed within the areas that constitute that natural regional habitat.

Extensive parts of the natural regional habitat within the study area are regarded as sub-optimal faunal habitat as a result of over-grazing and subsequent bush-encroachment, which has led to a decline in faunal diversity. The clearing of excessively dense areas could therefore be regarded as a positive impact in these parts. The loss of natural regional habitat resulting from the proposed development is minimal and the transformed habitat underneath power lines does not represent a significant obstacle to terrestrial animals.

8.1.4 Marang Substation Upgrades

Causal observations made in the areas of the proposed upgrade of the Marang Substation revealed the presence of degraded habitat. The faunal diversity of these areas is expected to be adequately represented in the surrounding area; surrounding areas are regarded more suitable for a higher faunal diversity. Available habitat within these areas is not considered suitable for the presence of any Red Data fauna species.

8.2 Regional Faunal Assemblages

8.2.1 Amphibians

A total of 116 amphibian species occur in South Africa, 27 of which are known to occur in the study area (Table 7). One species is listed as Red Data (**red**) and one species are restricted to 2 or less provinces in SA (**blue**).

Table 7: Amphibian species of the study area

Scientific Name	English Name	Provinces
Afrana angolensis	Common River Frog	9
Breviceps adspersus	Bushveld Rain Frog	8
Bufo fenoulheti	Northern Pygmy Toad	5
Bufo garmani	Eastern Olive Toad	7
Bufo gutturalis	Guttural Toad	9
Bufo maculatus	Flat-backed Toad	4
Bufo rangeri	Raucous Toad	9
Bufo vertebralis	Southern Pygmy Toad	7
Cacosternum boettgeri	Boettger's Caco	9
Chiromantis xerampelina	Southern Foam Nest Frog	5
Hemisus marmoratus	Mottled Shovel-nosed Frog	4
Hildebrantia ornata	Southern Ornate Frog	3
Kassina senegalensis	Bubbling Kassina	9
Phrynobatrachus mababiensis	Dwarf Puddle Frog	5
Phrynobatrachus natalensis	Snoring Puddle Frog	8
Phrynomantis bifasciatus	Banded Rubber Frog	5
Ptychadena anchietae	Plain Grass Frog	5
Ptychadena mossambica	Broad-banded Grass Frog	5
Pyxicephalus adspersus	**Giant Bullfrog**	**9**
Pyxicephalus edulis	Edible Bullfrog	5
Schismaderma carens	Red Toad	7
Strongylopus fasciatus	Striped Stream Frog	8
Tomopterna cryptotis	Tremolo Sand Frog	8
Tomopterna krugerensis	Knocking Sand Frog	4
Tomopterna marmorata	**Russet-backed Sand Frog**	**2**
Tomopterna natalensis	Natal Sand Frog	7
Xenopus laevis	Common Platanna	9

8.2.2 Reptiles

A total of 543 reptile species occur in South Africa, 67 of which are known to occur in the study area (Table 8). One species is listed as red data (**red**) and three species are restricted to 2 or less provinces in SA (**blue**).

Table 8: Reptile species of the study area

Scientific Name	English Name	Provinces
Acantocercus atricollis	Southern Tree Agama	7
Agama atra	Southern Rock Agama	9
Aparallactus capensis	Black-headed Centipede Eater	8
Aspidelaps scutatus	Common Shield-nose Snake	5
Bitis arietans	Puff Adder	9
Bitis caudalis	Horned Adder	6
Causus defilippii	Snouted Night Adder	3
Causus rhombeatus	Rhombic Night Adder	9
Chamaeleo dilepis	Flap-neck Chameleon	9
Cordylus breyeri	**Waterberg Girdled Lizard**	**2**
Cordylus guttatus	**Dwarf Flat Lizard**	**1**
Cordylus jonesii	Jones' Girdled Lizard	5
Cordylus vittifer	Transvaal Girdled Lizard	6
Crotaphopeltis hotamboeia	Red-lipped Snake	9
Dasypeltis scabra	Rhombic Egg-eater	9
Dendroaspis polylepis	Black Mamba	4
Dispholidus typus	Boomslang	9
Elapsoidea boulengeri	Boulenger's Garter Snake	5
Geochelone pardalis	Leopard Tortoise	9
Gerrhosaurus flavigularis	Yellow-throated Plate Lizard	8
Gerrhosaurus validus	Giant Plated Lizard	3
Heliobolus lugubris	Bushveld Lizard	4
Hemidactylus mabouia	Moreau's Tropical House Gecko	9
Homopholis wahlbergii	Wahlberg's Velvet Gecko	4
Homopus femoralis	Greater Padloper	5
Kinixys lobatsiana	Lobatse Hinged Tortoise	4
Kinixys spekii	Speke's Hinged Tortoise	4
Lamphrophis capensis	Brown House Snake	9
Leptotyphlops distanti	Distant's Thread Snake	6
Leptotyphlops incognitus	Incognito Thread Snake	5
Leptotyphlops nigricans	Black Thread Snake	5
Leptotyphlops scutifrons	Peters' Thread Snake	8
Lycodonomorphus rufulus	Common Brown Water Snake	9
Lygodactylus capensis	Cape Dwarf Gecko	8
Mehelya nyassae	Black File Snake	4
Monopeltis capensis	Cape Spade-snouted Worm Lizard	4
Naja annulifera	Snouted Cobra	6
Naja mossambica	M'fezi	5
Pachydactylus affinis	Transvaal Thick-toed Gecko	3
Pachydactylus turneri	Turner's Thick-toed Gecko	5

Pelusios sinuatus	Serrated Hinged Terrapin	5
Philothamnus hoplogaster	Green Water Snake	7
Philothamnus natalensis	Western Natal Green Snake	9
Philothamnus semivariegatus	Spotted Bush Snake	8
Platysaurus minor	**Waterberg Flat Lizard**	**1**
Prosymna stuhlmannii	East African Shovel-snout	3
Prosymna sundevallii	Sundevall's Shovel-snout	8
Psammobates oculiferus	Kalahari Tent Tortoise	5
Psammobates tentorius	Common Tent Tortoise	6
Psammophis angolensis	Dwarf Sand Snake	3
Psammophis brevirostris	Short-snouted Grass Snake	8
Psammophis mossambicus	Olive Grass Snake	5
Psammophis subtaeniatus	Western Stripe-bellied Sand Snake	3
Psammophylax tritaeniatus	Striped Skaapsteker	8
Pseudaspis cana	Mole Snake	9
Pseudocordylus melanotus	Drakensberg Crag Lizard	5
Pseudocordylus transvaalensis	Northern Crag Lizard	3
Python natalensis	**Southern African Python**	**6**
Rhinotyphlops schlegelii	Schlegel's Beaked Blind Snake	6
Telescopus semiannulatus	Eastern Tiger Snake	8
Thelotornis capensis	South-eastern Savanna Vine Snake	6
Trachylepis capensis	Cape Skink	9
Trachylepis margaritifer	Rainbow Skink	3
Trachylepis punctatissima	Montane Speckled Skink	7
Trachylepis varia	Variable Skink	9
Typhlops bibronii	Bibron's Blind Snake	8
Varanus albigularis	Rock Monitor	9

8.2.3 Mammals

A total of 293 reptile species occur in South Africa, 88 of which are known to occur in the study area (Table 8). Twenty-six species are listed as red data (**red**) and three species are restricted to 2 or less provinces in SA (**blue**).

Table 9: Mammal species of the study area

Scientific Name	English Name	Provinces
Acomys spinosissimus	Spiny Mouse	4
Aethomys chrysophilus	Red Veld Rat	3
Aethomys ineptus	Tete Veld Rat	6
Aethomys namaquensis	Namaqua Rock Mouse	9
Aonyx capensis	Cape Clawless Otter	9
Atelerix frontalis	**South African Hedgehog**	**7**
Atilax paludinosus	Water Mongoose	9
Canis mesomelas	Black-backed Jackal	9
Caracal caracal	Caracal	9
Cercopithecus aethiops	Vervet Monkey	9
Civettictis civetta	African Civet	4
Cloeotis percivali	**Short-eared Trident Bat**	**5**
Crocidura cyanea	**Reddish-grey Musk Shrew**	**9**
Crocidura fuscomurina	**Tiny Musk Shrew**	**9**
Crocidura hirta	**Lesser Red Musk Shrew**	**7**
Crocidura maquassiensis	**Maquassie Musk Shrew**	**6**
Crocidura mariquensis	**Swamp Musk Shrew**	**6**
Cryptomys hottentotus	Common Mole-rat	9
Cynictis penicillata	Yellow Mongoose	9
Dendromus melanotis	Grey Climbing Mouse	9
Dendromus mystacalis	Chestnut Climbing Mouse	6
Elephantulus brachyrhynchus	**Short-snouted Elephant-shrew**	**4**
Elephantulus intufi	**Bushveld Elephant-shrew**	**3**
Elephantulus myurus	Rock Elephant-shrew	8
Felis silvestris	African Wild Cat	9
Galago moholi	Southern Lesser Galago	4
Galerella sanguinea	Slender Mongoose	8
Genetta genetta	Small-spotted Genet	9
Genetta tigrina	Large-spotted Genet	8
Graphiurus murinus	Woodland Dormouse	8
Helogale parvula	Dwarf Mongoose	5
Hipposideros caffer	**Sundevall's Leaf-nosed Bat**	**6**
Hystrix africaeaustralis	Porcupine	8
Ichneumia albicauda	White-tailed Mongoose	7
Ictonyx striatus	Striped Polecat	9
Laephotis botswanae	**Botswana Long-eared Bat**	**1**
Lemniscomys rosalia	**Single-striped Mouse**	**5**
Leptailurus serval	**Serval**	**7**
Lepus saxatilis	Scrub Hare	9
Lutra maculicollis	**Spotted-necked Otter**	**8**

Manis temminckii	**Pangolin**	**4**
Mastomys coucha	Multimammate Mouse	8
Mellivora capensis	**Honey Badger**	**8**
Miniopterus schreibersii	**Schreibers' Long-fingered Bat**	**9**
Mungos mungo	Banded Mongoose	5
Mus indutus	**Desert Pygmy Mouse**	**1**
Myosorex varius	**Forest Shrew**	**9**
Neoromicia capensis	Cape Serotine Bat	9
Neoromicia zuluensis	Aloe Bat	3
Nycteris thebaica	Egyptian Slit-faced Bat	9
Oreotrachus oreotragus	Klipspringer	7
Orycteropus afer	Aardvark	6
Otocyon megalotis	Bat-eared Fox	6
Otomys angoniensis	Angoni Vlei Rat	5
Otomys irroratus	Vlei Rat	9
Papio ursinus	Chacma Baboon	9
Paraxerus cepapi	Tree Squirrel	4
Pedetes capensis	Springhare	9
Phacochoerus africanus	Warthog	5
Pipistrellus hesperidus	African Pipistrelle	6
Pipistrellus rusticus	**Rusty Bat**	**4**
Poecilogale albinucha	**African Weasel**	**9**
Potamochoerus porcus	Bushpig	6
Procavia capensis	Rock Hyrax	9
Pronolagus randensis	Jameson's Red Rock Rabbit	4
Proteles cristatus	Aardwolf	9
Raphicerus campestris	Steenbok	8
Rhabdomys pumilio	Striped Mouse	9
Rhinolophus blasii	**Peak-saddle Horseshoe Bat**	**5**
Rhinolophus clivosus	**Geoffroy's Horseshoe Bat**	**9**
Rhinolophus darlingi	**Darling's Horseshoe Bat**	**7**
Rhinolophus hildebrandtii	**Hildebrandt's Horseshoe Bat**	**2**
Rhinolophus simulator	Bushveld Horseshoe Bat	6
Saccostomys campestris	Pouched Mouse	9
Sauromys petrophilus	Flat-headed Free-tail Bat	6
Scotophilus dinganii	Yellow House Bat	6
Staetomys pratensis	Fat Mouse	5
Suncus lixus	**Greater Dwarf Shrew**	**5**
Suricata suricatta	Suricate	7
Sylvicapra grimmia	Common Duiker	9
Tadarida aegyptiaca	Egyptian Free-tailed Bat	9
Taphozous mauritianus	Mauritian Tomb Bat	7
Tatera brantsii	Highveld Gerbil	8
Tatera leucogaster	**Bushveld Gerbil**	**7**
Thallomys paedulcus	Tree Rat	5
Thryonomys swinderianus	Greater Cane Rat	6
Vulpes chama	Cape Fox	9
Xerus inauris	Cape Ground Squirrel	4

8.2.4 Invertebrates

Extremely little is known of the invertebrate richness of the region and only general assumptions can be made the absence of detailed sampling data. Trapping, sampling and identification of the invertebrate discipline is time consuming and extremely costly and was therefore excluded from the assessment. General observations were nonetheless made at sample points.

8.3 Red Data Fauna Species

The World Conservation Organisation (IUCN) has three threatened categories, namely Critically Endangered, Endangered and Vulnerable. Species that have been evaluated according to the IUCN criteria and do not fall into one of the threatened categories can be classified as Least Concern, Near Threatened or Data Deficient. Species classified as Least Concern have been evaluated and do not qualify for the Critically Endangered, Endangered, and Vulnerable or Near Threatened categories. Species that are widespread and abundant are normally included in this category.

Table 10: Red Data fauna species of the study area

Biological Name	English Name	RD Status	Habitat restrictions	Habitat type
INVERTEBRATES				
Aloeides dentatis	Roodepoort Copper	VU	*Hermannia* spp, ant nests	ridges
AMPHIBIANS				
Pyxicephalus adspersus	Giant Bullfrog	NT	seasonal, shallow grassy pans	wetland
REPTILES				
Python natalensis	Southern African Python	VU	open water, rocky areas	wetland & ridge
FREE ROAMING MAMMALS				
Atelerix frontalis	South African Hedgehog	NT	broad	broad
Cloeotis percivali	Short-eared Trident Bat	CR	caves for breeding	ridges
Crocidura cyanea	Reddish-grey Musk Shrew	DD	broad	broad
Crocidura fuscomurina	Tiny Musk Shrew	DD	broad	broad
Crocidura hirta	Lesser Red Musk Shrew	DD	broad	broad
Crocidura maquassiensis	Maquassie Musk Shrew	VU	rocky areas, montane grassland	ridges
Crocidura mariquensis	Swamp Musk Shrew	DD	marshy conditions	wetland
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	DD	heavy grass cover	broad
Elephantulus intufi	Bushveld Elephant-shrew	DD	sparse grass cover, sandy soils	broad
Hipposideros caffer	Sundevall's Leaf-nosed Bat	DD	caves for breeding	ridges
Laephotis botswanae	Botswana Long-eared Bat	VU	unknown breeding, outcrops	ridges
Lemniscomys rosalia	Single-striped Mouse	DD	heavy grass cover	broad
Leptailurus serval	Serval	NT	moist savanna, tall grass	wetland
Lutra maculicollis	Spotted-necked Otter	NT	permanent rivers & streams	wetland
Manis temminckii	Pangolin	VU	woody savanna, ant/termites	broad

Mellivora capensis	Honey Badger	NT	broad	broad
Miniopterus schreibersii	Schreiber's Long-fingered Bat	NT	caves for breeding	ridges
Myosorex varius	Forest Shrew	DD	marshes in grassland	wetland
Pipistrellus rusticus	Rusty Bat	NT	woody savanna, large trees	broad
Poecilogale albinucha	African Weasel	DD	broad	broad
Rhinolophus blasii	Peak-saddle Horseshoe Bat	VU	caves for breeding	ridges
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	caves for breeding	ridges
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	caves for breeding	ridges
Rhinolophus hildebrantii	Hildebrant's Horseshoe Bat	NT	caves for breeding	ridges
Suncus lixus	Greater Dwarf Shrew	DD	broad	broad
Tatera leucogaster	Bushveld Gerbil	DD	broad	broad

Sensitive habitat types (ridges and riparian habitat types) are considered highly suitable for the presence of Red Data fauna species. Ridges contain a multitude of micro habitat that is highly suitable for the presence of Red Data fauna species and these habitat types that could potentially be affected by the proposed development will undoubtedly contain some of these species. High faunal sensitivities are therefore attributed to these habitat types. Similarly, riparian zones, beit perennial rivers, or smaller non-perennial streams, are considered highly suitable for the presence of sensitive fauna species.

Red Data fauna species that are likely to occur in the study area are strongly associated with either of these habitat types and cannot exist without the habitat provided by these ecological units. If Data Deficient Red Data fauna species are excluded from the assessment, most Red Data fauna species associated with either wetlands or ridges. Only the Pangolin, SA Hedgehog, Honey Badger and Rusty Bat are not specifically linked to restricted habitat such as wetlands or ridges and are found in natural savanna habitat.

8.4 Fauna Habitat Sensitivities

The calculation of faunal habitat sensitivity is presented in Table 11.

Table 11: Faunal Habitat Sensitivities for the study area

Community	Status	Linkage	RD Likelihood	Average	SENSITIVITY CLASS
Ridge Habitat Types	8	7	10	83%	HIGH
Riparian Habitat Types	7	9	9	83%	HIGH
Regional Habitat Types	4	7	5	53%	MEDIUM
Substation Upgrade Sites	2	2	1	17%	LOW

Results of the initial scoping assessment are confirmed by the assessment of the status of available habitat as well as an assessment of the suitability of available habitat for Red Data fauna species.

9 Ecological Interpretation

Respective results of the floristic and faunal sensitivity analysis are combined to present an overview of the ecological sensitivity of the study area.

Habitat encountered along the proposed route is divided into the following categories:

- Natural habitat (regional habitat types, of which there are numerous varieties);
- Transformed habitat [the extent of this habitat type is indicated in the scoping report, Section 7.10 (p 17), Figure 9 (p 23)];
- Protected habitat (wetlands, RAMSAR Convention); and
- Sensitive habitat (Ridge habitat).

In order to present the reader with an indication of the ecological sensitivity of the respective sensitive habitat types, the highest sensitivity for each ecological unit is selected as being representative of the ecological sensitivity of the specific ecological unit. Results are presented in Table 12.

Table 12: Ecological Sensitivity of the study area

Community	Floristic Sensitivity	Faunal Sensitivity	Ecological Sensitivity
Ridge Habitat Types	HIGH	HIGH	HIGH
Riparian Habitat Types	MEDIUM-HIGH	HIGH	HIGH
Regional Habitat Types	MEDIUM	MEDIUM	MEDIUM
Substation Upgrade Sites	LOW	LOW	LOW

Combined results from the floristic and faunal sensitivity analysis indicate the high sensitivity of wetland regimes and ridge habitat types. The status of these areas is fairly pristine and are therefore considered suitable habitat for a variety of Red Data flora and fauna species.

The largest extent of the study area exhibit medium sensitivity ecological attributes and the proposed activity is not expected to result in significant impacts in these areas.

10 Cultural Landscapes

Comments received from the heritage specialist with regards to the likelihood of cultural landscapes situated within the study area indicate that some direct impacts are expected within areas where heritage sites occur. Most of these sites are associated with outcrops and ridges. The ecological attributes, as described in Sections 7 and 8 indicate the high ecological sensitivity associated with these areas. Most of the mitigation measures recommended in the Heritage as well as the Ecological sections require the realignment of the route around the ridge areas. This should provide adequate protection for the sensitive ecological and heritage attributes of these sites.

II IMPACT EVALUATION

Results of the floristic and faunal investigations are incorporated in order to present an overview of the impacts on the ecological environment (see Section 9).

The following sections are presented to describe the nature, extent significance and potential mitigation of identified impacts on the biological environment. A summary of these discussions are presented in Section 10.4 in the form of Impact Rating Matrix for each identified impact within the respective habitat types.

II.I Nature of Impacts

No impacts were identified that could lead to a beneficial impact on the ecology of the study area since the proposed development is largely destructive to the natural environment. The Precautionary Principal has been applied throughout this assessment. The following impacts/ issues were identified that could affect the ecology of the study area adversely:

- Destruction of threatened species and habitat;
- Destruction of sensitive habitat types (outcrops, riparian fringes, non-perennial streams, river, etc.) and areas of high biodiversity;
- Destruction of pristine habitat[3];
- Changes to the biodiversity as a result of habitat transformation; and
- impacts on surrounding natural habitat and species.

II.I.I Destruction of Threatened Species & Habitat

The loss of threatened species or habitat that is considered suitable for the presence of these species is a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but they are extremely important in terms of the biodiversity of an area and high ecological value is placed on the presence of such species in an area.

Threatened species are particularly sensitive to changes in their environment, having adapted to specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status.

Surface impacts resulting from the proposed activity will lead to changes that will affect these areas adversely. Effects of this impact will be permanent and recovery is generally

[3] Pristine habitat in this report implies natural habitat that are considered to be in a climax status, while natural vegetation refers to untransformed vegetation, that might be slightly degraded, but with a high likelihood of recovery to a pristine condition under correct management strategies.

not perceived as possible. This impact is pertinent since several sensitive areas were identified that are considered highly suitable for the presence of threatened species.

11.1.2 Destruction of Sensitive Habitat Types & Areas of High Biodiversity

Habitat types encountered in the study area that are considered sensitive include the ridges and riparian habitat. These areas represent centres of atypical habitat and contain attributes that are not frequently encountered. The floristic and faunal species composition of these areas is typically unique and is also not frequently encountered. A high conservation value is attributed to the communities and assemblages of these areas as they contribute significantly to the biodiversity of a region. Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will result in fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

11.1.3 Destruction of Pristine Habitat Types

The largest extent of the study area comprises natural regional habitat (Savanna biome). It is however not considered pristine in most cases. Ridges are considered fairly pristine while the riparian systems exhibit varying levels of disturbance, determined by the proximity to populated areas.

Areas that are regarded as pristine generally contain a high degree of flora and fauna species that are only associated with undisturbed regional habitat types. Red Data flora and fauna species are also associated with these areas. The absence of invasive and exotic species is an important attribute.

11.1.4 Changes to Habitat Diversity & Biodiversity

The transformation of woodland habitat by means of clearing of the woody component will result in the establishment of habitat types that are not considered representative of the regional habitat types. As a result of the severity of transformation, these areas are frequently also invaded by species that are not generally encountered in the area, invasive shrub and woody species are of particular concern.

This impact might be interpreted as a positive impact as it is likely to lead to an increase in biodiversity of the local area. A high number of animals that inhabit an area are generally considered an indication of effective ecological functioning and a positive and attractive ecological attribute. However, by allowing animals to inhabit areas that were not previously suitable for them, the effect on the current inhabitants is likely to be detrimental as a result of increased competition.

Furthermore, as a result of decreased habitat, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of animals that might be genetically similar to the endemic species (even the same species) might lead to different genetic selection structures, eventually affecting the genetic structure of current populations.

11.1.5 Impacts on Surrounding Natural Habitat & Species

A possibility exists that surrounding areas and species present in surrounding areas could be affected by impacts resulting from construction activities. These impacts could include all of the above impacts, depending on the nature and status of the surrounding habitat and species.

11.2 Significance of Impacts

The significance of impacts is determined by a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. All impacts that are considered relevant to this particular development are regarded as negative

11.2.1 Destruction of Threatened Species & Habitat

- **Ridge habitat**

Surface changes within these areas will result in the loss of important biophysical and biological attributes; these areas are generally accepted to be sensitive. Moderate to high likelihood of threatened species occurring in these areas are estimated. These effects are mostly permanent and the significance of this impact is high. Implementation of site specific mitigation measures are considered necessary.

- **Riparian habitat**

Surface changes within these areas will result in the loss of important biophysical and biological attributes. Moderate to high likelihood of threatened species occurring in these areas are estimated. These effects are mostly permanent and the significance of this impact is high. Implementation of site specific mitigation measures are considered necessary.

- **Regional habitat**

Surface changes within these areas will result in the loss of some biophysical and biological attributes. These effects are mostly permanent, but it is unlikely to affect sensitive species as representative habitat is readily available in the general surrounds. Moderate to low likelihood of threatened species occurring in these areas are estimated. The significance of this impact is high, but is fairly unlikely to occur. The implementation of generic mitigation measures should suffice in limiting localised impacts.

- **Substation upgrade sites**

Surface changes within these areas will result in the loss of some biophysical and biological attributes. These effects are mostly permanent, but it is unlikely to affect sensitive species as representative habitat is readily available in the general surrounds. The likelihood of these species occurring within these areas is low. The significance of this impact is low. The implementation of generic mitigation measures should suffice in limiting localised impacts.

11.2.2 Destruction of Sensitive Habitat Types & Areas of High Biodiversity

- **Ridge habitat**

Ridge areas are generally regarded as sensitive and as a result of atypical habitat conditions exhibit biodiversity that is dissimilar to the general region. Surface changes within these areas will result in the loss of important biophysical and biological attributes. Effects that contribute to a degradation of existing habitat conditions and consequently result in a loss of biodiversity are mostly permanent; the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Riparian habitat**

Surface changes within these areas will result in the loss of important biophysical and biological attributes that will cause a degradation of habitat conditions. These effects are mostly permanent and the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Regional habitat**

Surface changes will result in the loss of some biophysical and biological attributes. These effects are mostly permanent. Since no sensitive areas or areas of particular high biodiversity were identified in the general regional habitat, the likelihood of this impact occurring is relative low. The significance of this impact is medium as small pockets of sensitivity might be present that was not observed during this investigation. The implementation of generic mitigation measures should suffice in limiting localised impacts.

- **Substation upgrade sites**

Surface changes will result in the loss of some biophysical and biological attributes. Since no sensitive areas or areas of particular high biodiversity were identified in these sites, the likelihood of this impact occurring is low. The significance of this impact is low. The implementation of generic mitigation measures should suffice in limiting localised impacts.

11.2.3 Destruction of Pristine Habitat Types

- **Ridge habitat**

Surface changes within these areas will result in the loss of important biophysical and biological attributes; these areas are generally accepted to be sensitive. Ridges were generally found to be pristine. These effects are mostly permanent and the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Riparian habitat**

Surface changes within these areas will result in the loss of important biophysical and biological attributes. Riparian systems generally exhibit aspects of pristine habitat, depending on the proximity of populated areas. A high environmental sensitivity is attributed to this ecological habitat type. These effects are mostly permanent and the significance of this impact is therefore considered high. The implementation of site specific mitigation measures are considered necessary.

- **Regional habitat**

Surface changes will result in the loss of some biophysical and biological attributes. These effects are mostly permanent. Since no areas of pristine regional habitat were identified, the likelihood of this impact occurring is fairly low. The significance of this impact is medium as small pockets of pristine habitat might be present that was not observed during this investigation. The implementation of generic mitigation measures should suffice in limiting localised impacts.

- **Substation upgrade sites**

Surface changes will result in the loss of some biophysical and biological attributes. Since no pristine habitat were identified in these sites, the likelihood of this impact occurring is low. The significance of this impact is low. The implementation of generic mitigation measures should suffice in limiting localised impacts.

11.2.4 Changes to Habitat Diversity & Biodiversity

- **Ridge habitat**

Surface impacts within these areas will result in the changes to the general biodiversity of this habitat type, particularly since it is susceptible to physical disturbances. The infestation of these areas by species not generally associated with these habitat types is an aspect of particular concern. These effects are mostly permanent and the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Riparian habitat**

Surface impacts within these areas will result in the changes to the general biodiversity of this habitat type, particularly since it is susceptible to physical disturbances. The infestation of these areas by species not generally associated with these habitat types is

an aspect of particular concern. In addition, impacts can also have catastrophic effects further downstream. These effects are mostly permanent and the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Regional habitat**

Surface impacts within these areas will result in the changes to the general biodiversity of this habitat type. The infestation of these areas by species not generally associated with these habitat types is an aspect of particular concern. These effects are mostly permanent and the significance of this impact is high. The implementation of site specific mitigation measures are considered necessary.

- **Substation upgrade sites**

Surface changes will result in the loss of some biophysical and biological attributes. Since no pristine habitat were identified in these sites, the likelihood of this impact occurring is low. The significance of this impact is low. The implementation of generic mitigation measures should suffice in limiting localised impacts.

11.2.5 Impacts on Surrounding Natural Habitat & Species

- **Ridge habitat**

Surface changes within these areas could potentially result in biological changes to the immediate surroundings. The likelihood of this impact is however fairly low, but as a result of the sensitivity of the habitat, it is nonetheless medium. These effects are mostly permanent. The implementation of site specific mitigation measures are considered necessary.

- **Riparian habitat**

Surface changes within these areas could potentially result in biological changes to the immediate surroundings. In addition, impacts can also have catastrophic effects further downstream. The likelihood of this impact is however fairly low, but as a result of the sensitivity of the habitat, it is nonetheless medium. These effects are mostly permanent. The implementation of site specific mitigation measures are considered necessary.

- **Regional habitat**

Surface changes within these areas could potentially result in biological changes to the immediate surroundings. In addition, impacts can also have catastrophic effects further downstream. The likelihood of this impact is however fairly low, but as a result of the sensitivity of the habitat, it is nonetheless medium. These effects are mostly permanent. The implementation of generic mitigation measures should suffice in limiting adverse localised impacts.

- **Substation upgrade sites**

Surface changes within these areas could potentially result in biological changes to the immediate surroundings. In addition, impacts can also have catastrophic effects further downstream. The likelihood of this impact is however fairly low, but as a result of the sensitivity of the habitat, it is nonetheless medium. These effects are mostly permanent. The implementation of generic mitigation measures should suffice in limiting adverse localised impacts.

11.3 Mitigation of Impacts

The suitability and feasibility of all proposed mitigation measures are included in the assessment of significant impacts. This is achieved through the comparison of the significance of an impact before and after the proposed mitigation measure is implemented.

11.3.1 Destruction of Threatened Species & Habitat

- **Ridge habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower ecological sensitivity will limit or prevent this impact from occurring. Recommendations pertaining to this mitigation measure can be completed prior to the submission as databases are available. Finer alignment recommendations can be presented during the final walkthrough. Maintenance activities of moderate intensity are recommended in areas that are situated in proximity to ridges. The complete removal of the woody structure is not considered ideal and it is recommended that only the excessively high woody individuals be controlled while lower stratums are left intact.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed, i.e. threatened as well as protected flora species. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore surface conditions to the original condition.

- **Riparian habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower sensitivity will limit or prevent this impact from occurring and specific areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore surface conditions to the original condition.

- **Regional habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower ecological sensitivity will limit or prevent this impact from occurring and localised areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Substation upgrade sites**

The implementation of generic mitigation measures will allow for effective control over negative impacts in these areas. Site specific recommendations should be done during the final walkthrough.

11.3.2 Destruction of Sensitive Habitat Types & Areas of High Biodiversity

- **Ridge habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower ecological sensitivity will limit or prevent this impact from occurring. Recommendations pertaining to this mitigation measure should be done during the final walkthrough. Maintenance activities of moderate intensity are recommended in areas that are situated in proximity to ridges. The complete removal of the woody structure is not considered ideal.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Riparian habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and specific areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore surface conditions to the original condition.

- **Regional habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and localised areas of high sensitivity can be avoided.

Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction.

- **Substation upgrade sites**

The implementation of generic mitigation measures will allow for effective control over negative impacts in these areas. Site specific recommendations should be done during the final walkthrough.

11.3.3 Destruction of Pristine Habitat Types

- **Ridge habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower ecological sensitivity will limit or prevent this impact from occurring. Recommendations pertaining to this mitigation measure should be done during the final walkthrough. Maintenance activities of moderate intensity are recommended in areas that are situated in proximity to ridges. The complete removal of the woody structure is not considered ideal.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Riparian habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and specific areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore surface conditions to the original condition.

- **Regional habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and localised areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Substation upgrade sites**

The implementation of generic mitigation measures will allow for effective control over negative impacts in these areas. Site specific recommendations should be done during the final walkthrough.

11.3.4 Changes to Habitat Diversity & Biodiversity

- **Ridge habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas of lower ecological sensitivity will limit or prevent this impact from occurring. Recommendations pertaining to this mitigation measure should be done during the final walkthrough. Maintenance activities of moderate intensity are recommended in areas that are situated in proximity to ridges. The complete removal of the woody structure is not considered ideal.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Riparian habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and specific areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore surface conditions to the original condition.

- **Regional habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities to surrounding areas will limit or prevent this impact from occurring and localised areas of high sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction activities starting in order to identify species that should be removed.

- **Substation upgrade sites**

The implementation of generic mitigation measures will allow for effective control over negative impacts in these areas. Site specific recommendations should be done during the final walkthrough.

11.3.5 Impacts on Surrounding Natural Habitat & Species

- **Ridge habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities away from areas of high ecological sensitivity will limit or prevent this impact from occurring to a large extent. Recommendations pertaining to this mitigation measure should be done during the final walkthrough. The complete removal of all woody material is not considered ideal. Site specific investigations should be conducted prior to construction and the implementation of a bio-monitoring programme is recommended.

- **Riparian habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities will limit or prevent this impact from occurring and specific areas of high ecological sensitivity can be avoided. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction and the implementation of a bio-monitoring programme that also includes downstream areas is recommended. Rehabilitation of all surface disturbances is considered critical. Every effort should be made to restore disturbed surface conditions to the original condition.

- **Regional habitat**

The implementation of mitigation measures will allow for effective control over negative impacts. Moving the causing activities away from areas of high ecological sensitivity will limit or prevent this impact from occurring to a large extent. Recommendations pertaining to this mitigation measure should be done during the final walkthrough.

Site specific investigations should be conducted prior to construction.

- **Substation upgrade sites**

The implementation of generic mitigation measures will allow for effective control over negative impacts in these areas. Site specific recommendations should be done during the final walkthrough.

11.4 Summary

11.4.1 Destruction of threatened species & habitat

Rating Matrix for Impacts within the Ridges Habitat	
Impact - Destruction of threatened species & habitat	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	4
Probability of occurrence	3
Total	**13**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Realignment of lines to avoid ridges	
Limited maintenance activities, no severe impact on habitat	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Remove threatened and protected plant species	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Riparian Habitat	
Impact - Destruction of threatened species & habitat	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	4
Probability of occurrence	2
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Avoid surface impacts on riparian systems - 30m buffer zones	
Generic mitigation measures	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Remove threatened and protected plant species	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Regional Habitat	
Impact - Destruction of threatened species & habitat	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	2
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Remove threatened and protected plant species	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	2
Probability of occurrence	1
Total	**8**
This is rated as a **Medium** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Substation Upgrade Sites	
Impact - Destruction of threatened species & habitat	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Generic mitigation measures	
Rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Remove threatened and protected plant species	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

11.4.2 Destruction of sensitive habitat types and areas of high biodiversity

Rating Matrix for Impacts within the Ridges Habitat	
Impact - Destruction of sensitive habitat & areas of high biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	4
Total	**13**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Realignment of lines to avoid ridges	
Limited maintenance activities, no severe impact on habitat	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	1
Total	**9**
This is rated as a **Medium** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Riparian Habitat	
Impact - Destruction of sensitive habitat & areas of high biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	2
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Avoid surface impacts on riparian systems - 30m buffer zones	
Generic mitigation measures	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Regional Habitat	
Impact - Destruction of sensitive habitat & areas of high biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	1
Total	**9**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Substation Upgrade Sites	
Impact - Destruction of sensitive habitat & areas of high biodiversity	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Generic mitigation measures	
Rehabilitation, monitoring & control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

11.4.3 Destruction of pristine habitat types

Rating Matrix for Impacts within the Ridges Habitat	
Impact - Destruction of pristine habitat types	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	4
Total	**13**
This is rated as a **High** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Realignment of lines to avoid ridges	
Limited maintenance activities, no severe impact on habitat	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Riparian Habitat	
Impact - Destruction of pristine habitat types	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	2
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Avoid surface impacts on riparian systems - 30m buffer zones	
Generic mitigation measures	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Regional Habitat	
Impact - Destruction of pristine habitat types	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	2
Total	**10**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Substation Upgrade Sites	
Impact - Destruction of pristine habitat types	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact before the implementation of mitigation and management measures	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Generic mitigation measures	
Rehabilitation, monitoring & control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

II.4.4 Changes to habitat diversity & biodiversity

Rating Matrix for Impacts within the Ridges Habitat	
Impact - Changes to habitat diversity & biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	3
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Realignment of lines to avoid ridges	
Limited maintenance activities, no severe impact on habitat	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the implementation of mitigation and management measures	

Rating Matrix for Impacts within the Riparian Habitat	
Impact – Changes to habitat diversity & biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	3
Probability of occurrence	2
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Avoid surface impacts on riparian systems - 30m buffer zones	
Generic mitigation measures	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Regional Habitat	
Impact - Changes to habitat diversity & biodiversity	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	3
Total	**11**
This is rated as a **High** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	2
Total	**8**
This is rated as a **Medium** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Substation Upgrade Sites	
Impact – Changes to habitat diversity & biodiversity	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Generic mitigation measures	
Rehabilitation, monitoring & control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

11.4.5 Impacts on surrounding natural habitat and species

Rating Matrix for Impacts within the Ridges Habitat	
Impact - Impacts on surrounding natural habitat and species	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	2
Total	**10**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Rehabilitation and control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Riparian Habitat	
Impact – Impacts on surrounding natural habitat and species	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	1
Probability of occurrence	2
Total	**9**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Avoid surface impacts on riparian systems - 30m buffer zones	
Generic mitigation measures	
Implementation of rehabilitation, monitoring & control programmes	
Final recommendations during walk-through survey	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Regional Habitat	
Impact - Impacts on surrounding natural habitat and species	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	2
Probability of occurrence	2
Total	**10**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Rehabilitation and control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

Rating Matrix for Impacts within the Substation Upgrade Sites	
Impact – Impacts on surrounding natural habitat and species	
Criteria	**Rating**
Extent	2
Duration	4
Intensity	1
Probability of occurrence	1
Total	**8**
This is rated as a **Medium** Negative Impact before the implementation of mitigation and management recommendations	
Mitigation and Management measures	
Implementation of bio-monitoring programmes	
Adaptive management & conservation strategies	
Rehabilitation and control programmes	
Criteria	**Rating**
Extent	1
Duration	4
Intensity	1
Probability of occurrence	1
Total	**7**
This is rated as a **Low** Negative Impact after the successful implementation of all mitigation and management recommendations	

12 Line Variant Recommendations

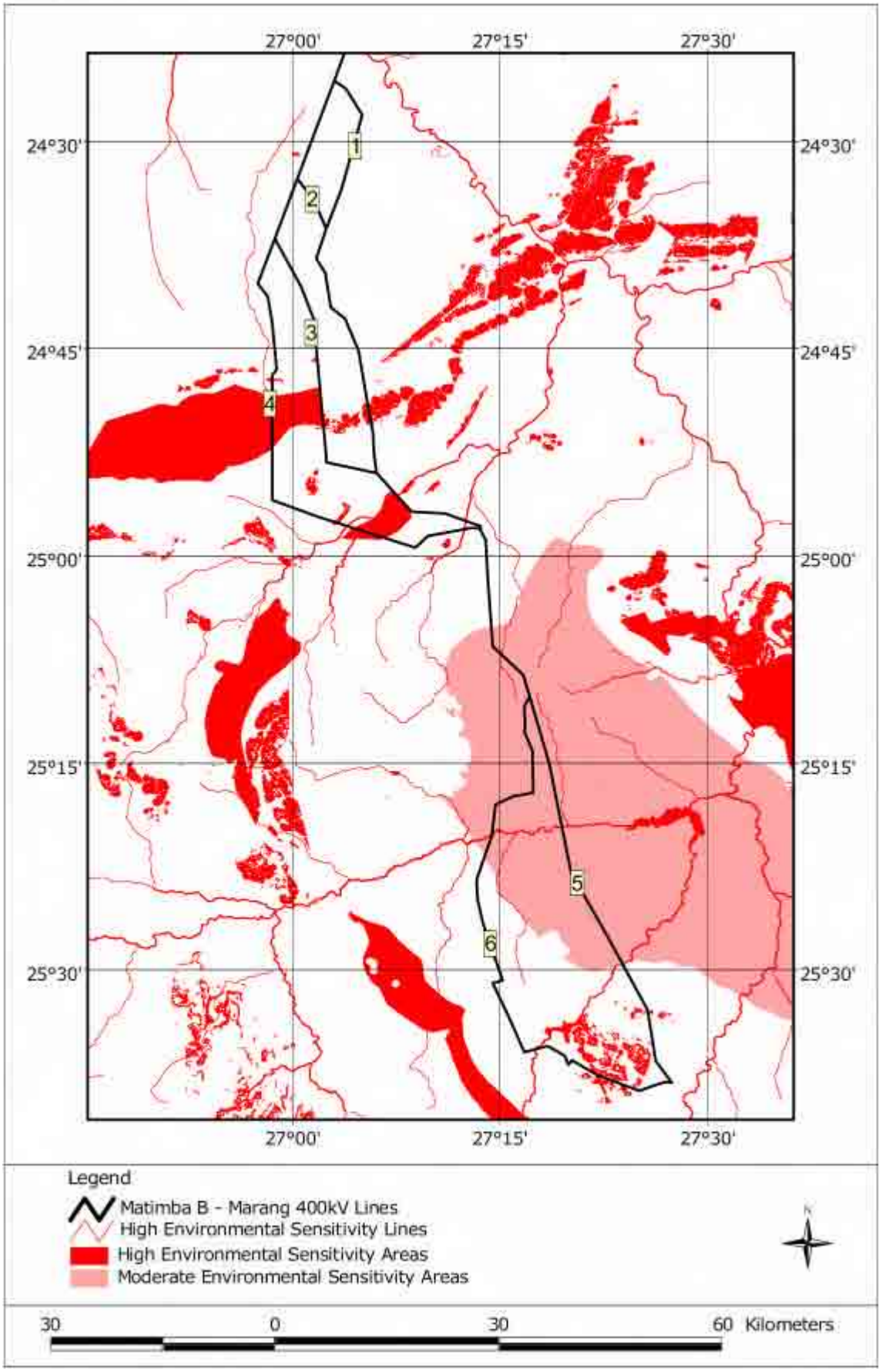
The respective line variants are visually presented in Figure 8 with an overlay of the more significant sensitive areas.

A recommendation of route variants between variants 1 to 4 and 5 and 6 will be made on the basis of ecological sensitivity, expected impact and mitigation potential of likely impacts.

- Of line variants 1, 2, 3 or 4, the use of either route variants 2 or 3 is recommended. Although it will pass in close proximity to sensitive natural features, the number of ridges that will be crossed is less and slight realignment is likely to limit potential impacts to a minimum. A slightly higher impact is expected with the use of route variants 3 and 4. The use of either route 1 or 2 also represents a shorter distance.

- The use of route variant 5 is recommended above variant 6. Although both these options will impact on moderately sensitive environments (protected vegetation type), route 5 will result in lower expected impacts on ridges in the southern section of the proposed route. Realignment of the routes in order to avoid impacts on ridges should be less intensive with the use of route variant 5. Route variant 5 also represents a shorter distance.

Figure 8: Line variants of the proposed project



APPENDIX I: SAMPLE SITE SPECIES LIST

Species Name	Growth Form	Family	Alien Status
Acacia caffra	Tree	Mimosaceae	
Acacia erioloba	Tree	Mimosaceae	
Acacia erubescens	Tree	Mimosaceae	
Acacia karroo	Tree	Mimosaceae	
Acacia mellifera	Tree	Mimosaceae	
Acacia nilotica	Tree	Mimosaceae	
Acacia tortilis	Tree	Mimosaceae	
Aloe greatheadii	Succulent	Liliaceae	
Aristida canescens	Grass	Poaceae	
Aristida congesta ssp *barbicollis*	Grass	Poaceae	
Aristida species	Grass	Poaceae	
Asparagus species	Shrub	Liliaceae	
Berchemia zeyheri	Tree	Rhamnaceae	
Bothriochloa insculpta	Grass	Poaceae	
Brachiaria serrata	Grass	Poaceae	
Buddleja salviifolia	Tree	Buddlejaceae	
Celtis africana	Tree	Ulmaceae	
Chamaecrista mimosoides	Forb	Ceasalpiniaceae	
Clerodendrum glabrum	Tree	Verbenaceae	
Combretum apiculatum	Tree	Combretaceae	
Combretum erythrophyllum	Tree	Combretaceae	
Combretum hereroense	Tree	Combretaceae	
Combretum imberbe	**Tree**	**Combretaceae**	
Combretum molle	Tree	Combretaceae	
Commelina africana	Forb	Commelinaceae	
Commelina species	Forb	Commelinaceae	
Conyza podocephala	Forb	Asteraceae	
Corchorus confusus	Forb	Tiliaceae	
Croton gratissimus	Tree	Euphorbiaceae	
Cussonia paniculata	Tree	Araliaceae	
Cynodon dactylon	Grass	Poaceae	
Cyperus species	Sedge	Cyperaceae	
Cyphostemma species	Climber	Vitaceae	
Dichanthium aristatum	Grass	Poaceae	
Dichrostachys cinerea	Shrub	Mimosaceae	
Digitaria eriantha	Grass	Poaceae	
Diheteropogon amplectens	Grass	Poaceae	
Diospyros lycioides	Tree	Ebenaceae	
Dombeya rotundifolia	**Tree**	**Sterculiaceae**	
Elionurus muticus	Grass	Poaceae	
Eragrostis capensis	Grass	Poaceae	
Eragrostis chloromelas	Grass	Poaceae	
Eragrostis lehmanniana	Grass	Poaceae	
Eragrostis rigidior	Grass	Poaceae	
Eragrostis species	Grass	Poaceae	

Eragrostis superba	Grass	Poaceae	
Euclea crispa	Tree	Ebenaceae	
Euclea divinorum	Tree	Ebenaceae	
Euphorbia cooperi	Tree	Euphorbiaceae	
Euphorbia ingens	Tree	Euphorbiaceae	
Eustachys paspaloides	Grass	Poaceae	
Ficus species	Tree	Moraceae	
Geigeria burkei	Forb	Asteraceae	
Gladiolus species	Geophyte	Iridaceae	
Gnidia capitata	Forb	Thymelaeaceae	
Gomphocarpus fruticosus	Shrub	Asclepidaceae	
Gomphrena celosioides	Forb	Amaranthaceae	
Grewia flava	Shrub	Tiliaceae	
Grewia flavescens	Shrub	Tiliaceae	
Grewia monticola	Shrub	Tiliaceae	
Gymnosporia buxifolia	Tree	Celastraceae	
Haemanthus species	Geophyte	Amaryllidaceae	
Heteropogon contortus	Grass	Poaceae	
Hibiscus trionum	Forb	Malvaceae	
Hyperthelia dissoluta	Grass	Poaceae	
Indigofera species	Forb	Fabaceae	
Ipomoea species	Forb	Convolvulaceae	
Ischaemum afrum	Grass	Poaceae	
Jatropha species	Forb	Euphorbiaceae	
Lannea discolor	Tree	Anacardiaceae	
Ledebouria cooperi	Geophyte	Liliaceae	
Ledebouria revoluta	Geophyte	Liliaceae	
Leersia hexandra	Grass	Poaceae	
Loudetia flavida	Grass	Poaceae	
Melia azedarach	Tree	Meliaceae	Category 3
Melinis repens	Grass	Poaceae	
Mundulea sericea	Tree	Fabaceae	
Panicum maximum	Grass	Poaceae	
Pappea capensis	Tree	Sapindaceae	
Pellaea calomelanos	Fern	Adianthaceae	
Peltophorum africanum	Tree	Ceasalpiniaceae	
Phragmites australis	Hydrophilic	Poaceae	
Phragmites mauritianus	Hydrophilic	Poaceae	
Phyllanthus reticulatus	Tree	Euphorbiaceae	
Polygala hottentotta	Forb	Polygalaceae	
Rhoicissus tridentata	Climber	Vitaceae	
Rhus lancea	Tree	Anacardiaceae	
Rhus leptodictya	Tree	Anacardiaceae	
Rhus pyroides	Tree	Anacardiaceae	
Rhus species	Tree	Anacardiaceae	
Rhynchosia species	Forb	Fabaceae	
Ricinus communis	Shrub	Euphorbiaceae	Category 2
Salix babylonica	Tree	Salicaceae	Category 2

Schmidtia pappophoroides	Grass	Poaceae	
Sclerocarya birrea	**Tree**	**Anacardiaceae**	
Senecio venosus	Forb	Asteraceae	
Setaria species	Grass	Poaceae	
Solanum panduriforme	Forb	Solanaceae	
Sorghum versicolor	Grass	Poaceae	
Tarchonanthus camphoratus	Shrub	Asteraceae	
Tephrosia species	Forb	Fabaceae	
Themeda triandra	Grass	Poaceae	
Triumfetta sonderi	Shrub	Tiliaceae	
Typha capensis	Hydrophilic	Typhaceae	
Urochloa mosambicensis	Grass	Poaceae	
Vangueria infausta	Tree	Rubiaceae	
Vepris lanceolata	Tree	Rutaceae	
Vernonia oligocephala.	Forb	Asteraceae	
Ziziphus mucronata	Tree	Rhamnaceae	

Appendix 2: Photographic Records

Photo 1: Example of Reedbed Riparian habitat type

Photo 2: Example of Ridge habitat type

Photo 3: Example of perennial river

Photo 4: Example of Wooded Riparian habitat type

Photo 5: Example of degraded Riparian habitat type

Photo 1: Example of severe habitat transformation within natural regional habitat

APPENDIX 3: REFERENCES

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