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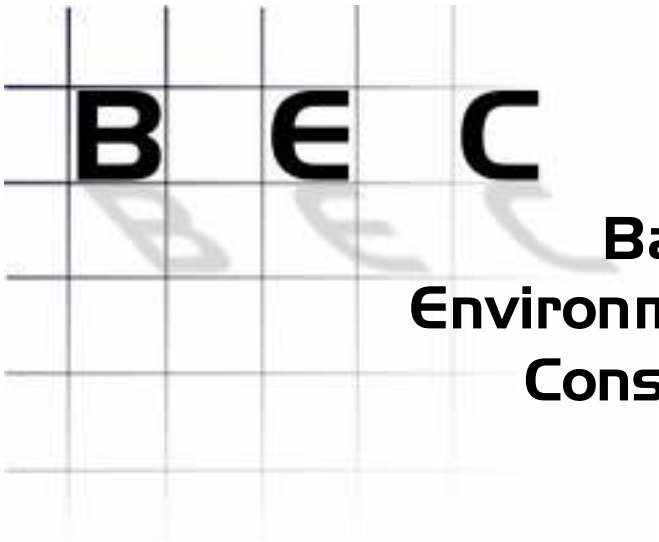
Biodiversity Report for the Kwagga – Phoebus 257kV Lines, Establishment of Phoebus Substation & Extension of Kwagga Substation

submitted by



June 2009

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I 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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II DECLARATION OF INDEPENDENCE

All specialist investigators, project investigators and members of companies employed for this particular assessment declare that:

- We act as independent specialists for this project.
- 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, in terms of the Environmental Impact Assessment Regulations, 2006.
- 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 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.
- We undertake to disclose to the National Department of Environmental Affairs and Tourism, any material information that have or may have the potential to influence its decision or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;
- We will provide to the National Department of Environmental Affairs and Tourism with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

III TERMS & LIABILITIES

- This report is based on a strategic assessment of available information and a short-term investigation of certain biological aspects of the site that will potentially be affected. No long-term investigation of biological attributes and biological diversity that may be present in the study area was conducted.
- The Precautionary Principle is applied throughout the investigation.
- This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from these assessments or requests made to them for the purpose of this assessment.
- Additional information may become known during a later stage of the process for which no allowance could have been made at the time of this report.
- No definite conclusions may be drawn about biological diversity within the study area or conservation strategies pertaining to the study area as far as this report is concerned.
- BEC withholds the right to amend this report, recommendations and/ or conclusions at any stage of the project should significant information becomes known.
- Information contained in this report cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.
- This document and all information contained herein are and will remain the intellectual property of Bathusi Environmental Consulting cc and Riaan A.J. Robbeson.
- This document, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of Riaan A.J. Robbeson.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgement of these terms and liabilities.

IV LEGISLATION

Compliance with provincial, national and international legislative aspects is recommended in the planning, assessment, authorisation and execution of this particular project. The following are included, but not necessarily limited to the following:

- Biodiversity Act (No. 10 of 2004);
- Conservation of Agricultural Resources Act 43 of 1983;
- Constitution of the Republic of South Africa (Act 108 of 1996);
- Convention on Biological Diversity, 1995;
- Convention on International Trade in Endangered Species of Wild Life and Fauna;
- Environmental Conservation Act (No. 73 of 1989);
- National Environmental Management Act (No. 107 of 1998);
- National Forests Act, 1998 (No 84 of 1998);
- Protected Areas Act (No. 57 of 2003); and
- White Paper on the conservation and sustainable use of South Africa's biological diversity.

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1 EXECUTIVE SUMMARY

1.1 BIOPHYSICAL ATTRIBUTES

The proposed 275kV line will be located between the existing Kwagga Substation (S25.75751° & E2810442°) and the proposed Phoebes Substation (S25.56360° & E28.09583°) in the City of Tshwane Metropolitan Municipality (CTMM), Gauteng Province, covering a distance of approximately 30km.

The proposed line variants comprise significant areas of concern in terms of C-PLAN. Environmental aspects that will potentially be affected include the following:

- ridges;
- perennial rivers;
- non-perennial rivers;
- primary vegetation;
- Red Data invertebrate confirmed location;
- Red Data plant metapopulation;
- Red Data plant confirmed location; and
- Orange plant historic location.

Areas of surface water that will potentially be affected by the proposed line variants include perennial and non-perennial rivers. The proposed line variants will potentially affect Class 1, Class 2 and Class 3 ridges. Significant ridge areas are present in the southern part of the proposed servitudes.

The VEGMAP database describes the following vegetation types within the study area:

- Central Sandy Bushveld (Vulnerable);
- Gold Reef Mountain Bushveld (Least Threatened);
- Marikana Thornveld (Endangered);
- Moot Plains Bushveld (Vulnerable); and
- Norite Koppies Bushveld (Least Threatened).

1.2 FLORISTIC ATTRIBUTES

The study area is located in two ¼-degree grids, namely 2528CA and 2528CC. The SANBI database indicates the known presence of approximately 2,236 and 904 plant species within these areas respectively. The extremely high diversity of species within the study area reflects the varied topography, habitat types and ecological attributes that give rise to a diverse environment in which a multitude of plant communities have developed, each with a unique composition of species. The presence of five regional vegetation types provides further indication of the varied floristic composition of the region, comprising aspects of both the grassland and savanna biome.

A basic analysis of the aerial photographs revealed the following preliminary habitat types:

- Degraded Habitat;
- Natural Grassland Habitat;
- Natural Woodland Habitat;
- Ridge Habitat;
- Riparian Habitat;
- Stands of Exotic Trees; and
- Transformed Habitat.

GDACE database indicate the known presence of 33 Red and Orange Listed flora species within the ¼-degree grids in which the study area is situated. All areas of pristine regional vegetation types, particularly ridges, are regarded suitable habitat for these species.

I.3 FAUNAL ATTRIBUTES

A total of 43 Red Data animals are known from Gauteng (excluding avifauna). The following Red Data status is ascribed to the species:

- 13 species are listed as Data Deficient (DD);
- 15 species are listed as Near Threatened (NT);
- 11 species are listed as Vulnerable (VU);
- 2 species area listed as Endangered (EN); and
- 2 species are listed as Critically Endangered (CR).

The following probabilities of occurrence in the study area are ascribed to the Red Data fauna species:

- 15 species are estimated to have a low probability of occurrence;
- 3 species are estimated to have a medium-low probability of occurrence;
- 9 species are estimated to have a medium probability of occurrence;
- 15 species are estimated to have a medium-high probability of occurrence; and
- 1 species is estimated to have a high probability of occurrence.

I.4 SCOPING ASSESSMENT & RECOMMENDATIONS

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive.

Potential impacts include the following, but are not necessarily limited to the following:

- Direct impacts:
  - Destruction of threatened species & habitat;
  - Destruction of protected tree species;
  - Destruction of sensitive/ pristine regional habitat types;

- Indirect Impacts:
  - Floristic species changes within the servitudes;
  - Faunal interactions with structures, servitudes and personnel;
  - Impacts on surrounding habitat/ species;

- Cumulative Impacts:
  - Impacts on conservation obligations & targets;
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

The use of Line Variants KP_2 and KP_3 is not recommended. Localised deviations should be implemented in order to avoid significant impacts on particularly ridge systems in the area. The location of the substations north and south of the ridges and the east west orientation of these features makes the recommendation of alternative alignments that will avoid these features altogether impossible. Therefore, short of exercising the No-Go option, it is recommended that an extensive route selection exercise be conducted as part of the EIA investigation in order to:

- Select areas where existing infrastructure are already in place, thereby minimising the cumulative impact in the region;
- Recommend site specific and significant mitigation measures in order to prevent any potential long-term adverse impacts within the servitudes; and
- Investigate any potential crossing points in the immediate vicinity of the proposed servitude that could be considered suitable in terms of minimising potential impacts on the ridge systems.

Deviations to the proposed line variants are recommended in order to avoid significant impacts in particularly the ridge environments.

2 INTRODUCTION

The current Eskom transmission network supplies Tshwane Municipality via three points, namely Kwagga, Njala and Verwoerdburg. The contracted reserve capacity at each point is reviewed annually and the latest information indicates that Kwagga's reserve capacity is 840MVA, Njala is 650MVA and Verwoerdburg is 200MVA. Meter measurements at the respective points indicate that the maximum loading has reached 920MVA at Kwagga (2007), 700MVA at Njala (2007) and 208MVA at Verwoerdburg (2007).

Tshwane has subsequently applied for new supply points and a step load increase to Eskom Transmission and Distribution. A number of options were analyzed based on technical and economical benefits to all parties involved and the proposed solution, which is known as the City of Tshwane Electricity Supply Plan Scheme proposed to build four new substations in the Tshwane area. Three will be built by ESKOM and one will be built by Tshwane. These four substations are ESKOM Phoebus 400/275/132kV Substation; ESKOM Verwoerdburg 400/132kV Substation; ESKOM Anderson 400/132kV Substation and Tshwane 400/132kV Wildebees Substation. The proposed solution will meet the Tshwane electricity requirement, representing the less costly option in addition to de-loading the heavily loaded Minerva and Apollo Substations. Phase 1 of this scheme entails the following:

- Construction of 275kV line from Phoebus to Kwagga Substation (30km); and
- Establishment of Phoebus Substation; and
- Extension of the existing Kwagga Substation.

3 SCOPE OF WORK

This biodiversity assessment aims to present the client with broad descriptions of floristic and faunal habitat attributes that could potentially occur within the study area and to highlight sensitive ecological attributes that might be affected adversely by the proposed development.

Objectives of the scoping exercise are as follows:

- Liaise with relevant provincial institutions to obtain relevant Red Data information;
- Conduct broad site investigations for scoping purposes to assess the availability and status of ecological habitat types within the study area;
- Conduct a sensitivity analysis of available habitat types in the area and present results in terms of liabilities and expected impacts of the proposed activity on the current ecological status of the area;
- Compile a sensitivity map, highlighting areas of concern;
- Identify likely and potential impacts on the biological environment that could potentially result from the proposed development; and
- Present all results in a suitable format.

4 METHODOLOGY

This scoping investigation is based on an extensive site investigation as well as a desktop assessment of available datasets. Results of this assessment represent only a preliminary investigation and the study area will ultimately be subjected to more detailed biodiversity investigations during the EIA phase of the project, particularly areas that are identified as highly sensitive in this assessment. Recommendations presented in this report are therefore only based on subjective and estimated environmental sensitivities that are ascribed to biophysical attributes of the study area.

Objectives of the site investigation were aimed at identifying preliminary ecological habitat units and ascribing a regional environmental status or biodiversity sensitivities to respective habitat types. Ultimately, an ecological sensitivity is ascribed to each habitat type and this will be taken forward in the environmental process in order to determine potential locations for infrastructure as well as guiding detailed biodiversity investigations. The Precautionary Principal is applied throughout the assessment.

4.1 BIOPHYSICAL SENSITIVITIES

Available desktop information is utilised to illustrate the location of the study area in terms of local and regional sensitivities. Biophysical attributes that are implemented in the assessment of regional and local biophysical sensitivities include:

- Gauteng Conservation Plan (C-PLAN);
- Areas of surface water (perennial and non-perennial streams, rivers, wetlands, pans, seepages, moist grasslands, etc);
- Topography and slopes;
- Regional vegetation types; and
- Known floristic diversity (data obtained from SANBI, including floristic PRECIS data, known distribution of Red Data flora species and protected tree species.

4.2 PRELIMINARY HABITAT TYPES

Available aerial imagery is obtained from Google Earth (www.googleearth.com). These images are georeferenced with Arcview 3.2a's Image Georeference tool. Preliminary ecological habitat units are then stratified on aerial images with physiognomic characteristics as a first approximation and labelled to reflect the estimated physiognomic attributes. The extent and ecological characteristics of these preliminary habitat types will be confirmed during the EIA investigations.

4.3 FAUNAL RED DATA PROBABILITIES

Three parameters are used to assess the Probability of Occurrence of each Red Data species:

- Habitat requirements (HR) - Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area is evaluated.
- Habitat status (HS) - 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); and
- Habitat linkage (HL) - 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.

The estimated Probability of Occurrence for Red Data species is presented in five categories, namely:

- low;
- medium-low;
- medium;
- medium-high; and
- high.

4.4 ECOLOGICAL SENSITIVITY ANALYSIS

The method implemented to estimate the ecological sensitivity is considered effective in highlighting significant habitat attributes and is based on subjective assessments of ecological attributes, rated across the spectrum of preliminary habitat types that characterise the study area. General community attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human impacts, size, fragmentation are important in assessing the sensitivity of the respective preliminary habitat types.

Criteria employed in assessing the 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 sensitivity of these preliminary habitat types:

- Status, suitability and availability of habitat for Red Data flora & fauna species;
- Landscape or habitat sensitivity;
- Current habitat status;
- Potential biodiversity/ species richness; and
- Ecological performance/fragmentation.

Each 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 ecological status of the preliminary habitat type. Separate Values are multiplied with the Criteria Weighting Values, which emphasizes the importance/ triviality that the individual Sensitivity Criteria have on the status of each habitat. Ranked Values are then added and expressed as a percentage of the maximum possible value (Ecological 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%

4.5 RIDGE ASSESSMENT

Due to similar biodiversity, ecological and aesthetic values, the term 'ridge' used in this assessment will refer loosely to hills, koppies, mountains, kloofs, gorges, etc. A GIS analysis of the slopes on the study area was compiled by GDACE using available contours (20m). The essential characteristic defining ridges is the slope, whereby any topographic feature in the landscape that is characterised by slopes of 5° or more (i.e. >8.8%, >1 in 11 gradient), as determined by means of a GIS digital elevation model, is defined as a ridge.

4.6 SENSITIVITY MAPPING RULES (GDACE BIODIVERSITY GUIDELINES)

The objective of a sensitivity mapping exercise is to determine the location and extent of all sensitive areas that must be protected from transforming land uses. A development proposal is only considered compatible with the biodiversity sensitivities of the site if all sensitive areas are avoided and are incorporated into an open space system. The sensitivity map must be constructed within a GIS so that it can inform the proposed development layout and enable comparative analyses between sensitive areas and the proposed activity. The sensitivity map must comply with the following spatial mapping rules:

I.I.I Vegetation

- **General Vegetation**

All good condition natural vegetation and primary grassland must be mapped and designated as sensitive.

- **Red List & Near Threatened plants**

Areas occupied by populations of Red List and Near Threatened plants must be mapped and buffer zones provided to mitigate deleterious edge effects. Plant populations and protective buffer zones must be designated as sensitive. Rules for buffer zones are as follows:

- 200m for Red List and Near Threatened plant populations occurring within the urban edge;
- For Red List and Near Threatened plant populations occurring outside the urban edge:
  - A1 species 600m
  - A2 species 500m
  - A3 species 400m
  - B species 300m

Suitable habitat for expected Red List and Near Threatened plant species (i.e. those species historically recorded in the area but not located during surveys due to unfavourable environmental conditions) must be mapped and designated as sensitive.

4.6.1 Fauna

- **Red List mammals**

The location of confirmed Red List mammal species must be designated as sensitive. Suitable habitat for Red List mammal species must be designated as sensitive. Landscaped gardens and areas dominated by alien vegetation are considered suitable habitat for Juliana's Golden Mole. Any caves and a 500m buffer zone must be designated as sensitive.

- **Red List amphibians**

Areas of suitable habitat (differentiate between breeding, foraging, aestivation etc.) for each Red List species must be demarcated on a map of the site, together with appropriate buffers and corridors, and designated sensitive. For pans and wetlands where breeding has been confirmed or is highly probable, the following buffers are required:

- Within urban areas within the urban edge – minimum 60m terrestrial buffer around the outer edge of the wetland temporary zone to conserve basic wetland functions and provide limited foraging habitat.
- Within peri-urban areas within the urban edge - minimum of 60m terrestrial buffer around the outer edge of the wetland temporary zone to conserve basic wetland functions and provide limited foraging habitat.
- Outside the urban edge - minimum 500m terrestrial buffer around the outer edge of the wetland temporary zone to conserve basic wetland functions and provide more extensive foraging habitat.

All buffer zones must be designated sensitive.

- **Red List reptiles**

Areas of suitable habitat (differentiate between breeding, foraging, aestivation etc.) for each Red List species must be demarcated on a map of the site, together with appropriate buffers and corridors, and designated sensitive. A 1,260m buffer (i.e. 500ha) around confirmed localities of the Southern African Python is required.

- **Red List invertebrates**

The entire extent of all located populations of Red List, rare and endemic invertebrates within the survey area must be accurately mapped and a 200m buffer zone added around the population extent. Both the population habitat and buffer zone must be designated as sensitive in a sensitivity map. Additionally, suitable habitat on site for these species must be accurately mapped out and designated as sensitive in a sensitivity map.

Suitable habitat for expected Red List, rare and endemic invertebrate species (i.e. those species historically recorded in the area but not located during surveys due to unfavourable environmental conditions or other factors) must be mapped and designated as sensitive in a sensitivity map.

- **Ridges**

All ridges must be designated as sensitive. Already transformed areas (i.e. dominated by exotics, denuded of vegetation, landscaped, covered in development structures) can be ascribed a low sensitivity. Where the interface between the lower slopes and adjacent land is deemed important species (e.g. low-density herbivores recorded on site and important/rare invertebrates), a buffer zone of 200m must be mapped and designated as sensitive. A 200m buffer zone for Class 1 ridges must be designated as sensitive.

This assessment will determine the nature, extent, duration, probability and significance of expected impacts of the project on the ecological environment. In addition, reasonable alternatives will be investigated in cases of unacceptable impact levels and pertinent mitigation measures for each impact during the life of the mine will be presented. To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason, a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation. Each impact identified will be assessed in terms of probability (likelihood of occurring), extent (spatial scale), intensity (severity) and duration (temporal scale). To enable a scientific approach to the determination of the impact significance (importance), a numerical value will be linked to each rating scale.

5 THE BIOPHYSICAL ENVIRONMENT

5.1 LOCATION

The proposed 275kV line will be located between the existing Kwagga Substation (S25.75751° & E2810442°) and the proposed Phoebes Substation (S25.56360° & E28.09583°) in the City of Tshwane Metropolitan Municipality (CTMM), Gauteng Province, covering a distance of approximately 30km (Figure 1) A Google earth image of the region is presented in Figure 2.

For technical specifications pertaining to the proposed lines, the reader is referred to the main document. Only aspects that will potentially affect the biodiversity and ecology of the area will be included in this document.

5.2 GAUTENG CONSERVATION PLAN (C-PLAN) SENSITIVITIES)

C-PLAN sensitivities are illustrated in Figure 3. The proposed line variants comprise significant areas of concern in terms of C-PLAN. Environmental aspects that will potentially be affected include the following:

- ridges;
- perennial rivers;
- non-perennial rivers;
- primary vegetation;
- Red Data invertebrate confirmed location;
- Red Data plant metapopulation;
- Red Data plant confirmed location; and
- Orange plant historic location.

5.3 AREAS OF SURFACE WATER

Areas of surface water that will potentially be affected by the proposed line variants include perennial and non-perennial rivers. The distribution of these areas is illustrated in Figure 3.

Areas of surface water contribute significantly towards the local and regional biodiversity of an area due to the atypical habitat that is present within the interface of terrestrial and aquatic habitat types. These ecotones (areas or zones of transition between different habitat types) are frequently occupied by species that occur in both the bordering habitat types, and is therefore generally rich in species. In addition, many flora and fauna species is specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas and exhibits extremely narrow habitat variation tolerance levels. In addition, these areas are also visited on a frequent basis by all terrestrial animals that utilise water

sources on a frequent basis. Ecotonal interface areas form extremely narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale.

Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds. This method of seed distribution is extremely evident in the case of several invasive alien tree species that occur extensively in many of the rivers and streams. The morphology of a region can also be loosely associated with the presence and diversity of aquatic habitat types. Mountainous areas or regions with a high interval of topographical variations is usually associated with the presence of numerous rivers and streams caused by increased run-off and slopes. These aquatic habitat types are usually small and narrow. Plains and areas where low slopes prevail are usually characterised by the presence of few, but large, rivers and pans, comprising extensive surface areas.

Figure 1: Location of the study area & layout of line variants & substation sites

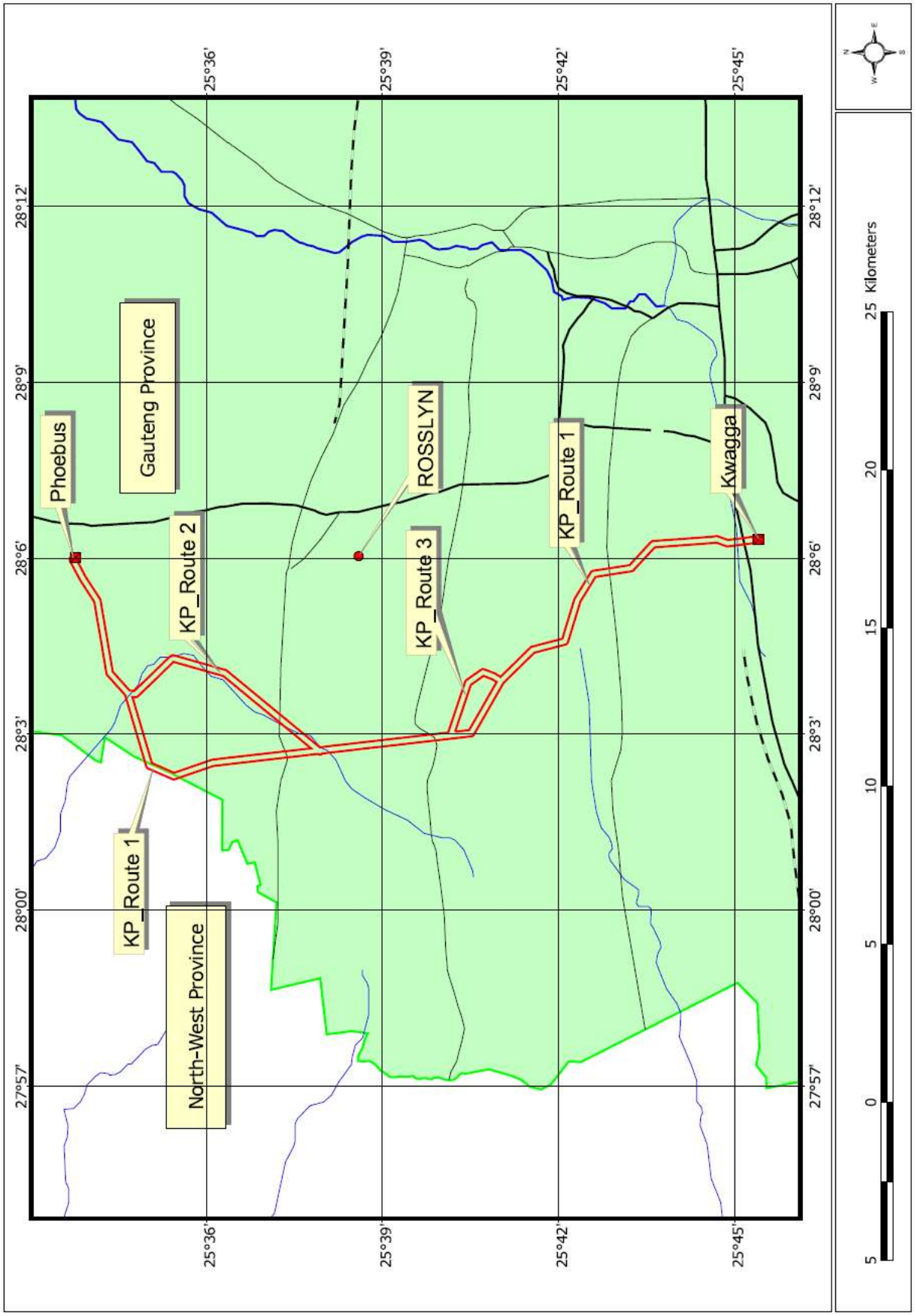


Figure 2: Google earth image of the region

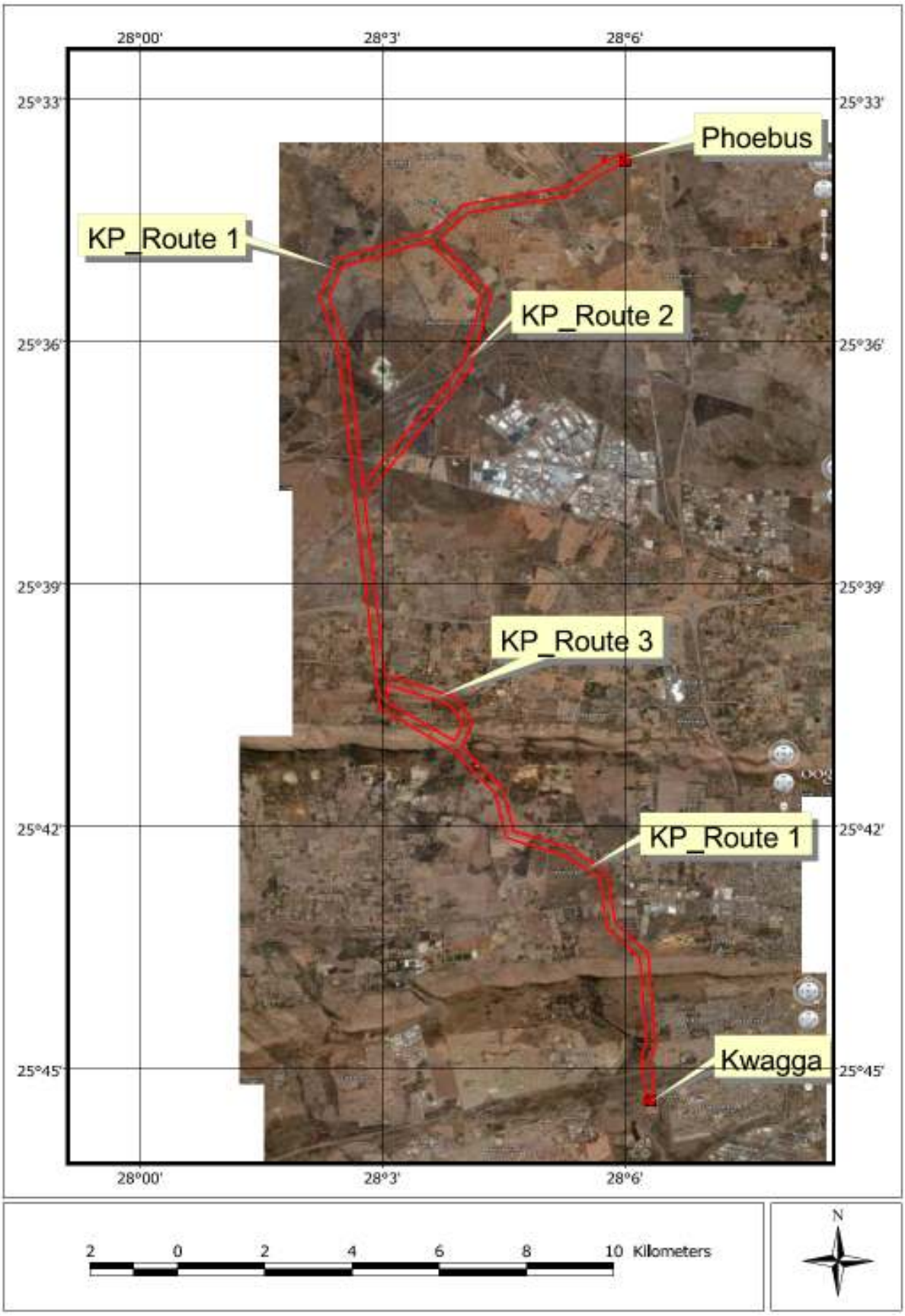
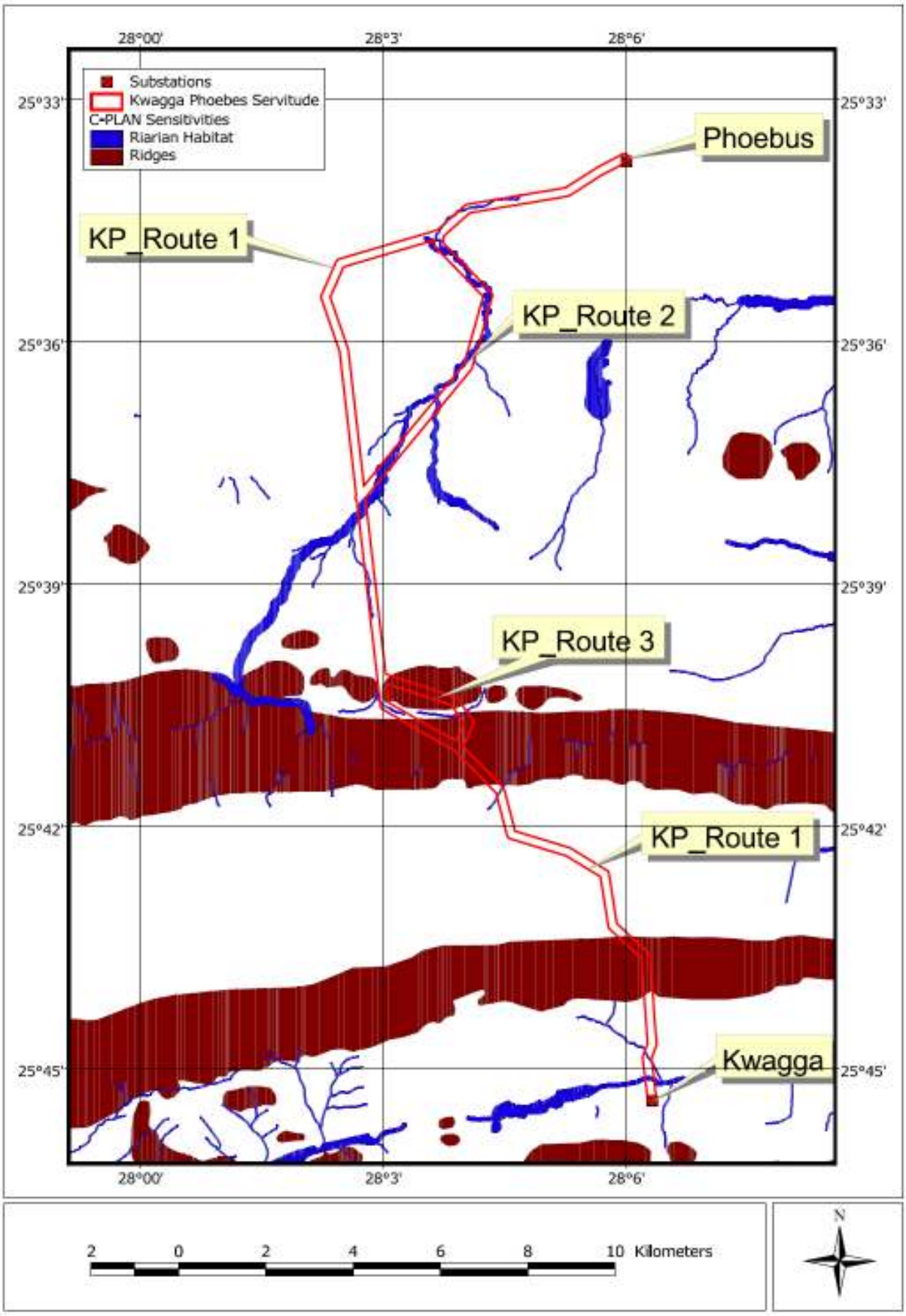


Figure 3: C-PLAN sensitivities of the region



5.4 Ridges & Slopes

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. The interplay between topography and climate over a long period has led to the evolution of a rich biodiversity. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments.

Ridges are characterised by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes, all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. The temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. It follows that ridges will be characterized by a particularly high biodiversity; as such their protection will contribute significantly to the conservation of biodiversity in Gauteng.

Many Red Data / threatened species of plants and animals inhabit ridges. Due to their threatened status, Red Data species require priority conservation efforts in order to ensure their future survival. As such, the conservation of ridges in Gauteng will contribute significantly to the future persistence of these species.

At least three threatened mammal species that occur within Gauteng utilise habitat provided by ridges environment including Juliana's Golden mole (*Amblysomus julianae*), which is perhaps the most threatened small mammal in Africa. Several bird species occurring in Gauteng that are on the South African or international Red Data lists or are considered to be of conservation concern are dependent on ridges, koppies and hills. Similarly, three rare reptile species that occur in Gauteng utilise rocky habitats such as those provided by ridges. The Northern Pygmy Toad (*Bufo fenoulheti*) and the Common River Frog (*Rana angolensis*) are found in kloofs. Many Red Data butterflies (especially those belonging to the lycaenid group) occur on the southern slopes of ridges, e.g. the Heidelberg copper butterfly (*Chrysoritis aureus*) is restricted to the rocky southern slopes of the Alice Glockner Nature Reserve. *Metisella meninx* is a Vulnerable butterfly species that occurs at altitudes above 1,600m and as such, these butterflies are often present on ridge systems. Invertebrates are reliant on hilltops as thermal refugia from winter cold air drainage.

Natural corridors, which are present in unfragmented landscapes, such as rivers, riparian zones and topographic features should be retained following fragmentation. Such corridors may remain relatively self-sustaining after fragmentation as they continue to be

essentially isolated in a larger matrix, unlike remnant corridors that require substantial management to counteract the external effects of the surrounding matrix. Remnant corridors only become corridors when the surrounding landscape is fragmented and until that time had been part of the overall matrix.

Ridges may have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as "fire-avoiders". Because of the influence of topography on rainfall, many streams in Gauteng originate on ridges and control water inputs into wetlands. The protection of the ridges in Gauteng in a natural state will thus ensure the normal functioning of ecosystem processes. In contrast, development of a ridge will alter these major landscape processes. For example, water runoff into streams and wetlands will increase. The proposed line variants will potentially affect Class 1, Class 2 and Class 3 ridges. Significant ridge areas are present in the southern part of the proposed lines (Figure 7).

5.4.1 Class I Ridges

Figure 4 provides an example of a Class 1 ridge, being classified as any ridge on which less than 5% of the ridge is transformed. No further development should be allowed in these areas; a strict no-go policy should be exercised. No further subdivisions will be allowed and consolidation of subdivisions is encouraged. If developer should wish government to deviate from strict no-go policy, a full EIA is required with full set of specialist reports including, but not limited to the following:

- An ecological study, including both functional and compositional (biodiversity) aspects;
- A Red Data study for both fauna and flora;
- An invertebrate study;
- All specialist studies to examine cumulative impacts; and
- A 200m buffer zone of low impact development is required around Class 1 ridges.

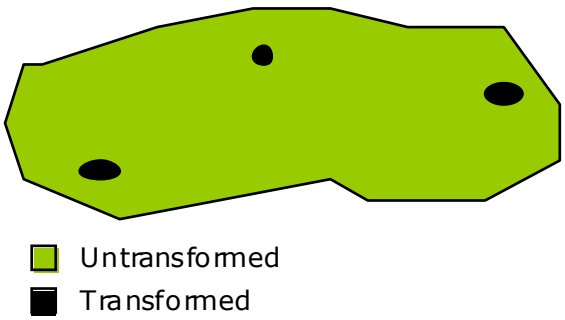


Figure 4: Example of Class 1 Ridge

5.4.2 Class 2 Ridges

Figure 5 provides an example of a Class 2 ridge, being classified as any ridge on which between 5% and 35% of the ridge is transformed. No further subdivisions will be allowed and consolidation of subdivisions is encouraged. No-go development policy should be enforced and only low impact (e.g. tourism developments) will be considered requiring full EIA with full set of specialist reports including, but not limited to the following:

- An ecological study, including both functional and compositional (biodiversity) aspects;
- A Red Data study for both fauna and flora;
- An invertebrate study;
- All specialist studies to examine cumulative impacts;
- Ecological footprint of low impact developments to cover no more than 5% of a property. All impacts for these developments must be sufficiently mitigated;
- A management plan to maintain the ecological integrity of remaining property is required and implementation is the responsibility of the developer; and
- A 200m buffer zone of low impact development is required around Class 2 ridges.

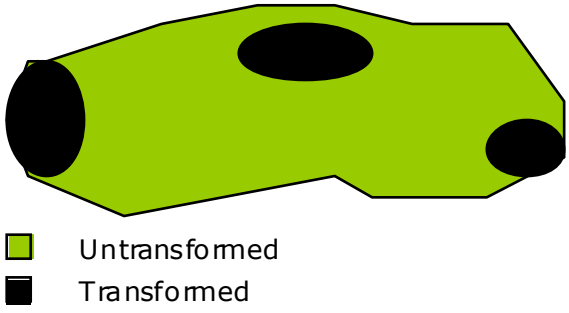


Figure 5: Example of Class 2 Ridge

5.4.3 Class 3 Ridges

Figure 4 provides an example of a Class 3 ridge, with BLACK indication the transformed areas and GREEN indicating the untransformed parts. A Class 3 ridge is classified as any ridge on which 35% to 65% of the ridge is transformed. Ridges in this class are to be designated as low impact development areas (A) and high impact development areas (B). Development should be contained within areas that are already transformed (B).

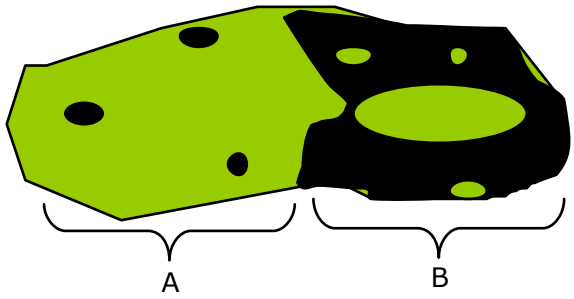


Figure 6: Example of Class 3 ridge

- **Untransformed areas:**

No further subdivisions will be allowed and consolidation of subdivisions will be encouraged. Low impact developments will be considered requiring full EIA with full set of specialist reports including, but not limited to the following:

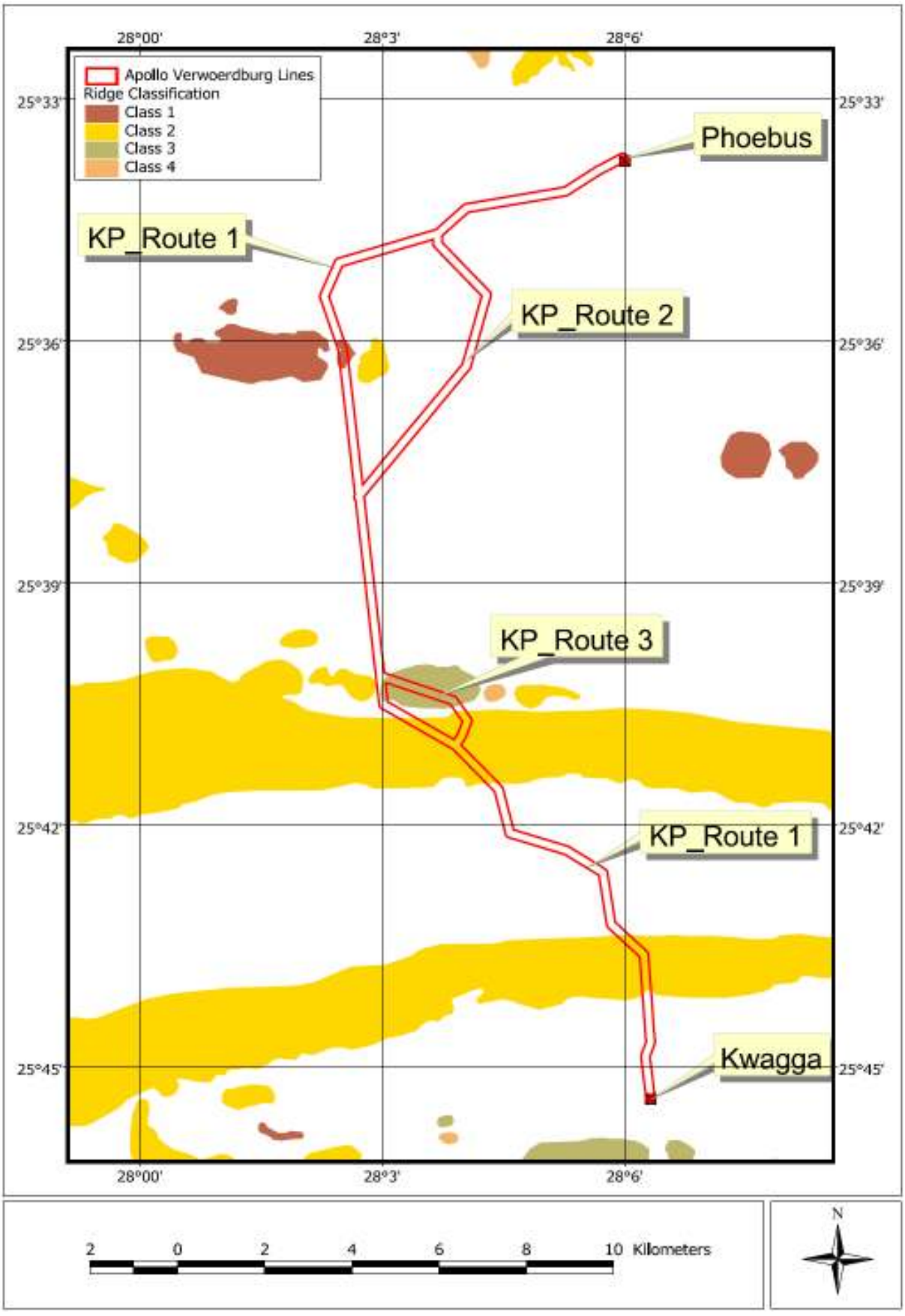
- An ecological study, including both functional and compositional aspects;
- A Red Data study for both fauna and flora;
- An invertebrate study;
- All specialist studies to examine cumulative impacts.
- Ecological footprint of low impact developments to cover no more than 5% of a property;
- All impacts for these developments must be sufficiently mitigated;
- A management plan to maintain the ecological integrity of remaining property is required and implementation is the responsibility of the developer; and
- A 200m buffer zone of low impact development is required around class 3(A) ridges.

- **Transformed areas**

Exempt from EIA process unless:

- A Red Data species is recorded for the ridge – implementation of Red Data policy is required.
- The open space is 4ha or larger. EIA with all specialist reports (see above) is required. All policy guidelines as listed for (Untransformed areas) above are applicable.
- Surrounding community / landowners object. A scoping report is then required with specialist reports identified in accordance with public objections but should at least include a social study, including cultural, historical and open space value aspects

Figure 7: Distribution of ridges in the study area



5.5 REGIONAL VEGETATION - VEGMAP

The VEGMAP database describes the following vegetation types within the study area (Figure 8):

- Central Sandy Bushveld;
- Gold Reef Mountain Bushveld;
- Marikana Thornveld;
- Moot Plains Bushveld; and
- Norite Koppies Bushveld.

5.5.1 Central Sandy Bushveld

It is located in undulating terrain, occurring mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. The habitat conforms to low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broadleaved *Combretum* woodland on shallow, rocky or gravely soils. Species of *Acacia, Ziziphus* and *Euclea* are found on flats lower slopes on eutrophic sands and some less sandy soils. *A. tortilis* may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic soils are noted frequently.

The Central Bushveld endemic grass species *Mosdenia leptostachys* and herb *Oxygonum dregeanum* subsp. *canescens* var. *dissectum* are present within this unit.

This vegetation type is regarded Vulnerable with less than 3% statutorily conserved, spread thinly across many nature reserved, including the Doorndraai Dam and Skuinsdraai Dam Nature Reserves. An additional 2% is conserved in other reserves including the Wallmansthal SANDF Property and a grouping of the Nylsvlei freshwater wetlands. About 24% is transformed, including 19% cultivated and 4% urban and built-up areas. Much of the unit in the broad arc south of the Springbokvlakte is heavily populated by rural communities. Several alien plants are widely scattered by often at low densities, including *Cereus jamacuru, Eucalyptus* species, *Lantana camara, Melia azedarach, Opuntia ficus-indica* and *Sesbania punicea.*

Acacia sieberiana occurs in the transition zone with grassland in the east, while *A. caffra* and *Faurea saligna* are dominant in the transition zone to the Waterberg Mountain Bushveld in the western parts of this unit. The following species are regarded representative of this particular vegetation type:

- **Tall Trees**

Acacia burkei, A. robusta and *Sclerocarya birrea* subsp. *caffra.*

- **Small Trees**

Burkea africana, *Combretum apiculatum*, C. *zeyheri*, *Terminalia sericea*, *Ochna pulchra, Peltophorum africanum* and *Rhus leptodictya.*

- **Tall Shrubs**

Combretum hereroense, Grewia bicolor, G. *monticola* and *Strychnos pungens.*

- **Low Shrubs**

Agathisanthemum bojeri, *Indigofera filipes*, *Felicia fascicularis, Gnidia sericocephala.*

- **Geoxylic Suffrutex**

Dichapetalum cymosum

- **Woody Climber**

Asparagus buchananii

- **Graminoids**

Brachiaria nigropedata, *Eragrostis pallens*, *E. rigidior*, *Hyperthelia dissoluta*, *Panicum maximum*, *Perotis patens*, *Anthephora pubescens, Aristida scabrivalvis* subsp. *scabrivalvis, Brachiaria serrata, Elionurus muticus, Eragrostis nindensis, Loudetia simplex, Schmidtia pappophoroides, Themeda triandra* and *Trachypogon spicatus.*

- **Herbs**

Dicerocaryum encelioides, *Barleria macrostegia, Blepharis integrifolia, Crabbea angustifolia, Evolvulus alsinoides, Geigeria burkei, Hermannia lancifolia, Indigofera daleoides, Justicia anagalloides, Kyphocarpa angustifolia, Lophiocarpus tenuissimus, Waltheria indica* and *Xerophyta humilis.*

- **Geophytic Herb**

Hypoxis hemerocallidea var. *davyana*

- **Succulent Herb**

Aloe greatheadii

5.5.2 Gold Reef Mountain Bushveld

This vegetation type is situated on rocky hills and ridges often west-east facing slopes associated with distinct florist differences (e.g. preponderance of *Acacia caffra* on the southern slopes). Tree cover elsewhere is variable. Tree and shrub layers are often continuous and the herbaceous layer is dominated by grasses. This vegetation type is regarded Least Threatened with a target of 24%. Some 22% is statutorily conserved mainly in the Rustenberg, Wonderboom and Suikerbosrand Nature Reserves. At least and additional 1% is conserved in other reserves, brining the total conserved very close to target. About 15% is transformed mainly be cultivation and urban and built-up areas.

Some areas occur with dense stands of the alien tree species *Melia azedarach,* which is often associated with drainage lines or alluvia (i.e. azonal vegetation), are embedded within this unit. The endemic succulent shrub *Aloe peglerae* and the succulent herb *Frithia pulchra* are present in this vegetation type. The following species are regarded representative of the Gold Reef Mountain Bushveld vegetation type.

- **Small Trees**

Acacia caffra, Combretum molle, Protea caffra, Celtis africana, Dombeya rotundifolia, Englerophytum magalismontanum, Ochna pretoriensis, Rhus leptodictya, Vangueria infausta, V. parvifolia and *Ziziphus mucronata.*

- **Tall Shrubs**

Canthium gilfillanii, Ehretia rigida, Grewia occidentalis, Gymnosporia buxifolia and *Mystroxylon aethiopicum.*

- **Low Shrubs**

Athrixia elata, Pearsonia cajanifolia, Rhus magalismontana and *R. rigida.*

- **Woody Climber**

Ancylobotrys capensis

- **Graminoids**

Loudetia simplex, Panicum natalense, Schizachyrium sanguineum, Trachypogon spicatus, Alloteropsis semialata, Bewsia biflora, Digitaria tricholaenoides, Diheteropogon amplectens, Sporobolus pectinatus, Tristachya leucothrix and *T. biseriata.*

- **Herbs**

Helichrysum nudifolium, H. rugulosum, Pentanisia angustifolia, Senecio venosus and *Xerophyta retinervis.*

- **Geophytic Herbs**

Cheilanthes hirta, Hypoxis hemerocallidea and *Pellaea calomelanos.*

5.5.3 Marikana Thornveld

The northern and southern sections of the study area correspond to a vegetation type known as Marikana Thornveld and were previously classified by Van Rooyen and Bredenkamp as Rocky Highveld Grassland. This ecological type is structurally similar to open *Acacia* savanna woodland, occurring in valleys and slightly undulating plains and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrop or in other habitat protected from fire. The Marikana Thornveld is a threatened ("endangered") vegetation type of which less than 1% is formally conserved within

reserves and is mainly threatened by cultivation and urbanisation. The following species are regarded representative of the Marikana Thornveld vegetation type.

- **Tall Tree**

Acacia burkei

- **Small Trees**

Acacia caffra, *A. gerrardii*, *A. karroo*, *Combretum molle*, *Rhus lancea*, *Ziziphus mucronata*, *Acacia nilotica, A. tortilis* subsp. *heteracantha, Celtis africana*, *Dombeya rotundifolia, Pappea capensis, Peltophorum africanum* and *Terminalia sericea.*

- **Tall Shrubs**

Euclea crispa subsp. *crispa*, *Olea europaea* subsp. *africana*, *Rhus pyroides* var. *pyroides*, *Diospyros lycioides* subsp. *guerkei, Ehretia rigida* subsp. *rigida, Euclea undulata, Grewia flava* and *Pavetta gardeniifolia.*

- **Low Shrubs**

Asparagus cooperi, Rhynchosia nitens, Indigofera zeyheri and *Justicia flava.*

- **Woody Climbers**

Clematis brachiata and *Helinus integrifolius.*

- **Herbaceous Climbers**

Pentarrhinum insipidum and *Cyphostemma cirrhosum.*

- **Graminoids**

Elionurus muticus, Eragrostis lehmanniana, Setaria sphacelata, Themeda triandra, Aristida scabrivalvis subsp. *scabrivalvis, Fingerhuthia africana, Heteropogon contortus, Hyperthelia dissoluta, Melinis nerviglumis* and *Pogonarthria squarrosa.*

- **Herbs**

Hermannia depressa, Ipomoea obscura, Barleria macrostegia, Dianthus mooiensis subsp. *mooiensis, Ipomoea oblongata* and *Vernonia oligocephala.*

- **Geophytic Herbs**

Ledebouria revoluta, Ornithogalum tenuifolium and *Sansevieria aethiopica.*

5.5.4 Moot Plains Bushveld

This vegetation type occurs immediately to the south of both the Dwarsberg-Swatruggens Mountain Bushveld and Gold Reef Mountain Bushveld, consisting of an open to closed *Acacia* savanna with a well-developed herbaceous layer dominated by grasses. This vegetation type is Vulnerable of which only 13% is conserved, mainly in the Magaliesberg Nature Area. About 28% is transformed mainly by cultivation and urban and built-up areas. Are scattered occurrences to sometimes dense patched in places of various alien plains occur, including *Cereus jamacuru, Eucalyptus* species, *Jacaranda mimosifolia, Lantana camara, Melia azedarach* and *Schinus molle.* The following species are regarded representative of the Moot Plains Bushveld vegetation type.

- **Small Trees**

Acacia nilotica, *A. tortilis* subsp. *heteracantha* and *Rhus lancea*.

- **Tall Shrubs**

Buddleja saligna, *Euclea undulata*, *Olea europaea* subsp. *africana*, *Grewia occidentalis, Gymnosporia polyacantha* and *Mystroxylon aethiopicum* subsp. *burkeanum.*

- **Low Shrubs**

Aptosimum elongatum, Felicia fascicularis, Lantana rugosa and *Teucrium trifidum.*

- **Succulent Shrub**

Kalanchoe paniculata

- **Woody Climber**

Jasminum breviflorum

- **Herbaceous Climber**

Lotononis bainesii

- **Graminoids**

Heteropogon contortus, *Setaria sphacelata*, *Themeda triandra*, *Aristida congesta, Chloris virgata, Cynodon dactylon, Sporobolus nitens* and *Tragus racemosus.*

- **Herbs**

Achyropsis avicularis, Corchorus asplenifolius, Evolvulus alsinoides, Helichrysum nudifolium, H. undulatum, Hermannia depressa, Osteospermum muricatum and *Phyllanthus maderaspatensis.*

5.5.5 Norite Koppies Bushveld

This vegetation type is encapsulated in the central part of the study area, corresponding to low, semi-open to closed woodland up to 5m tall, consisting of dense deciduous shrubs and trees with very sparse undergrowth on shallow soil, with large areas not covered by vegetation. Tree and shrub layers are continuous. The stands of this unit are found on noritic outcrops and koppies, many appearing as inselbergs above the surrounding plains.

The conservation status is regarded Least Threatened according to remote sensing data, but ground truthing suggests that it is rather susceptible. None is conserved in statutory reserves, but 4% is conserved in De Onderstepoort Nature Reserve. Mining, urban and built-up developments as well as agriculture represent the main threats to this vegetation type. Areas close to human settlements are often severely disturbed and many woody species in these areas have been harvested for fuel and building materials.

Vegetation patterns on norite koppies are primarily determined by the amount of rockiness and aspect, warmer north-facing sloes and cooler south-facing slopes bearing floristically distinct vegetation. A number of the woody species are typical chasmophytes, penetrating the rocks with their roots. The vegetation unit is transitional between xeric lowland bushveld and mesophyllous woodland in cooler more moist upland areas associated with the Magaliesberg and may be considered a more xeric phase of these upland areas. The following species are regarded representative of the Norite Koppies Bushveld vegetation type.

- **Tall Tree**

Sclerocarya birrea subsp. *caffra*

- **Small Trees**

Combretum molle, *Croton gratissimus*, *Ficus abutilifolia*, *Pappea capensis*, *Acacia caffra, Bridelia mollis, Combretum apiculatum, Cussonia paniculata, Dombeya rotundifolia*, *Faurea saligna, Ficus glumosa, Lannea discolor, Obetia tenax, Peltophorum africanum, Rhus leptodictya, Vangueria infausta* and *Ziziphus mucronata.*

- **Succulent Tree**

Euphorbia cooperi

- **Shrubs**

Triaspis glaucophylla, *Canthium gilfillanii, Clerodendrum glabrum, Diplorhynchus condylocarpon, Euclea natalensis, Grewia flavescens,* G. *monticola, Gymnosporia nemorosa,* G. *polyacantha, Pavetta eylesii, Pouzolzia mixta, Psydrax livida, Vitex zeyheri, Jatropha latifolia* var. *latifolia*, *Abutilon austro-africanum, Hermannia floribunda, Hibiscus subreniformis* and *Rhus zeyheri.*

- **Succulent Shrub**

Tetradenia brevispicata

- **Semiparasitic Shrub**

Osyris lanceolata

- **Woody Climbers**

Helinus integrifolius, Rhoicissus tridentata and *Turraea obtusifolia.*

- **Woody Succulent Climber**

Sarcostemma viminale

- **Herbaceous Climber**

Cyphostemma lanigerum

- **Graminoids**

Chrysopogon serrulatus, *Setaria lindenbergiana*, *Aristida congesta, Bulbostylis humilis, Eustachys paspaloides, Heteropogon contortus, Loudetia simplex, Melinis nerviglumis, Panicum maximum* and *Themeda triandra.*

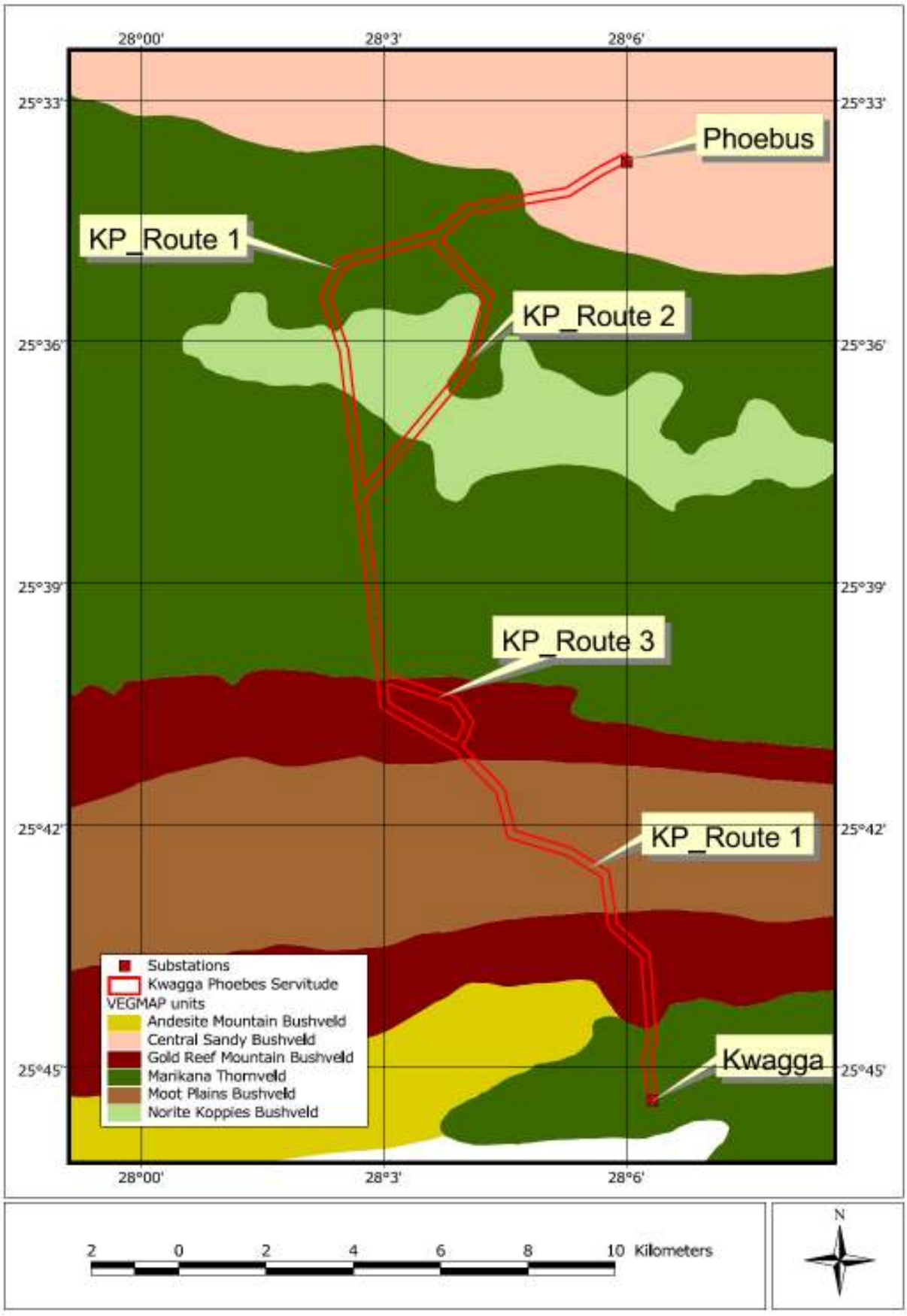
- **Herb**

Hibiscus sidiformis

- **Geophytic Herbs**

Pellaea calomelanos, P viridis and *Scadoxus puniceus.*

Figure 8: VEGMAP vegetation types in the region of the study area



6 VEGETATION OF THE STUDY AREA

6.1 REGIONAL FLORISTIC DIVERSITY

The study area is located in two ¼-degree grids, namely 2528CA and 2528CC. SANBI database indicates the known presence of approximately 2,236 and 904 plant species within these areas respectively. The extremely high diversity of species within the study area reflects the varied topography, habitat types and ecological attributes that give rise to a diverse environment in which a multitude of plant communities have developed, each with a unique composition of species. The presence of five regional vegetation types provides further indication of the varied floristic composition of the region, comprising aspects of both the grassland and savanna biome. In addition, the presence of riparian areas creates numerous ecotonal zones, or contact zones between the aquatic and terrestrial environment. These areas are known to exhibit high floristic diversity.

6.2 PRELIMINARY HABITAT TYPES OF THE STUDY AREA

A basic analysis of the aerial photographs revealed the following preliminary habitat types:

- Degraded Habitat;
- Natural Grassland Habitat;
- Natural Woodland Habitat;
- Ridge Habitat;
- Riparian Habitat;
- Stands of Exotic Trees; and
- Transformed Habitat.

6.2.1 Degraded Habitat

Parts of the study area within the proposed servitudes are characterised by poor floristic status because of historic agricultural activities, high grazing pressure or physical habitat disturbances resulting from nearby industrial or urban developments. It could be expected that most of the species associated with pristine grassland and woodland areas are no longer present within these parts, or occur at much lower cover abundance values. Species that indicate the degraded nature of the grassland and woodland areas usually proliferate in these parts.

The effect of habitat degradation in both grassland and woodland areas are not only the removal and replacement of species that are endemic to the region, but also significant changes to the structure of the vegetation. Degradation in grassland areas are normally accompanied by increase in height and varied structure, caused by the influx of dominant and exotic species that are well adapted to the changed environment. Degradation in woodland areas, on the contrary, is characterised by a reduction in the structure, mostly

as a result of the removal of the dominant woody layer and the establishment of an open, sometimes grassy, vegetation structure. The shrubby appearance of the dominant woody component provides an indication of recent, low level impacts on the woody layer.

The likelihood of these areas being utilised as habitat for Red Data plant species is regarded medium-low, mainly because of the changed habitat conditions. Red data species normally exhibit low habitat variation tolerance and are adapted to highly specific conditions. Any changes in their habitat will therefore result in severe impacts on the community. These low habitat variation tolerance levels are a major reason for these species having a threatened status.

6.2.2 Natural Grassland Habitat

Although none of the regional vegetation types conform to natural grasslands, extensive parts of the study area exhibit attributes of pristine grasslands, comprising a high diversity of species that are associated with grassland communities that are located in the vicinity, i.e. Carletonville Dolomite Grassland and Egoli Granite Grassland. In association with these physiognomic grassland communities, elements of the regional savanna habitat types also occur as localised variations. These areas of mixed floristic derivation is a major reason for the extremely high floristic diversity that is noted in the study area

The likelihood of encountering flora species of importance in these areas is estimated at medium to high and a medium-high floristic status is ascribed to natural grassland areas of the study area.

6.2.3 Natural Woodland Habitat

In contrast to the characterisation of woodland habitat by regional vegetation database, relative few areas exhibit true woodland attributes. Selected parts of the proposed servitudes are however characterised by a dominant woodland physiognomy. The prominence of particularly *Acacia* species is noted in the flatter areas where soil conditions indicate a high clay content of the soils. Areas of varied topography are occupied by a varied composition of broad-leafed woody species. This difference between the fine-leafed and broad-leafed types is the result of soil dynamics. Clayey soils contain a high nutrient content and *Acacia* species predominate in these parts, while sandy soils that proliferate in areas of varied topography are characterised by poor nutrient status due to leaching of nutrients from the A-horizon. These areas are normally inhabited by broadleaf woody species.

Natural woodland areas of the study area were found to be in a relative good condition and a medium-high floristic status is ascribed to these parts. A medium-high likelihood of encountering Red Data flora species within these parts is estimated.

6.2.4 Ridge Habitat

C-PLAN indicates the extensive presence of ridges (Classes 1, 2 and 3) within the proposed servitudes. Two ridges in particular are of importance, namely the Magaliesberg and Daspoort Ranges. A basic investigation revealed that these ridges are well defined and significantly important in terms of C-PLAN and represent pristine examples of regional vegetation. The vegetation in these parts is representative of the regional vegetation and because of the atypical habitat conditions and the rocky nature of these parts; micro-niches are formed where plants occur with specific habitat requirements. The association of Red Data plant species with ridges and rocky outcrops have been indicated in research it is natural to ascribe high Red Data potential in these areas.

The rocky nature of these parts renders it unsuitable for agricultural activities and a low accessibility factor for cattle provides protection against high grazing pressures. As a result, a high ecological status is attributed to these parts. A high conservation value is placed on these areas, as they are also suitable habitat for a number of Red Data plant species.

6.2.5 Riparian Habitat

Numerous perennial- and non-perennial rivers are present within the proposed servitudes and is characterised by a high occurrence of trees in close association with the aquatic environment. Atypical habitat conditions that characterise these areas also render them extremely sensitive and the habitat is regarded moderately suitable for Red Data flora species. The ecological status of these parts might not always be pristine, because of aspects that contribute to degradation, including the proliferation of exotic trees, high grazing pressures, nearby agricultural practices, upstream activities, etc., but a regional and national importance is nonetheless attributed.

6.2.6 Stands of Exotic Trees

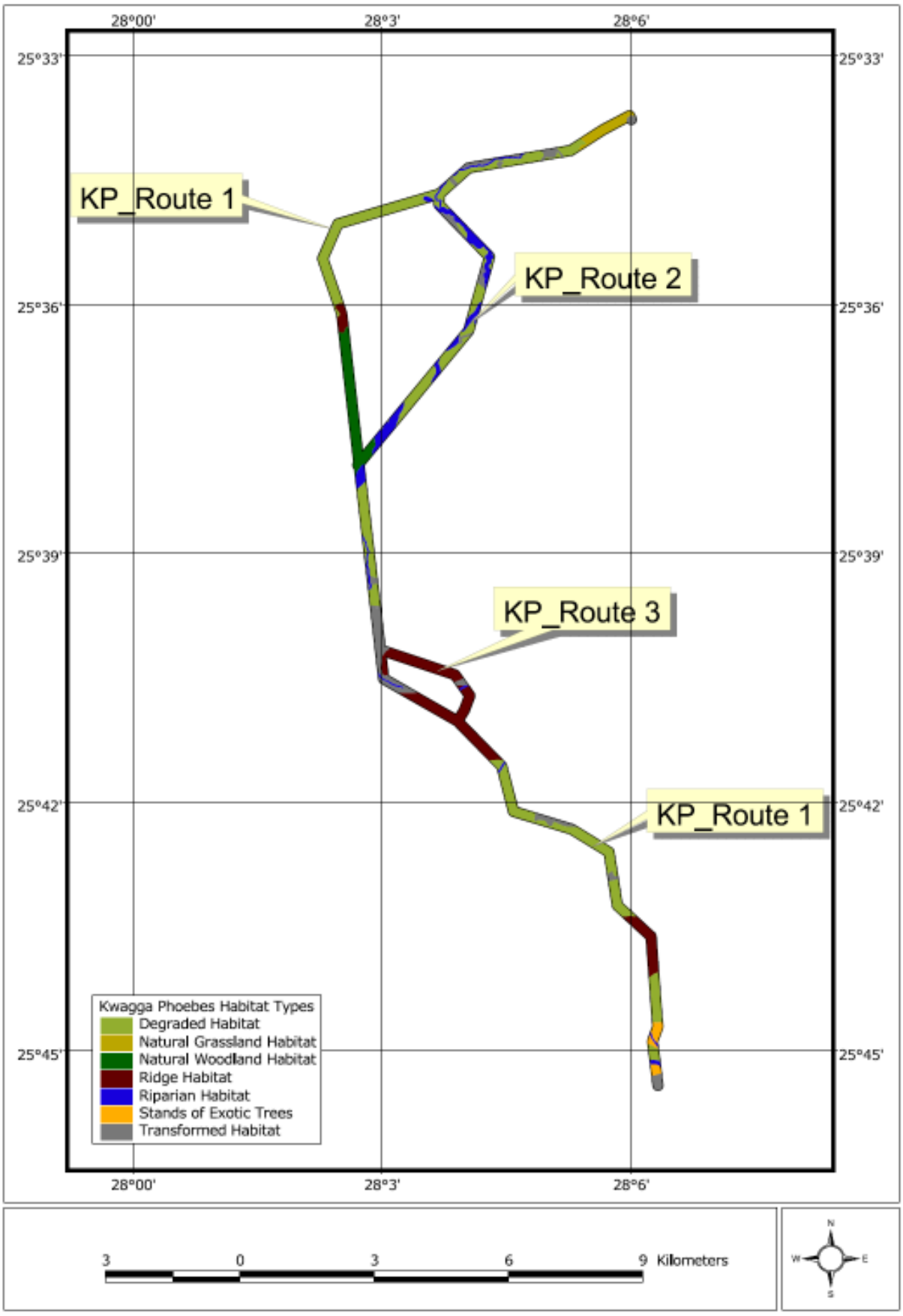
Natural vegetation has been displaced by stands of exotic trees, most often *Acacia mearnsii* (Black Wattle) and Eucalyptus species. These trees occur mostly as localised stands. In some cases, these stands of exotic trees are located in close proximity to streams, rivers and other sensitive habitat types, implying a high impact on the status of these sensitive areas.

A low ecological status is attributed to these parts. In addition, the likelihood of these areas being utilised as habitat for Red Data fauna species, or encountering Red Data plant species is regarded low. Because of the absence of natural habitat as well as low Red Data probabilities, low biodiversity sensitivity is estimated for this habitat type.

6.2.7 Transformed Habitat

Transformed areas represent parts where historical or recent human activities led to the total transformation of natural vegetation. No natural vegetation remains in these areas and the floristic status of these areas is therefore regarded low because of the presence of secondary vegetation or the entire absence of any vegetation. The likelihood of encountering Red Data flora species within these areas are regarded low.

Figure 9: Preliminary habitat types of the study area



7 FAUNAL ATTRIBUTES

7.1 RED DATA FAUNA ASSESSMENT

A total of 43 Red Data animals are known from Gauteng (excluding avifauna). The following Red Data status is ascribed to the species:

- 13 species are listed as Data Deficient (DD);
- 15 species are listed as Near Threatened (NT);
- 11 species are listed as Vulnerable (VU);
- 2 species area listed as Endangered (EN); and
- 2 species are listed as Critically Endangered (CR).

The following probabilities of occurrence in the study area are ascribed to the Red Data fauna species:

- 15 species are estimated to have a low probability of occurrence;
- 3 species are estimated to have a medium-low probability of occurrence;
- 9 species are estimated to have a medium probability of occurrence;
- 15 species are estimated to have a medium-high probability of occurrence; and
- 1 species is estimated to have a high probability of occurrence.

Although the categories of Data Deficient and Near Threatened are not considered as "threatened" species the importance of these groups cannot be over-estimated. Most of the Data Deficient species are more than not likely to be "threatened", but insufficient data exists to verify their true status. When considering nature conservation, prevention is surely better than cure. Although nature conservationists have to focus on "crisis management" – i.e. scrambling to conserve threatened taxa, it is just as important to considered taxa on the brink of being under threat – i.e. NT species. Because of these principles, the above-mentioned IUCN Red Data categories are used in the sensitivity analyses and impact assessments.

Eight of the Red Data species listed are considered to have "broad habitat tolerances"; that being said, seven of these species are listed as DD and information on their biology, and indeed habitat preferences, is insufficient. Red Data Chiropterans (Bats) are found in the region of the study area; seven of these need caves for roosting and breeding purposes. These caves are usually found within rocky areas, ridges and areas characterised by sinkholes (such areas are usually found in regions characterised by Dolomite and include regional vegetation communities such as Carletonville Dolomite Grassland).

Table 1: Red Data fauna probabilities for the study area				
Biological Name	**English Name**	**Rd**	**Probability**	**Habitat**
		Invertebrates		
Metisella meninx	Marsh Sylph	Vulnerable	low	wetlands with *Leersia hexandra*
Platylesches dolomitica	Hilltop Hopper	Vulnerable	medium-low	hill tops, rocky ledges
Aloeides dentatis	Roodepoort Copper	Vulnerable	low	grasslands - flatlands & hillsides
Chrysoritis aureus	Golden Opal	Near Threatened	low	mountains, rocky slopes, hillsides
Lepidochrysops praeterita	Highveld Blue	Vulnerable	low	flatlands, hillsides
Orachrysops mijburghi	Mijburgh's Blue	Vulnerable	low	flatlands, hillsides, wetlands
		Reptiles		
Cordylus giganteus	Giant Girdled Lizard	Vulnerable	low	flat *Themeda* grassland, transitional zones
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	low	grassland
		Amphibians		
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	medium-high	grassland & savanna, sandy soils, temp wetland
		Mammals		
Acinonyx jubatus	Cheetah	Vulnerable	low	broad, open habitat
Amblysomus septentrionalis	Higveld Golden Mole	Near Threatened	low	moist highveld grassland
Atelerix frontalis	South African Hedgehog	Near Threatened	medium-high	dry habitats with ground cover
Chrysospalax villosus	Rough-haired Golden Mole	Critically Rara	medium-low	bogs, marshes, swamps, fens, peatlands
Cloeotis percivali	Short-eared Trident Bat	Critically Rara	medium	caves in savanna
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient	medium-high	broad
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient	medium-high	broad, moist savanna and wetlands
Crocidura maquassiensis	Maquassie Musk Shrew	Vulnerable	low	montane and temperate grassland, rocky areas
Crocidura mariquensis	Swamp Musk Shrew	Data Deficient	medium-high	bogs, marshes, swamps, fens, peatlands
Crocidura silacea	Lesser Grey-brown Musk Shrew	Data Deficient	medium-high	woodland, coast forest, grassland, rocky areas
Dasymys incomtus	Water Rat	Near Threatened	medium	bogs, marshes, swamps, fens, peatlands
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Data Deficient	medium-high	shrubland, grassland, heavy cover - grass, shrubs
Graphiurus platyops	Rock Dormouse	Data Deficient	medium-high	rocky terrain
Hippotragus niger niger	Sable Antelope	Vulnerable	low	woody savanna, water dependent grazer
Hyaena brunnea	Brown Hyaena	Near Threatened	medium-low	broad
Lemniscomys rosalia	Single-striped Mouse	Data Deficient	medium-high	grassland, good cover, fallow fields

Table 1: Red Data fauna probabilities for the study area				
Biological Name	**English Name**	**Rd**	**Probability**	**Habitat**
Lutra maculicollis	Spotted-necked Otter	Near Threatened	low	large, pristine rivers
Mellivora capensis	Honey Badger	Near Threatened	medium	broad
Miniopterus schreibersii	Schreiber's Long-fingered Bat	Near Threatened	medium-high	caves in savanna, grassland, etc.
Myosorex cafer	Dark-footed Forest Shrew	Data Deficient	low	forest, damp habitats
Myosorex varius	Forest Shrew	Data Deficient	medium	bogs, marshes, swamps, fens, peatlands
Myotis tricolor	Temminck's Hairy Bat	Near Threatened	medium-high	caves in mountains, grassland, savanna
Myotis welwitschii	Welwitsch's Hairy Bat	Near Threatened	medium	savanna, roosts in shrubs and trees
Mystromys albicaudatus	White-tailed Rat	Endangered	medium	sandy soils, good cover
Neamblysomus juliane	Juliana's Golden Mole	Vulnerable	low	rocky highveld grassland
Ourebia ourebi	Oribi	Endangered	low	grassland, tall and short grasses
Pipistrellus rusticus	Rusty Bat	Near Threatened	medium	savanna, riparian forest, roosts in trees
Poecilogale albinucha	African Weasel	Data Deficient	medium-high	broad
Rhinolophus blasii	Peak-saddle Horseshoe Bat	Vulnerable	medium-high	caves in woodland, savanna
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Near Threatened	medium-high	caves in various habitats0
Rhinolophus darlingi	Darling's Horseshoe Bat	Near Threatened	medium-high	caves in woodland, savanna
Suncus infinitesimus	Least Dwarf Shrew	Data Deficient	medium	termitaria
Suncus varilla	Lesser Dwarf Shrew	Data Deficient	medium	termitaria
Tatera leucogaster	Bushveld Gerbil	Data Deficient	high	sandy soils

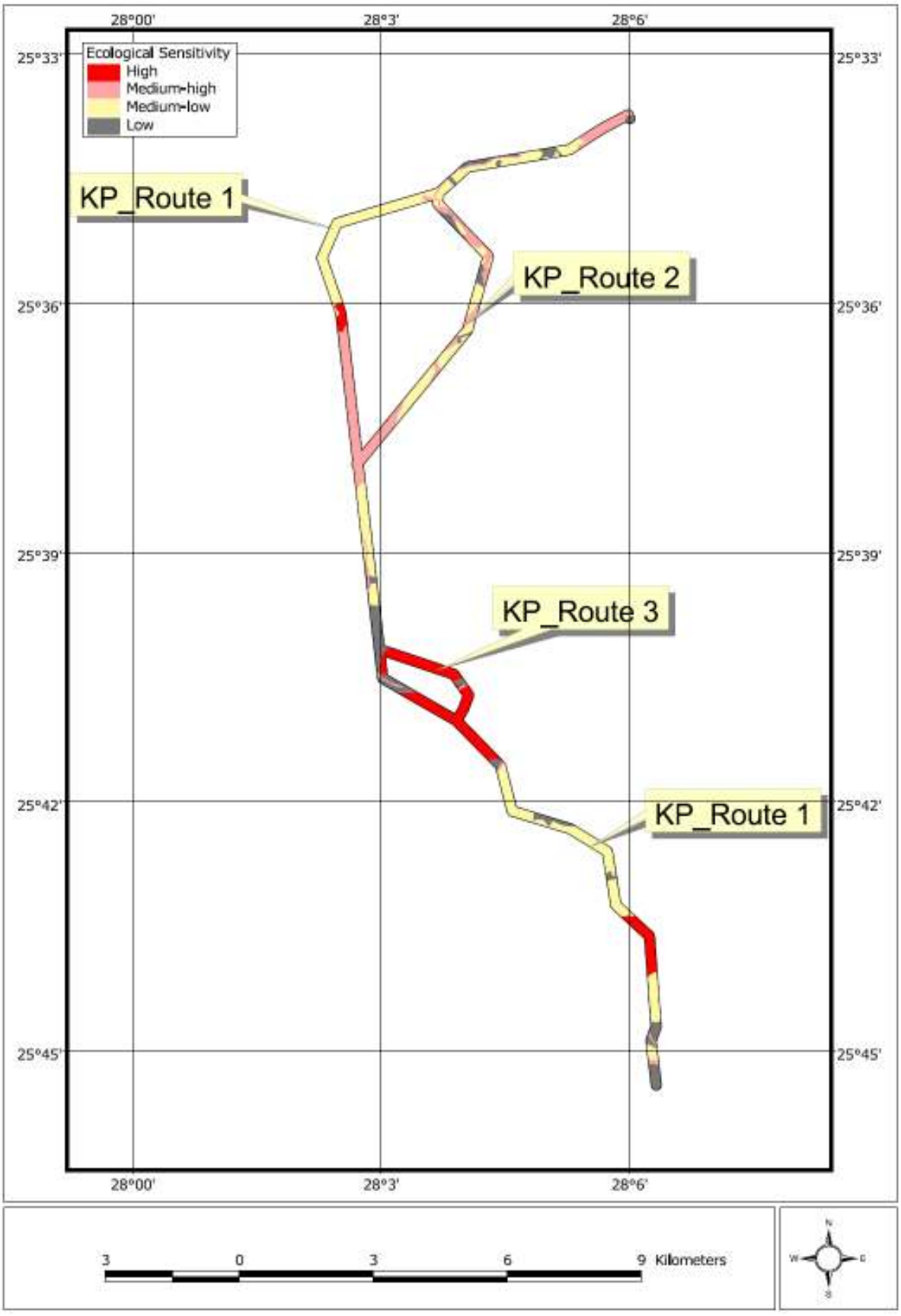
8 ECOLOGICAL SENSITIVITY ASSESSMENT

Results of the floristic and faunal assessments are combined to present an overview of the ecological sensitivity of the preliminary habitat types that occur in the study area. Results are determined in Table 2 and visually presented in Figure 10.

Table 2: Ecological sensitivity of the preliminary habitat types

Criteria	RD species	Landscape sensitivity	Ecology Status	Species diversity	Functionality/ fragmentation	TOTAL	SENSITIVITY INDEX	SENSITIVITY CLASS
Community	Criteria Ranking							
Degraded Habitat	2	2	3	3	4	71	24%	Medium-Low
Natural Grassland Habitat	5	7	8	8	9	196	68%	Medium-High
Natural Woodland Habitat	6	7	8	8	9	206	71%	Medium-High
Ridge Habitat	10	10	10	10	10	290	100%	High
Riparian Habitat	5	10	4	6	10	184	63%	Medium-High
Stands of Exotic Trees	2	1	2	1	1	45	16%	Low
Transformed Habitat	0	0	1	1	1	12	4%	Low

Figure 10: Ecological sensitivities of the study area



9 GDACE BIODIVERSITE REQUIREMENTS

GDACE requires the following studies to be conducted as part of the EIA assessment:

TO BE COMPLETED WITH RECEIVAL OF INFORMATION FROM GDACE

10 SCOPING ASSESSMENT

This scoping assessment considers the potential impacts resulting from the construction and operation of the proposed power lines, substation and associated infrastructure on the natural environment. Rating of impacts is based on the estimated effect that construction and operation of power lines will have on biodiversity attributes in the study area. Impacts identified in this section are partly based on the Guidance Document on Biodiversity, Impact Assessment and Decision Making in Southern Africa (2006).

10.1 ANTICIPATED IMPACTS

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive.

Impacts resulting from the construction and operation of power lines on ecological attributes of the study area are largely restricted to the physical impacts of biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and easy to assess, as the effects thereof is immediately visible and can be determined to an acceptable level of certainty. In contrast, the effect of indirect impacts is not immediately evident and can consequently not be measured immediately. A measure of estimation is therefore necessary in order to evaluate these impacts. Lastly, cumulative impacts place direct and indirect impacts of this project in a regional and national context, particularly in view of similar or resultant developments and activities in the immediate surrounds of this proposed development.

Potential impacts include the following, but are not necessarily limited to the following:

- **Direct impacts:**
  - Destruction of threatened species & habitat;
  - Destruction of protected tree species;
  - Destruction of sensitive/ pristine regional habitat types;

- **Indirect Impacts:**
  - Floristic species changes within the servitudes;
  - Faunal interactions with structures, servitudes and personnel;
  - Impacts on surrounding habitat/ species;
- **Cumulative Impacts:**
  - Impacts on conservation obligations & targets;
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

10.2 NATURE OF IMPACTS

10.2.1 DIRECT - Destruction of Threatened Flora Species & Habitat

The loss of Red Data or Threatened flora and fauna species or areas that are suitable for 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 a high ecological value is placed on the presence of such species in an area, as they are frequently an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of 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 transformation activities within habitat types that are occupied by flora species of conservation importance will definitely result in significant and permanent impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data species in the study area. In order to assess this impact an approach it is therefore necessary to assess the presence/ distribution of habitats frequently associated with these species. Furthermore, by applying ecosystem conservation principles to this development, resultant impacts on Red Data species will be limited largely.

The likelihood of encountering Red Data species within parts of the study area is regarded medium-high, particularly in the Ridges Habitat Type. The EIA phase will determine the presence/ absence of these species from sensitive areas and will guide route selection in terms of effective planning. The EIA assessment will also consider the impact of construction and operation of power lines in an environment in which Red Data flora and fauna species might be present.

10.2.2 DIRECT - Destruction of Protected Tree Species

Tree species included in the National List of Declared Protected trees (as promulgated by the National Forests Act, 1998 (No 84 of 1998)) might be present in the woodland areas of the study area and impacts will be unavoidable, stemming from physical habitat disturbance. Because of the distribution patterns of these species and their presence in

the study area, the level of impact on these species (in terms of conservation status) is not as severe as in the case of Red Data flora species. Cognisance of the presence of these species is taken during this phase of the project, but site-specific actions will be recommended during the walk-through phase of the project.

10.2.3 DIRECT - Destruction of Sensitive/ Pristine Regional Habitat Types

The loss of pristine natural habitat represents loss of habitat and biodiversity on a regional scale. Sensitive habitat types include ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is attributed to the floristic communities and faunal 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 risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

The importance of regional habitat types is based on the conservation status ascribed to vegetation types. However, the actual impact of the construction and operation of power lines in grassland habitat types might not be as severe as anticipated and is heavily dependent on the type of servitude clearance activities. Grassland habitat is not affected significantly in areas where minimal servitude maintenance is since extremely little impacts result on the structure of the vegetation. Impacts within grassland habitat are mostly restricted to the footprint areas of the pole structures, which is extremely small. Visual observations within existing servitudes revealed very little variation in the species composition between areas in- and outside the power line servitude.

This impact is likely to occur in both of the proposed line variants and an assessment of the extent of natural regional habitat that will be affected by the proposed servitude will be compiled in the EIA phase. Mitigation measures will guide the development and operational activities in order to minimise the effect of this impact in sensitive areas, particularly rivers and ridges.

10.2.4 INDIRECT - Floristic Species Changes within the Servitudes

The partly transformation of particularly the grassland habitat during the construction process could potentially result in the establishment of habitat types that are not considered representative of the region. Because of the severity of habitat manipulation in some cases, servitudes are frequently invaded by species not normally associated with the region (exotic and invasive species). In addition, many species that are not necessarily abundant in the region will increase in abundance because of more favourable habitat conditions being created because of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply changes in the faunal component that occupies the habitat.

If left unmitigated, this risk will result in 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 and plant communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages.

This impact is likely to occur and will be of moderate significance, particularly in areas of sensitive habitat types, including natural grassland, rivers and ridges. The EIA will assess the extent of areas affected by this impact and will guide mitigation measures in order to minimize the severity of servitude maintenance activities.

10.2.5 INDIRECT - Faunal Interactions with Structures, Servitudes & Personnel

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. While the structures are usually visible because of clearance around tower footprints, injuries and death of animals do occur sporadically because of accidental contact. Large mammals are mostly prone to this type of impact. The only types of large animal that are likely to occur in these parts are domestic cows.

Alteration of habitat conditions within the servitudes does not necessarily imply a decrease in faunal habitation. These areas are frequently preferred by certain fauna species. The establishment of a dominant grass layer generally results in increased presence of grazer species, which might lead to an unlikely, but similar increase in predation within these areas.

The presence of personnel within the servitude during construction and maintenance periods will inevitably result in contact with animals. While most of the larger animal species are likely to move away from human contact, dangerous encounters with snakes and scorpions. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, road kills, poisoning, trapping, etc.

This impact is likely to occur, but is estimated to be of moderate significance. Mitigation measures in this regard are usually effective.

10.2.6 INDIRECT - Impacts on Surrounding Habitat/ Species

Surrounding areas and species present in the direct vicinity of the study area could be affected by indirect impacts resulting from construction and operation activities. These impacts could include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities.

10.2.7 CUMULATIVE – Impact on Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas.

The presence of two major ridge systems within the proposed servitudes is a significant concern in terms of the provincial GDACE Ridges Policy. Impacts relating to the construction and operation of power lines in this sensitive environment are likely to affect the status of these areas adversely and are regarded unacceptable. Mitigation of some of the impacts is possible, but usually at significant costs. Because of the nature of the ridges in the study area, the lines do need to cross at some locality, selecting a suitable crossing point is a significant issue that need to be determined as part of the EIA phase.

10.2.8 CUMULATIVE - Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known, to a large degree, with immediate effect and when these effects become visible, they are normally beyond repair. Linear types of developments affect the migratory success of animals in particular.

10.2.9 CUMULATIVE - Increase in Environmental Degradation

Impacts associated with this type of development that would lead to initial, incremental or augmentation of existing types of environmental degradation include impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

10.3 DISCUSSION

The presence of the Magaliesberg and Daspoort ridges in the southern part of the study area is regarded the most significant impact in terms of the natural environment. Impacts relating to the construction and operation of power lines in a natural environment of this nature are regarded to be of significant nature and extent. Specific comments pertaining to the respective line variants and substations are as follows:

10.3.1 Phoebes Substation

No significant or sensitive natural features are present in the proposed site for Phoebes Substation. The locality is located in close vicinity of an existing substation (Buffalo Substation) and the construction and operation is not foreseen to result in significant impacts on the natural environment.

10.3.2 Kwagga Substation

The extension of the existing Kwagga Substation is not foreseen to result in significant impacts on the natural environment. The proposed location is located in a generally degraded and transformed area and no sensitive biological elements are expected to occur in these parts.

10.3.3 Line Variant KP_Route 1

Some sensitive natural elements are present within this proposed line variant; except for the ridge systems in the southern part; it is possible to avoid most of these sensitive areas by means of local deviations or recommended re-alignment. In particular, a localised Class 1 ridge is present in the northern part of this line variant; a local deviation towards the east is recommended to avoid impact on this ridge system. It is recommended to align the servitude parallel to the road for this section.

10.3.4 Line Variant KP_Route 2

This line variant is not regarded a suitable option because of the number of river crossings that will be involved. Much of the alignment runs parallel to perennial rivers and the impacts associated with this line variant is regarded significant. Other, more acceptable options are available.

10.3.5 Line Variant KP_Route 3

This line variant is not regarded a suitable option because of a ridge crossing. Although Line Variant KP_1 also involves a ridge crossing, less area will be affected.

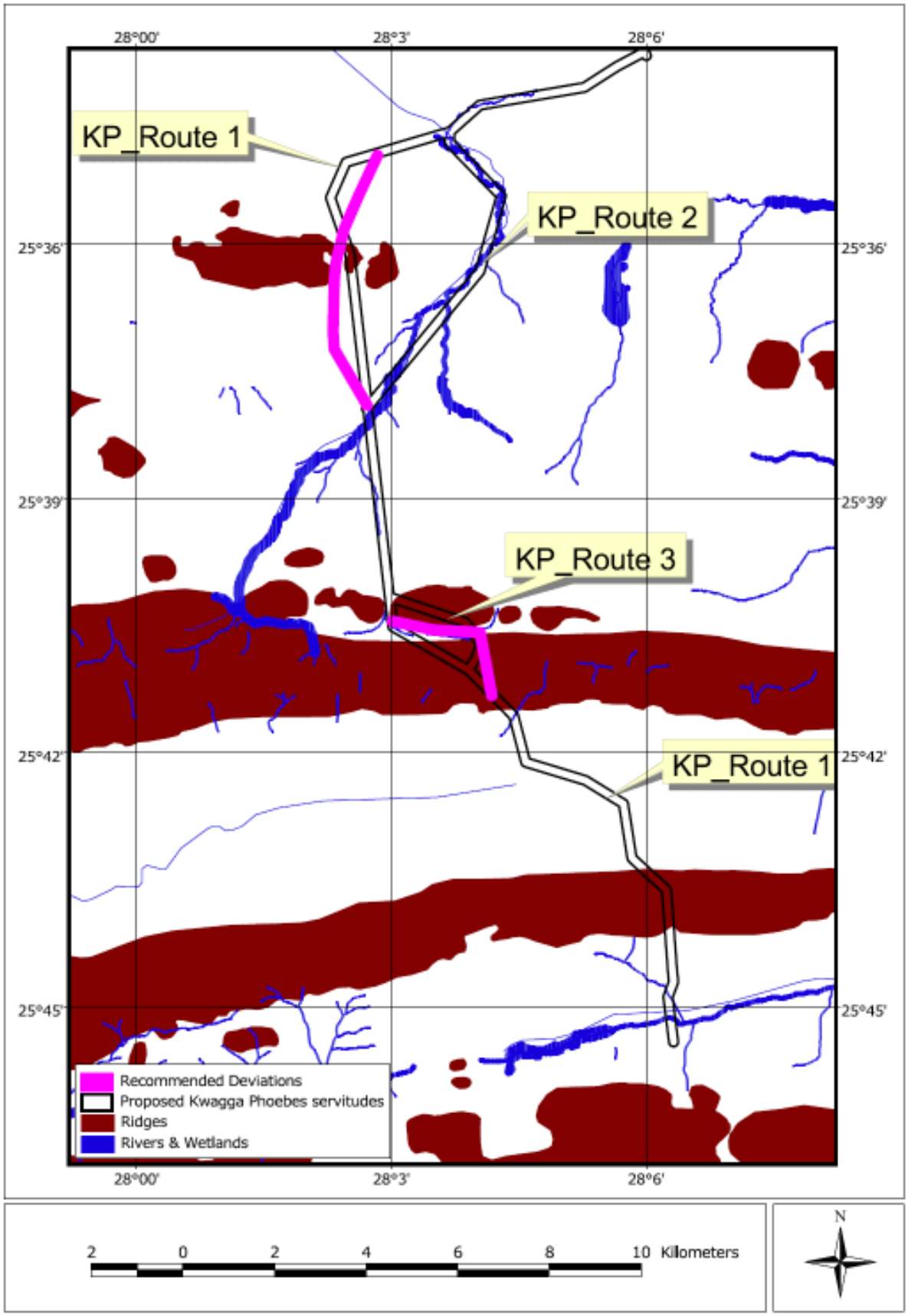
10.4 RECOMMENDATIONS

The use of Line Variants KP_2 and KP_3 is not recommended. Localised deviations should be implemented in order to avoid significant impacts on particularly ridge systems in the area. The location of the substations north and south of the ridges and the east west orientation of these features makes the recommendation of alternative alignments that will avoid these features altogether impossible. Therefore, short of exercising the No-Go option, it is recommended that an extensive route selection exercise be conducted as part of the EIA investigation in order to:

- Select areas where existing infrastructure are already in place, thereby minimising the cumulative impact in the region;
- Recommend site specific and significant mitigation measures in order to prevent any potential long-term adverse impacts within the servitudes; and
- Investigate any potential crossing points in the immediate vicinity of the proposed servitude that could be considered suitable in terms of minimising potential impacts on the ridge systems.

Recommended deviations to the proposed line variants are are presented in Figure 11.

Figure 11: Recommendation deviations



II EIA RECOMMENDATIONS

GDACE Guidelines for Biodiversity Investigations in Gauteng will be implemented for the investigations during the EIA phase. New environmental regulations pertaining to minimum requirements for biodiversity assessments require the following: "*Full surveys on all biodiversity data and mitigation measures to manage the impact on these living systems.*" In order to compile detailed knowledge of the biodiversity of the study area the following aspects should be included as part of the EIA investigation.

II.1 FLORISTIC INVESTIGATION

- Map the location and extent of all plant communities, indicating size and ecological sensitivity, areas of disturbance, surrounding land use, etc;
- A list of potential Threatened Plant Species that occur in the area;
- Conduct flora surveys during the growing season of all species that may potentially occur (this may require more than one season's survey in order to identify flowering species) with two visits undertaken (November and February). Visits undertaken during other seasons will be determined by the flowering and fruiting times of species that do not occur during the summer;
- Supply comprehensive plant species lists;
- Identify plant species that may be of conservation importance down to species level;
- Provide locality, date surveyed, GPS location, spatial resolution and distribution, including actual numbers, of plant species that may be of conservation importance;
- Provide a list of alien plant species occurring on the property, considering eradication programmes of alien vegetation; and
- Provide relocation plants for plants of conservation importance. These species may include:
    - Species endemic to the province;
    - Red Data listed plants; and
    - Protected plants.

II.2 FAUNAL INVESTIGATION

- Obtain all relevant Red Data faunal information;
- Provide a list of all potential species. The following should be highlighted for Threatened species:
    - International Red Data status;
    - National Red Data status;
    - Endemic status of each species; and
- A full survey to determine species richness should be carried out. The time of the survey should depend on the activity patterns of species;

- The survey area should not be restricted to the site, but should include all habitat types over the entire property as well as adjacent areas;
- Provide a list of all species recorded during the survey;
- Provide maps indicating the following:
  - Areas already disturbed;
  - Proposed development and size;
  - Surrounding land use on neighbouring properties; and
  - Location of important species as well as roosting and hibernation sites;
- A list of threatened species that occur on the potential list, but not found during the site surveys; and
- A list of exotic/ introduced/ vertebrate species occurring on the property.

II.3 IMPACT ASSESSMENT

In addition to these, the effect of expected or likely impacts on the biological environment should be determined by compilation of an EIA that consider the following aspects:

- the relationship of potential impacts to temporal scales;
- the relationship of potential impacts to spatial scales;
- the severity of potential impacts;
- the risk or likelihood of potential impacts occurring; and
- the degree of confidence placed in the assessment of potential impacts.

This should be done in a holistic manner, considering both the floristic and faunal environment. Cumulative impacts should also be assessed on a regional scale.

12 PHOTOGRAPHIC RECORDS

Photo 1: Example of grassland habitat at the proposed Phoebes Substation site

Photo 2: Example of degradation in vicinity of perennial rivers in northern part of study area

Photo 3: Example of natural woodland habitat

Photo 4: Example of rocky outcrops (Ridge habitat)

Photo 5: Example of moderately pristine perennial river

Photo 6: Example of ridge habitat type

Photo 7: Example of environment at Kwagga Substation