SPECIALIST ECOLOGICAL ASSESSMENT FOR THE PROPOSED NEW 132kV LINE FROM LYDENBURG SUBTATION to MERENSKY SUBSTATION, NORTHERN REGION; MPUMALANGA & LIMPOPO PROVINCE

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1. BACKGROUND INFORMATION

Eskom Distribution is responsible for providing a high quality supply of electricity to meet the ever increasing needs of its end users. As a result, its infrastructure of power lines and substations are continuingly being established and expanded upon to support annual load growth. Eskom is planning to build a new approximately 55 km 132kV distribution line from the existing Lydenburg Substation situated adjacvent to the R37 within the outskirts of Lydenburg to the existing Merensky substation situated adjacent to the R555 near Steelpoort..

Eskom Holdings Limited has, in line with the EIA Regulations, appointed Royal HaskoningDHV (formerly SSI Engineers and Environmental Consultants) as the independent consultant to undertake the Environmental Authorization for the proposed Lydenburg-Merensky 132kV power line located in the Mpumalanga and Limpopo Provinces. Royal HaskoningDHV has appointed Mr C.L. Cook to undertake an ecological habitat assessment as well as faunal habitat assessment to investigate the potential animal (mammals, reptiles and amphibians) related impacts associated with the construction and operation of the proposed Lydenburg-Merensky 132kV power line.

Six alternatives alignments were proposed for the new 132kV distribution lines between the Lydenburg and Merensky substations. It must be stressed that due to time as well as financial constraints no comprehensive vegetation or faunal surveys were conducted; but merely a brief assessment of the current ecological status of the proposed three alternative powerline alignments. By surveying the proposed alignments as well as immediate habitats adjacent to the proposed alignments for specialised habitats, as well as the remaining vegetation and specific habitats, one can make an assumption of the possible presence or absence of threatened plant and animal species. The survey was supplemented by literature investigations; personal records, historic data and previous surveys conducted in the Lydenburg-Steelpoort-Burgesrfort areas as well as in similar habitats from 1997-2015.

1.1 OBJECTIVES OF THE ECOLOGICALSURVEY/ HABITAT ASSESSMENT

- To provide a basic description of the fauna and vegetation occurring along the proposed six alternative Lydenburg-Merensky 132kV distribution powerline alignments. List the prominent plant species (trees, shrubs, grasses and other herbaceous species of special interest) present for vegetation unit and ecosystem delimitation.
- To identify plant and animal/faunal species (mammals, birds reptiles, amphibians) of conservation importance; which could possibly occur along the proposed Lydenburg-Merensky 132kV six alternative alignments.
- To describe the available habitats on the six Lydenburg-Merensky 132kV powerline alignments including areas of important conservation value or areas most likely to form important habitat for remaining threatened plant and animal species.
- To determine potential impacts of the development on the vegetation as well as associated fauna occurring along the proposed Lydenburg-Merensky 132kV powerline alignments.
- To provide management recommendations to mitigate negative and enhance potential positive impacts of the Lydenburg-Merensky 132kV distribution line.

1.2 SCOPE OF STUDY

- A preliminary mammal, reptile and amphibian survey recording sightings and/or evidence of existing fauna and vegetation communities.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened animal species (Red Data Species), occurring or likely to occur within the proposed Lydenburg-Merensky 132kV powerline alignment and immediate adjacent areas.
- To rank the six alternative Lydenburg-Merensky 132kV powerline alignments from an ecological perspective and select proposed alignment with least potential environmental impacts on associated vegetation and fauna.
- Identification of potential ecological impacts that could occur as a result of the new Lydenburg-Merensky 132kV distribution line and assess the significance of these, where possible.
- Investigate feasible and practical management recommendations that should be implemented to reduce or minimize the impacts, should the project be approved.
- Documentation of the findings of the study in a report.

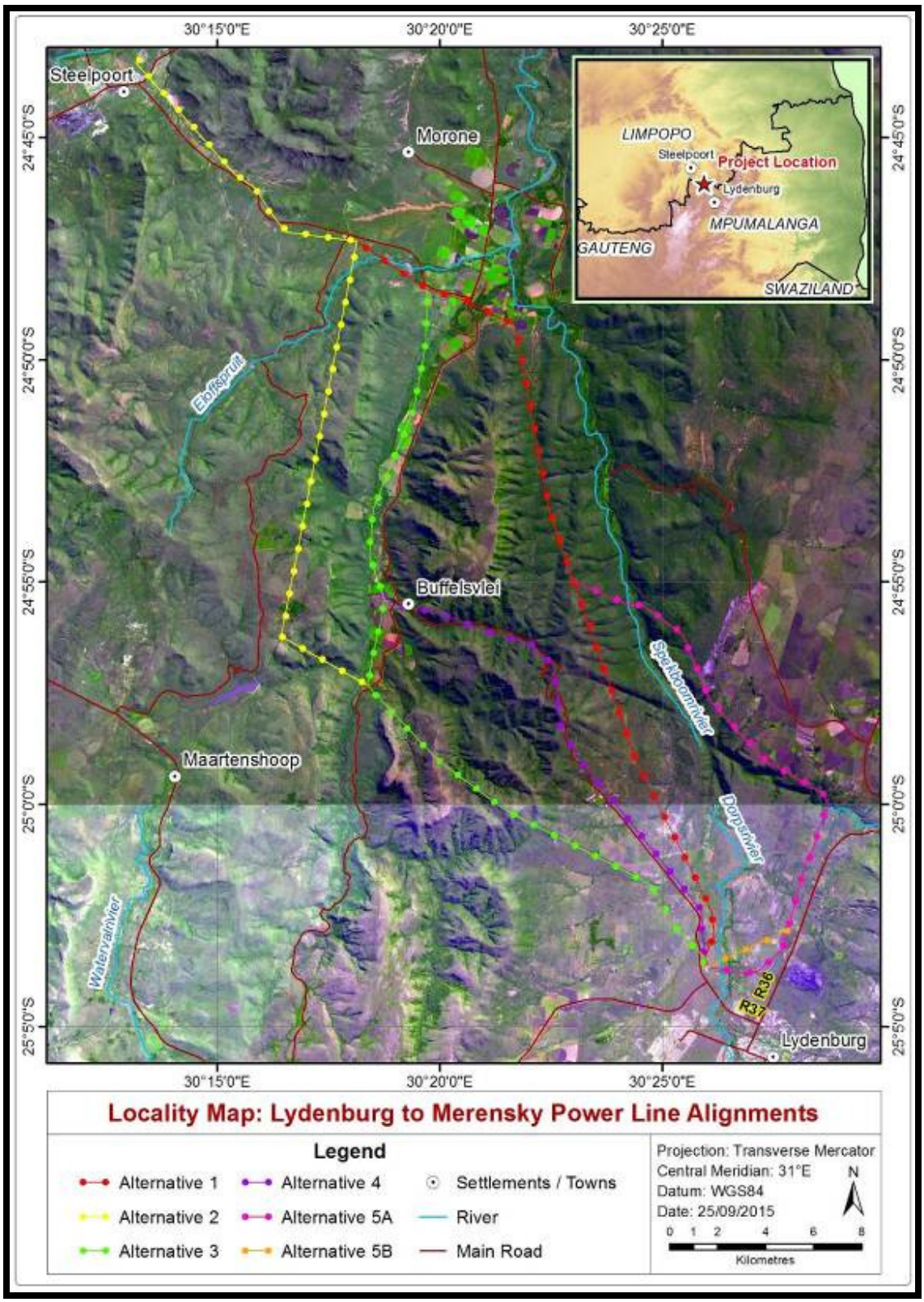

Figure2. Locality map of the proposed Lydenburg-Merensky 132kV distribution lines.

2. METHODOLOGY

2.1 Predictive methods

A 1:50 000 map of the study area was provided showing existing infrastructure and the proposed three alternative alignments. This was used as far as possible in order to identify potential "hot-spots" along the corridors, e.g. Patches of undisturbed Lydenburg Montane Grassland, Lydenburg Thornveld, Ohrigstad Montain Bushveld, Sekhukhune Mountain Plains Bushveld, Subtropical Freshwater wetlands within the flood benches of the Waterval River a tributary of the Spekboom River, the Steelpoort and adjacent mountain ranges, ridges, river crossings, wetlands (valley bottoms, pans/depressions and hillslope seeps) and dams and agricultural areas. Satellite imagery of the area was obtained from Google Earth was studied in order to get a three dimensional impression of the topography and land use.

2.2 Literature Survey

A detailed literature search was undertaken to assess the current status of threatened fauna that have been historically known to occur in the study area for the 2430 DA, 2430 DB and 2530 AB quarter degree grid cells (or 1: 50 000 map unit), within which the three alternative alignments are located. The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al,* 2009). *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) and ADU's MammalMap (http://vmus.adu.org.za/vm_sp_list.php for mammals. The *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter *et al.* 2004) and ADU's FrogMAP and South African Frog Atlas (SAFAP) data http://sarca.adu.org.za for amphibians. The *Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book-Reptiles and Amphibians* (Branch 1988) and South African Reptile Conservation Assessment (SARCA) http://sarca.adu.org.za for reptiles.

2.3 Site Investigation Methodology

A preliminary assessment of the status, spatial requirements and habitat preferences of all priority species along the proposed Lydenburg-Merensky 132kV powerline as well as potential threats was conducted. For certain faunal species, an estimate of the expected or historical distribution for the area could be extrapolated from published information and unpublished reports, while habitat and spatial requirements were generally derived from the literature. For other species, little of this information was readily available and conservation targets remain speculative. Species assessments will be updated when additional data becomes available and where appropriate, proposed conservation targets will be revised.

Two general habitat sensitivity scan was carried out on the 15th-19th of April 2013 as well as an additional survey of alternative alignments conducted between the 15-16th of September 2015. These preliminary site visits did not entail intensive surveying or utilisation of any specialised sampling methods and can rather be viewed as being an opportunity to identify sensitive habitats occurring along the proposed three alternative Lydenburg-Merensky 132kV powerline alignments. Due to severe time constraints as well as accessibility of alignment 1 and 2 (no formal access roads, private fenced off lands, gradients of mountains) the focus on the lower lying sections of alternative 2. The majority of the alternative alignment 3 was accessible besides the privately fenced off areas along the Sterkfontein River (south of Steelpoort within Sehkukune Mountain Bushveld). The majority of alternative alignments 4 and 5 were accessible via existing access roads although certain sections were situated within fenced off private properties which restricted the access.

All animals (mammals (larger), reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings) to identify animals. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, personal records and historic data. Different habitats were explored to identify any sensitive or specialized species. The proposed Lydenburg-Merensky alignments bisect the following vegetation units **Lydenburg Montane Grassland (Gm 18), Lydenburg Thornveld (Gm 21), Ohrigstad Mountain Bushveld (SVcb 26), Sehkhukhune Mountain Grassland (Gm 19), Sekhukhune Mountain Bushveld (SVcb 28), Sekhukhune Plains Bushveld (SVcb 27)** and **Subtropical Freshwater Wetlands (Azf 6)** within the flood benches of the Waterval River a tributary of the Spekboom River as well as scattered seasonally inundated pans or depressions**.** The vegetation is in various forms of transformation and degradation (overgrazing, wood

harvesting, frequent fires, alien vegetation invasion) with large areas displaying a natural species composition especially within the higher lying mountain plateaus as well as steep hillslopes and wooded valley bottoms. The proposed powerline alignments bisect the Marambane and the Jood se Loop Rivers which are tributaries of the Dorps River. The Waterval River and the Elof Spruit which are tributaries of the Spekboom River and the Sterkfontein River which is a tributary of the Steelopoort River.

Mammal names are as used by Skinner and Chimimba (2005), reptile names by Branch (1998) and Alexander and Marais (2007) and amphibian names by Passmore and Carruthers (1995) and Minter *et.al.* (2004)

2.4 Uncertainties in predicting results

- Limitation to a base-line ecological survey for only 4 days (40 hours) during the late summer months (April).
- The majority of threatened plant species are extremely seasonal only flowering at specific times during the summer months (November-March). No. specialist vegetation surveys have been conducted.
- Some of the more rare and cryptic plant species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the field) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could therefore increase the chances to record a larger portion of the total species complex associated with the area.
- The majority of threatened faunal species are extremely secretive and difficult to observe even during intensive field surveys conducted over several seasons/ years. No specialist faunal surveys have been conducted.
- The presence of threatened species on site is assessed mainly on habitat availability and suitability as well as desk research (literature, personal records) and previous surveys conducted in similar habitats between 1997-2013.
- As large portions of the proposed alignments are situated on private lands, which are fenced, access is limited especially during nocturnal surveys. Access was restricted within the steep mountainous areas around Lydenburg as well as the Steelpoort range (Olifantspoort).
- The majority of the red data atlases are outdated as well as inadequate coverage of some areas by the atlases (SAFAP, SARCA).

2.5 Gaps in the baseline data

- The proposed alignments bisect the Lydenburg as well as Sekhukuneland/Steelpoort Centres of Endemism which harbour a vast range of habitats with limited habitat destruction and degradation and still harbours high plant diversity with many endemics, many of which still await formal description (Siebert et al. 2001). Several red listed plant and tree species have been recorded from the area.
- The proposed alignments bisect several mountain ranges, rivers, bushveld and grassland habitats whith diverse habitats for several faunal species. High diversity of fauna especially reptiles (99 species) and amphibians (39).
- Little long-term, verified data of faunal species distribution on micro-habitat level along the proposed powerline alignments.
- Little long-term, verified data on impacts of existing lines in the study area on fauna.

3. Vegetation and Faunal habitat Availability

Vegetation structure is generally accepted to be more critical in determining faunal habitat than actual plant composition. Therefore, the description of vegetation presented in this study concentrates on factors relevant to faunal species abundance and distribution, and does not give an exhaustive list of plant species which occur in the study area. No comprehensive vegetation or faunal surveys were conducted due to timing of survey (late summer months) as well as financial constraints and faunal species lists provided in the Appendix are of species most likely to occur on the site using habitat as an indicator of species presence. The study area falls within the 2430 DA, 2430 DB and 2530 AB quarter degree grid cells. Vegetation composition in these two grid cells consists of **Lydenburg Montane Grassland (Gm 18)**, **Lydenburg Thornveld (Gm 21)**, **Ohrigstad Mountain Bushveld (SVcb 26)**, **Sehkhukhune Mountain Grassland (Gm 19)**, **Sekhukhune Mountain Bushveld (SVcb 28), Sekhukhune Plains Bushveld (SVcb 27)** and **Subtropical Freshwater Wetlands (AZ f6)** within the flood benches of the Waterval River a tributary of the Spekboom River, (Mucina & Rutherford 2006).

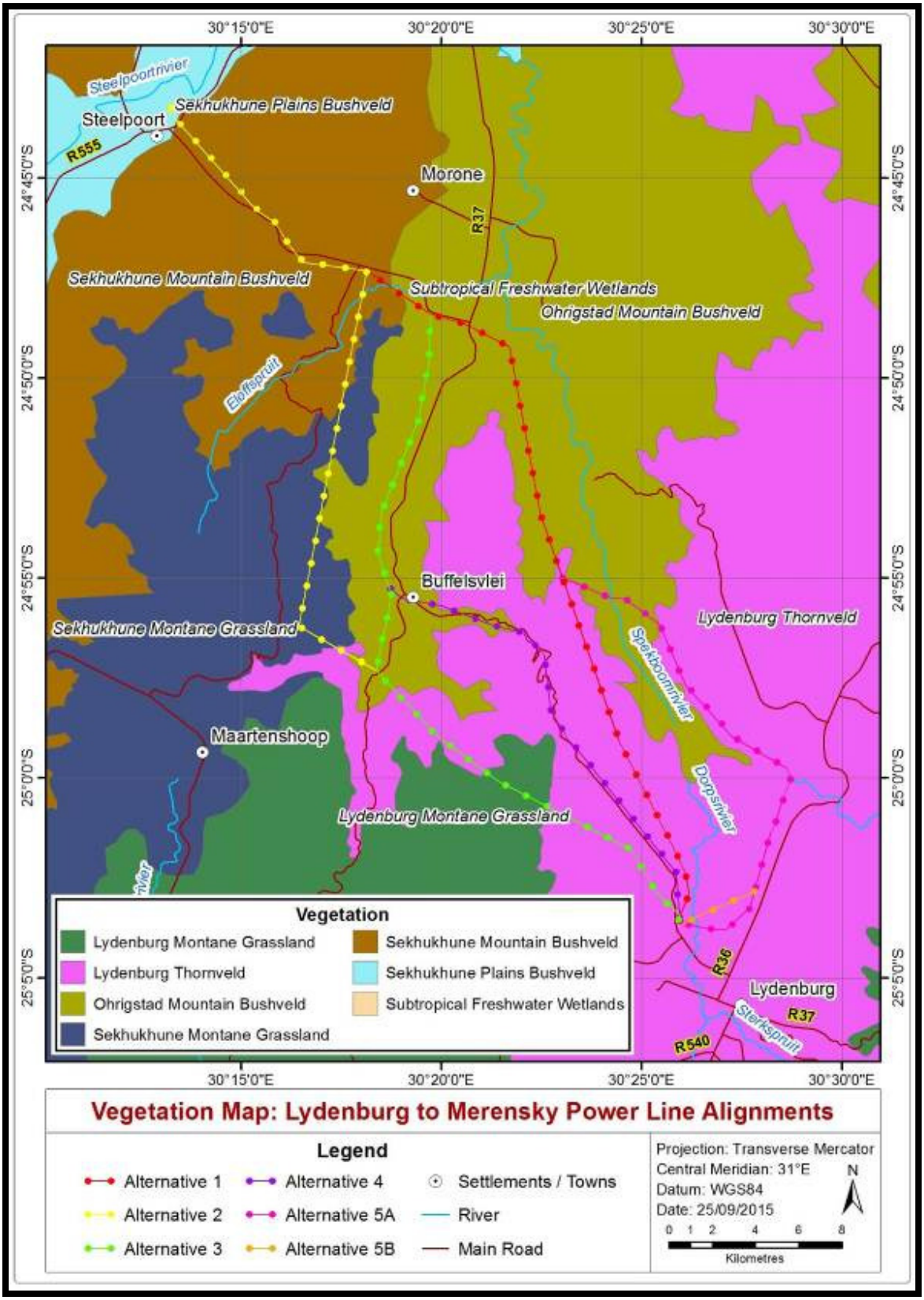

Figure3. Vegetation units observed along the proposed Lydenburg-Merensky 132kV powerline alignments (adapted from Mucina *et al.* 2006).

3.2 Lydenburg Montane Grassland (Gm 18)

Previously known as **North-Eastern Sandy Highveld** (53%) (Acocks 1953) and (LR 43) **North-eastern Mountain Grassland** (73%) (Low & Rebelo 1996).

Distribution in Mpumalanga Province:

From just above Pilgrim's Rest in the north, southwards and westwards skirting Lydenburg, extending to Dullstroom, to Belfast and Waterval Boven in the south. It includes both the Steenkampsberg and Mauchsberg (Mucina & Rutherford 2006).

Altitude 1 260-2 160 m.

Vegetation Type	Lydenburg Montane Grassland (Gm 18)	**Tree cover**	0-40 %
Soil	Mispah and Glenrosa soil forms.	**Shrub cover**	0-50 %
Topography	Plateau	**Herb cover**	0-40 %
Land use	Agricultural lands and Livestock (Cattle) grazing activities	**Grass cover**	0-90 %
Dominant Tree Species	*Vachellia karroo, Senegalia caffra, Protea caffra, Faurea galpinii, Cussonia transvaalensis, Cussonia paniculata, Searsia pyroides, Celtis africana, Combretum erythrophyllum, Dombeya rotundifolia*		

Dominant Shrub Species	*Diospyros lycoides, Gnidia caffra, Leucosidea serícea, Lopholaena disticha, Euclea crispa subsp. crispa, Rhemnus prinoides, Senecio microglossus, Lippia javanica, Seneghalia* (*Acacia*) *ataxacantha, Dichrostachys cinerea,*
Dominant Grass spp.	*Aristida canescens, Aristida congesta, junciformis, Cymbopogon caesius, Dihetropogon amplectens, Heteropogon contortus, Themeda triandra, Hyparrhenia hirta, Cynodon dactylon, Panicum natalensis, Panicum maximum, Melinis repens, Setaria sphacelata, Digitaria sanguinalis, Eragrostis curvula, Eragrostis racemosa*
Dominant Herb spp.	*Chamaesyce inaequilatera, Commelina erecta, Crotalaria lotoides, Hermannia depressa, Mariscus congestus, Pavonia burchellii, Pollichia campestris, Pseudognaphalium luteo-album, Rhynchosia totta, Schkuhria pinnata, Senecio microglossus, Senecio venosus, Monopsis decipiens, Gladiolus sp., Wahlenbergia undulata, Pelargonium luridum, Haplocarpha scaposa, Helichrysum nudifolium, H. rugulosum, Merremia tridentata, Dicerocaryum eriocarpum, Rubus sp., Asclepias fruticosa, Helichrysum rugilosum, Hypoxis rigidula var. pilosissima, Aloe greatheadii var. davyana, Lantana rugosum; Ipomoea spp Achyranthes aspera, Bidens bipinnata, Chamaecrista mimosoides, Sida alba, Sonchus wilmsii, Tephrosia macrocarpa, Verbena brasiliensis*
Alien Invasive Species	*Acacia mearnsii*, Populus x canescens, Eucalyptus grandis*, Ipomoea alba*, Ipomoea indica*, Ipomoea purpurea*, Lantana camara*, Melia azedarach*, Jacaranda mimosifolia*, Morus alba*, Ricinus communis*, Rubus rigidus*, Robinia pseudoacacia*, Solanum mauritianum**
Red Data Species	None observed although summits and plateaus comprises suitable habitat for several red listed species (see attached list 2530 AB)

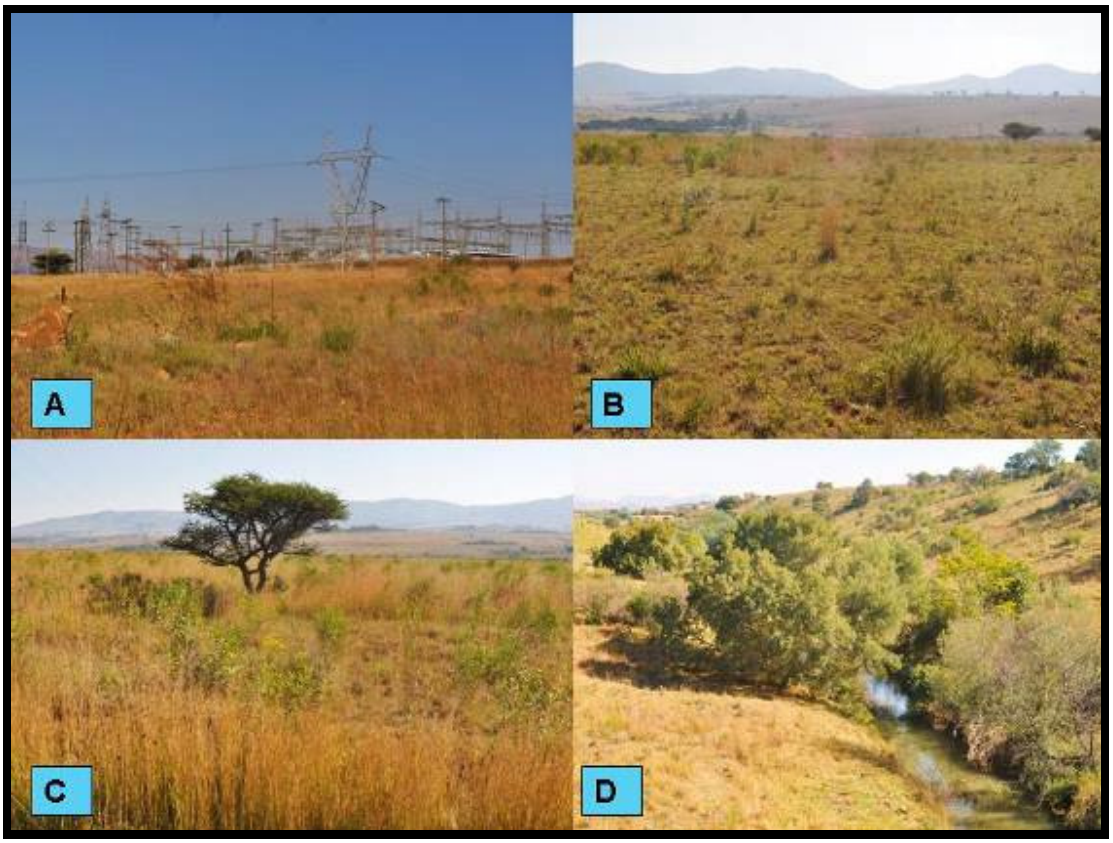

Figure4. A collage of photographs displaying the habitats observed within Lydenburg Thornveld vegetation unit. A: The Lydenburg substation is situated immediately adjacent to the R37 within Lydenburg Thornveld vegetation. The grasslands around the substation have become severely degraded as well as transformed due to present and historic agricultural practices. **B:** The grasslands on the mid and lower slopes to the north of the substation have been heavily impacted on by historic and current agricultural activities and comprise mainly of degraded (heavily overgrazed, frequent fires) as well as secondary succession *Aristida junciformis, Eragrostis curvula, Cymbopogon excavatus* grasslands**. B:** *Vachellia karroo* has invaded the disturbed areas as well as along drainage areas. Dense patches of the anthropogenic grass *Hyparrhenia hirta* occur within disturbed areas as well as along road reserves. **D:** The tree and shrub layer increases along the Marabane River with several large *Combretum erythrophyllum, Celtis africana, Senegalia caffra* as well as fire-protected ridges and gullies. Medium-High infestations of alien invasive vegetation (*Acacia mearnsii*, Populus alba* var. *alba*, *Melia azedarach*, Morus alba*, Cotoneaster spp.*) were observed especially along the rivers (Marabane and Jood Se Loop) and several seasonal or non-perennial drainage lines.

Vegetation & Landscape Features

High-altitude plateaus, undulating plains, mountain peaks and slopes, hills and deep valleys of the Northern Escarpment region, supporting predominantly very low grasslands on the high-lying areas. Height of the grass sward increases on the lower slopes. The grassland is very rich in forb species (Mucina & Rutherford 2006). The vegetation within the mid and lower slopes of the proposed alternative alignment 3 has been heavily impacted on by surrounding anthropogenic activities including (old lands) and degraded overgrazed grasslands. The woody vegetation within protected rocky outcrops and drianage lines are dominated by the tall shrub *Diospyros lycioides* ssp. *Guerkei*, *Euclea crispa* subsp. *crispa* and the trees *Vachellia karroo* and *Senegalia caffra,* while the herbaceous layer is dominated by the tall grass *Hyparrhenia tamba.* Other species also present include *Diospyros whyteana, Searsia pyroides, Panicum maximum, Themeda triandra, Chamaecrista mimmosoides, Achyranthes sicula,* and *Senecio microglossus.* Extensive livestock grazing, altered fire regimes and alien vegetation invasion has altered the natural species composition (low in forb species). The majority of the proposed alignment bisects secondary succession grasslands although primary montane grassland occurs on the upper slopes and crescent of the higher-lying mountains on the Farms Boomplaat 24 JT and Vroegenoeg 22 JT.

Geology & Soils

The soils are mostly derived from shale and quartzite as well as lavas and dolomites of the Pretoria Group of the Transvaal Supergroup (Vaalian Erathem). Land types Ac and Fa cover areas of approximately equal size (Mucina & Rutherford 2006).

Climate

Orographic precipitation and mists throughout most months of the year support a unique flora, including rich mesophytic plants such as the Orchidaceae. MAP 858 mm (660-1 180 mm), augmented by the frequent mists. Frost days 21 days per year, varying greatly between 3 and 40, generally more frost to the west (Mucina & Rutherford 2006).

Conservation

Lydenburg Montane Grassland is classified as **Vulnerable**. The conservation target is 27%, with 2.4% formally protected within reserves (Gustav Klingbiel. Makobulaan, Mt Anderson, Ohrigstad Dam. Sterkspruit and Verlorenvlei) as well as in a number of private conservation areas (Buffelskoof, Crane Creek, mc, In-de-Diepte, Kaalboom, Kalmoesfontein. Mbesan. Mondi Indigenous Forest. Mt Sheba: Waterval etc.). The level of transformation is relatively high at 23% with mostly alien plantations (20%) and cultivated lands (2%). Erosion potential very low (74%) and low (12%) (Mucina & Rutherford 2006).

3.3 Lydenburg Thornveld (Gm 21)

Vegetation Type	Lydenburg Thornveld (Gm 21)	**Tree cover**	0-40 %
Soil	Mispah, Glenrosa or Hutton soil forms. Red Clay soils as well a sandy-clay loams	**Shrub cover**	0-50 %
Topography	Plateau	**Herb cover**	0-40 %
Land use	Agricultural lands and Livestock (Cattle) grazing activities	**Grass cover**	0-90 %
Dominant Tree Species	*Vachellia robusta* subsp. *robusta, Vachellia karroo, Senegalia caffra, Cussonia transvaalensis, Searsia pyroides, Celtis africana, Combretum erythrophyllum, Dombeya rotundifolia*		
Dominant Shrub Species	*Diospyros lycoides subsp. guerkei, Euclea crispa subsp. crispa, Rhemnus prinoides,Senecio microglossus, Lippia javanica, Acacia ataxacantha, Dichrostachys cinerea, Euphorbia clavariodes*		
Dominant Grass spp.	*Aristida canescens, Aristida congesta, junciformis, Cymbopogon caesius, Dihetropogon amplectens, Heteropogon contortus, Themeda triandra, Hyparrhenia hirta, Cynodon dactylon, Panicum natalensis, Panicum maximum, Melinis repens, Setaria sphacelata, Digitaria sanguinalis, Eragrostis curvula, Eragrostis racemosa*		

Dominant Herb spp.	*Acanthospermum rigidum, Achyranthes aspera var. sicula, Conyza bonariensis, Crotalaria lotoides, Cyperus esculentus, Mariscus congestus, Pseudognaphalium luteo-album, Richardia brasiliensis, Solanum panduriforme, Sonchus wilmsii, Tagetes minuta, Verbena bonariensis, Wahlenbergia caledonica, Nidorella hottentotica, Vernonia oligocephala, Zornea milneana, Senecio inornatus, Merremia tridentata, Dicerocaryum eriocarpum, Rubus sp., Asclepias fruticosa, Helichrysum rugilosum, Hypoxis rigidula var. pilosissima, Aloe greatheadii var. davyana, Lantana rugosum; Ipomoea spp*
Alien Invasive Species	*Acacia mearnsii*, Opuntia ficus-indica*, Cotoneaster pannosus*, Cotoneaster franchetii*, Populus x canescens, Eucalyptus grandis*, Ipomoea alba*, Ipomoea indica*, Ipomoea purpurea*, Lantana camara*, Melia azedarach*, Jacaranda mimosifolia*, Morus alba*, Ricinus communis*, Robinia pseudoacacia*, Solanum mauritianum**
Red Data Species	*Hypoxis hemerocallidea*[*] and suitable habitat for several red listed species within primary thornveld and grassland

The vegetation unit situated around the Lydenburg substation comprises of **Lydenburg Thornveld (Gm 21)** (Mucina & Rutherford 2006) previously classified **as North-eastern Mountain Sourveld** (Acocks 1953) and **North-Eastern Mountain Grassland** (Low & Rebelo 1996).

Distribution

Situated in a broad band between the high-lying mountains from just north of Ohrigstad, tapering southwards through Lydenburg to as far south as the area in the vicinity of the Kwena Dam. Lydenburg Montane Grassland (Gm18) occurs in the eastern section of the Gustav Klingbiel Nature Reserve (Mucina *et al.* 2006).

Altitude

Altitude varies between 1 160 -1 660 m; altitude on site 1 442m.

[*] A taxon is 'Declining' when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

Figure5. A collage of photographs displaying dominant vegetation within the Lydenburg Thornveld alignments. A: The alignments bisect Lydenburg Thornveld in various stages of transformation and degradation. Patches of open and closed Acacia karroo-Acacia caffra woodland occur around the proposed alignment 3 and 1 within the midslopes, rocky areas, rivers and drainage lines. **B:** Large portions comprises of dense anthropogenic grasses *Hyparrhenia hirta, Hyparrhenia filipendula* and *Hyparrhenia tamba*. **C:** The vegetation in the fallow or old agricultural lands are dominated by the secondary successional grass *Eragrostis curvula* and *Cymbopogon excavatus.* Other species that are prominent locally include the forbs *Nidorella hottentotica, Vernonia oligocephala, Zornea milneana,* and *Senecio inornatus.* **D:** The riparian vegetation along the Jood se Loop River is dominated by *Combretum erythrophyllum*, *Celtis africana* as well as alien invasive species including *Acacia mearnsii*, Melia azedarach** as well as dense patches of *Populus alba* var. *alba**

Vegetation & Landscape Features

This vegetation unit occurs at lower levels at the foot of the mountains and on undulating plains. This is open, frost-hardy woodland. Structurally this unit comprises closed grassland which is almost always wooded, sometimes densely so in rocky areas and less so in frost-ridden valleys where *Vachellia karroo* is still able to persist. Many woody plants have evolved a suffrutex habit (*Argyrolobium wilmsii*), where aerial parts die back to an underground rootstock during cold winters. It is a transition zone between the high-lying grasslands and the warmer and drier bushveld areas. The vegetation along the proposed alignment 3 has been impacted on by historic as well as current agricultural activities. Large sections of alignment 1 comprise of fallow lands or secondary succession *Hyparrhenia hirta, H. tamba*, *Eragrostis curvula* and *Cymbopogon excavatus* grasslands. Other species that are prominent locally include the grasses *Heteropogon contortus, Hyparrhenia filipendula,* and the forbs *Nidorella hottentotica, Solanum* panduriforme, *Vernonia oligocephala, Zornea milneana,* and *Senecio inornatus.* The geophytic herb *Hypoxis rigidula* var. *polossisima* was locally abundant. The alignment 3 displays a more natural species composition although the grasslands have been impacted on by livestock (cattle) grazing activities, soil erosion and alien vegetation invasion. Alien invasive vegetation was observed between medium and high infestations; especially within the riparian zones of the Jood se Loop River. Several Red listed 'declining' *Hypoyxis hemerocallidea* were observed scattered within the grasslands.

Geology & Soils

Red clay soils mostly derived from shales of the Pretoria Group (including the Silverton and Timeball Hill Formations). Shales occasionally intersected with bands of quartzite or andesite. Land types Ba, Fa, Ib and Ae, with predominantly Mispah, Glenrosa or Hutton soil forms (Mucina *et al.* 2006).

Climate

This unit occurs in the rain-shadow of the Escarpment, where the climate is much drier and the winters are very cold (MAT 16°C). The rainfall is generally lower than in surrounding areas since it falls within a rain-shadow. Rainfall varies between 580-810 mm with a Mean Annual Precipitation (MAP) of 707 mm. Most of this unit experiences fairly infrequent frost (Mucina *et al.* 2006).

CONSERVATION

Lydenburg Thornveld is currently listed as **Vulnerable**. The conservation target is 27% and 2% is protected (Gustav Klingbiel and Ohrigstad Dam Nature Reserves). A total of 22% of this unit has been transformed mainly by dryland and irrigated cultivation. Rainfall is generally too low for aforestation or plantations. Erosion from very low (45%), low (26%) and moderate (18%) (Mucina & Rutherford 2006).

3.4 Sekhukhune Montane Grassland (Gm 19)

Vegetation Type	Sekhukhune Montane Grassland (Gm 19)	**Tree cover**	0-20 %
Soil	High-clay content and include Arcadia, Mayo, Milkwood, Mispah, Shortlands ans Steendal	**Shrub cover**	0-10 %
Topography	Mountainous	**Herb cover**	0-40 %
Land use	Livestock (Cattle) grazing activities and eco-tourism	**Grass cover**	0-100 %
Dominant Tree Species	*Senegalia caffra, Protea caffra* subsp. *caffra*, *Apodytes dimidiata* subsp. *dimidiata*, *Cussonia transvaalensis,*		
Dominant Shrub Species	*Diospyros austro-africana, Euclea crispa subsp. crispa, Brachylaaena ilicifolia, Pavetta zeyheri, Searsia discolorLippia javanica, Acacia ataxacantha, Dichrostachys cinerea*		
Dominant Grass spp.	*Aristida junciformis* subsp. *galpinii*,, *Cymbopogon caesius, Dihetropogon amplectens, Heteropogon contortus, Themeda triandra, Hyparrhenia hirta, Cynodon dactylon, Panicum natalensis, Panicum maximum, Melinis repens, Setaria sphacelata, Setaria nigrigrostis, Digitaria sanguinalis, Eragrostis curvula, Eragrostis racemosa*		

Dominant Herb spp.	*Berkheya setifera, Berkheya sp., Helichrysum nudifolium, Ipomoea crassipes, Vernonia natalensis, Xerophyta retinervis, Elephantorrhiza elephantiza, E. praetermissa, Leonotis leeonorus, Hypoxis rigidula var. pilosissima, Aloe greatheadii var. davyana, , Lantana rugosum; Ipomoea* spp
Alien Invasive Species	*Acacia mearnsii*, Populus x canescens, Eucalyptus grandis*, Ipomoea alba*, Ipomoea indica*, Ipomoea purpurea*, Lantana camara*, Melia azedarach*, Jacaranda mimosifolia*, Morus alba*, Ricinus communis*, Robinia pseudoacacia*, Solanum mauritianum**
Red Data Species	*Hypoxis hemerocallidea*, *Aloe cooperi*. Several other red listed species occur in the Roosenekal and Steelpoort subcentres of the Sekhukhuneland CE (Van Wyks & Smith 2001)

The proposed Alternative 2 alignment is situated within a section of mountainous area on the Farms Bergfontein 383 KT and Doornhoek 355 KT comprising of **Sekhukhune Montane Grassland (Gm 19)** (Mucina & Rutherford 2006) previously classified as **Bankenveld (VT 61)** and **North-eastern Sandy Highveld Mountain (VT 57)** (Acocks 1953) and **Mixed Bushveld (LR 18)** (Low & Rebelo 1996).

Distribution

Situated in Mpumalanga Province in a continuous undulating norite hills in the Roosesenekal region from Stoffberg in the south, northwards through Mapochs Gronde to Schurinksberg in the north, with the Steelpoort River in the west (Mucina *et al.* 2006).

Altitude

Altitude varies between 1 300 -1 960 m. The proposed alignment 3 altitude ranges up to 1825m on the Farm Vroegenoeg 22JT.

Vegetation & Landscape Features

Major chains of hills transects the area and have a north-south orientation, creating moderately steep slopes with predominantly eastern and western aspects. Large norite boulders and stones cover the shallow soils on the hillsldes. Dense, sour grassland occur on slopes of mountains and undulating hills, with scattered clumps of trees and shrubs in sheltered and fire protected areas. Turf and clay soils characterize the open plains between the chains of hills. Dense, tall grassland (*Hyparrhenia hirta, Hyparrhenia tamba*) is found on the lower hillslopes and encroachment by indigenous (*Vachellia karroo*) or invasion by alien microphyllous tree species (*Acacia mearnsii**) is common in disturbed places. Alien invasive vegetation was observed especially within the non-perennial drainage lines as well as kloofs. Natural montane grassland vegetation remains on the plateaus and upper slopes of the mountainous areas.

Geology & Soils

The area mostly overlies the mafic intrusive rocks of the Upper Main Zones of the Rustenburg Layered Suite, which is economically the most important part of the Bushveld Igneous Complex (Vaalian Erathem). The west of this area is dominated by diorite and gabbro (often magnetite rich) of the Roossenekal Subsuite, wheras the east is dominated by norite and gabbro of the Dsjate Subsuite. In the extreme north-east of the area are metasediments of the Pretoria Group (also Vaalian Erathem) that were metamorphosed by the intrusion of the Bushveld Igneous Complex. Substrates of the undulating hills are generally heterogenous rocky areas with miscellaneous soil types and those of the southern plain have diagnostic horizons that are vertic, melanic or red-structured. Dominant soil forms have high-clay content and include Arcadia, Mayo, Milkwood, Mispah, Shortlands ans Steendal. Land type dominated by Ea (40%) with minor occurrences of Ib and Ab (Mucina *et al.* 2006).

Climate

This unit experiences similar climate to the adjacent Lydenburg Montane Grassland, although frost incidence decreases towards the north. Summer rainfall regime with the MAP from about 720 mm in the east to 6 00 mm in the west, much of the rain falling in the form of thunderstorms in summer from November to January. Mean daily temperature ranges from a minimum of 2.8°C in winter to a maximum of 24.9°C in summer (Mucina *et al*. 2006).

CONSERVATION

Sekhukhune Montane Grassland is currently listed as **Vulnerable**. The conservation target is 24%. There is no formal conservation in this region, although many farmers have embanked on ecotourism initiatives. Approximately 30% of this area in under commercial or subsistence cultivation. Vast areas are mined for vanadium using strip mining, and in recent years mining of gabbro has increased substantially. Erosion very low (56%), moderate (18%) and high (16%) (Mucina & Rutherford 2006). The proposed alternative 2 alignment is not supported from an ecological perspective (least preferred) as it bisects primary montane grassland, steep gorges and rocky cliffs which harbors suitable habitat for several red listed plant and animal species.

3.5 Ohrigstad Mountain Bushveld (SVcb 21)

Vegetation Type	Ohrigstad Mountain Bushveld (SVcb 26)	**Tree cover**	20-80 %
Soil	Mispah or Glenrosa soil forms. Shallow sandy soils	**Shrub cover**	10-60 %
Topography	Undulating Mountains (Moderate-Steep slopes)	**Herb cover**	0-40 %
Land use	Livestock (Cattle) grazing activities	**Grass cover**	0-90 %
Dominant Tree Species	*Sclerocarya birrea subsp. caffra*[*], *Senegalia caffra, Vachellia exuvialis, Vachellia karroo, Vachelia tortilis* subsp. *hetaracantha, Combretum apicualtum, Combretum molle*, *Kirkia wilmsii, Dombeya rotundifolia, Croton gratissimus, Englerophytum magalismontanum, Terminalia prunoides, Ziziphus mucronata, Euphorbia cooperi, Olea europaea* subsp. *africana, Aloe marlothii*		
Dominant Shrub Species	*Dichrostachys cinerea, Grewia bicolour, Grewia monticola, Euclea crispa , Aloe spp.*		
Dominant Grass spp.	*Aristida canescens, Aristida congesta, junciformis, , Dihetropogon amplectens, Heteropogon contortus, Cynodon dactylon, Panicum maximum, Melinis repens, Setaria sphacelata, Digitaria*		

[*] Protected tree species

	sanguinalis, Eragrostis curvula, Eragrostis racemosa
Dominant Herb spp.	*Merremia tridentata,Clematis brachiata* (climber) *Dicerocaryum eriocarpum, Rubus sp., Asclepias fruticosa, Helichrysum sp., Hypoxis rigidula, Aloe greatheadii var. davyana, Lantana rugosum; Ipomoea* spp
Alien Invasive Species	*Caesalpinia decapetala, Nicotiana glauca*, Ipomoea indica*, Ipomoea purpurea*, Lantana camara*, Melia azedarach*, Jacaranda mimosifolia*, Ricinus communis*, Solanum mauritianum**
Red Data Species	*Hypoxis hemerocallidea*[*] as well as suitable habitat for several other species (see attached red list for 2430 DB)

The vegetation unit situated around the comprises of **Ohrigstad Mountain Bushveld (SVcb 26)** (Mucina & Rutherford 2006) previously classified as **Sourish Mixed Bushveld (VT 19) (44**%) and **Mixed Bushveld (VT 18) (33%)** (Acocks 1953) and **North-eastern Mountain Sourveld** (Acocks 1953) and **North-Eastern Mountain Grassland (LR 43)** (Low & Rebelo 1996).

Distribution

Mountain slopes and steep valleys situated in Mpumalanga and Limpopo Provinces from the Blyde River Canyon, Ohrigstad and Burgersfort in the south continuing in the vicinity of the western side of the escarpment northwards to the Mohlapitse Valley and eastwards along the Strydpoort Mountains as far as Chuniespoort.

Altitude

Altitude varies from around 500 m to about 1 400 m

* The corm is utilised and harvesting is destructive. These plants are used to treat cancer, bladder disorders, insanity and urinary infections (Van Wyk et al. 1997). Mander (1998) records trade in *Hypoxis* spp. in the Durban traditional markets. However, it appears as if trade may be more popular amongst the white South African population, particularly after a popular article was published describing its "magical properties" (Louw 1997). Large quantities of corms are now being harvested and sold nationwide. *Hypoxis* corms were reported to be traded in 66% of the formal muthi shops in the Witwatersrand (Williams *et.al.* 2000).

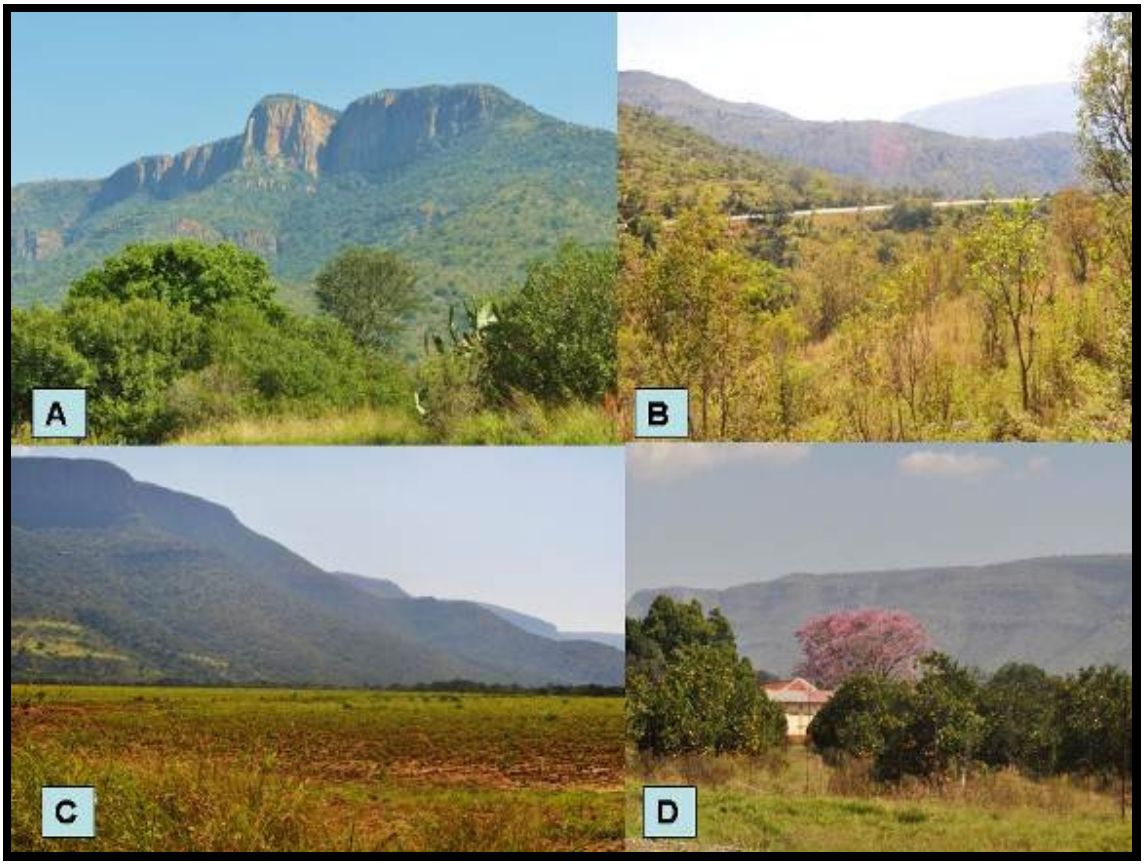

Figure6. A collage of photographs displaying the domiant habitats observed within the Ohrigstad Mountain Bushveld vegetation units. A: Open and densely closed wooded layer occurs within mid and uppers slopes, the incised valleys as well as along drainage lines. **B:** The proposed alignment 1 follows an existing servitude which bisects the mountainous and valleys of the Spekboom River. **C:** Alternative 3 bisects the footslopes and follows the outer edge of the riparian zone of the Watevals River. The adjacent plains have been transformed into irrigated agricultural lands as well as **D:** citrus plantations. This has resulted in complete transformation of habitats.

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Vegetation & Landscape Features

Open to dense woody layer, with associated woody and herbaceous shrubs and closed to open grass layer. Moderate to steep slopes on mountainsides and sometimes deeply incised valleys; also on fairly flat terrain in a few places. The proposed alternative 1 follows an existing servitude however the adjacent areas display a more natural representative of Ohrigstad Mountain bushveld especially on the Frams Wildebeesthoek 389 KT and the Farm Boerboomkraal 353 KT. The alternative 3 alignment is situated within the lower-lying areas or footslopes adjacent to the Waterval River on the Farms Olifantshoek 387 KT and Buffelsvlei 388 KT. The area has been heavily impacted on by surrounding agricultural activities including citrus orchards and irrigated agricultural lands.

Geology & Soils

Primarily on quartzite and shale (Timeball Hill and Silverton Formations of the Pretoria Group), with some chemical sediments of the Chuniespoort Group, weathering to shallow rocky soils of either Glenrosa and Mispah soil forms Land types Ib, Ae, and Fa (Mucina *et al.* 2006).

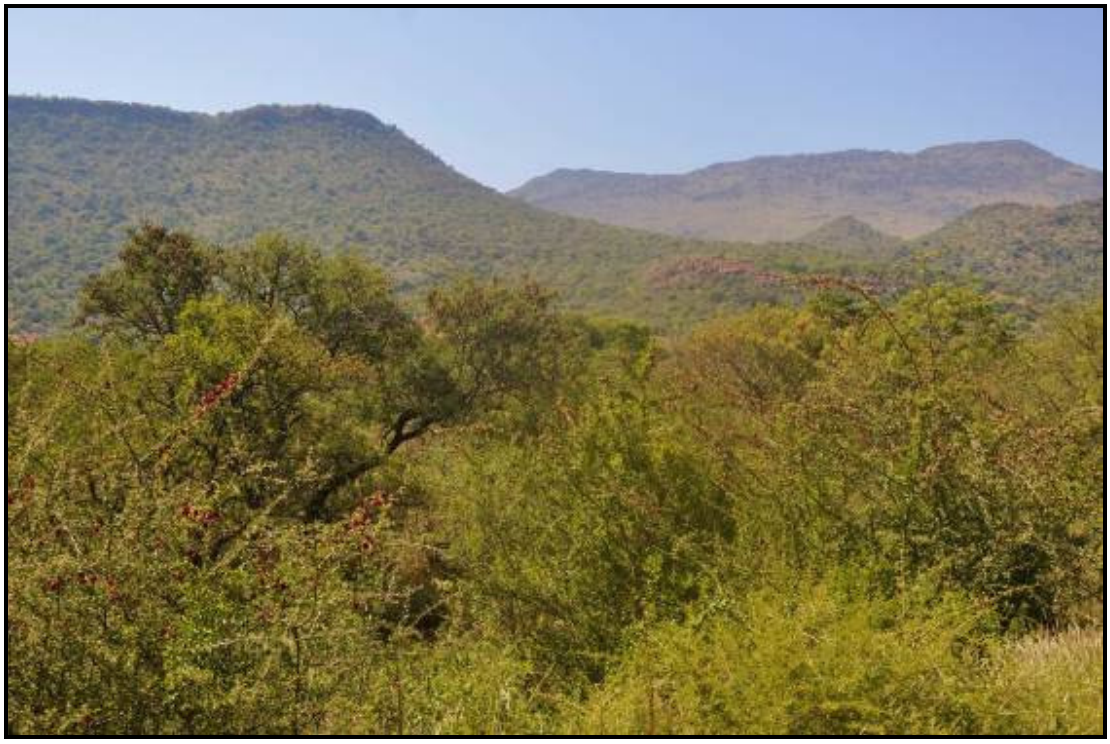
Climate

Summer rainfall with very dry winters. Mean Annual Precipitation (MAP) of 500-800mm mm. Most of this unit experiences fairly infrequent frost.

CONSERVATION

Ohrigstad Mountain Bushveld is currently listed as **Least Threatened**. The conservation target is 24% with approxiamtelyn 8% statutorily conserved mainly in the Bewaarkloof and Blyde River Canyon Reserve. At least an additional 4% in other reserves, mainly the Wolkberg (Serala) Wilderness Area. At least 9% of this unit has been transformed mainly by dryland and irrigated cultivation. Erosion is very variable, from very low to very high in the Sekhukhune region (Mucina & Rutherford 2006).

3.6 Sekhukhune Mountain Bushveld (SVcb 28)



Vegetation Type	Sekhukhune Mountain Bushveld (SVcb 28)	**Tree cover**	20-80 %
Soil	Soils are dominantly shallow, rocky and clayey and typical of the Mispah and Gelnrosa soil forms (lime is present in low-lying areas).	**Shrub cover**	10-60 %
Topography	Undulating Mountains	**Herb cover**	0-40 %
Land use	Livestock (Cattle) grazing activities	**Grass cover**	0-90 %
Dominant Tree Species	*Senegalia nigrescens, Combretum apiculatum, Combretum molle*, *Kirkia wilmsii, Commiphora mollis, Bolusanthus speciosus, Schotia latifolia, Cusonia transvaalensis, Croton gratissimus, Englerophytum magalismontanum, Sclerrocarya birrea subsp. caffra, Terminalia prunoides, Ziziphus mucronata, Euphorbia cooperi, Olea europaea* subsp. *africana, Aloe marlothii*		
Dominant Shrub Species	*Dichrostachys cinerea, Combretum hereroensis, Acacia ataxacantha, Grewia vernicosa, Euclea linearis* and *Euclea undulata*, *Euclea crispa, Aloe marlothii.*		

Dominant Grass spp.	*Aristida canescens, Aristida congesta, junciformis, Dihetropogon amplectens, Heteropogon contortus, Cynodon dactylon, Panicum maximum, Melinis repens, Setaria sphacelata, Digitaria sanguinalis, Eragrostis curvula, Eragrostis racemosa*
Dominant Herb spp.	*Commeliana africana, Senecio latifolius, Zinnia peruviana*, Sansevieria hyacinthoides, Hypoxis rigidula, Aloe greatheadii var. davyana*
Alien Invasive Species	*Nicotiana glauca*, Ipomoea indica**, *Ipomoea purpurea**, *Lantana camara**, *Melia azedarach**, *Jacaranda mimosifolia**, *Ricinus communis*, Solanum mauritianum**
Red Data Species	None observed although suitable habitat remains for several red listed species (see attached species list 2430 DB) *Searsia sekhukhuniensis, Combretum petrophilum, Adenia fruticosa*

The vegetation unit situated around the comprises of **Sekhukhune Mountain Bushveld (SVcb 26)** (Mucina & Rutherford 2006) previously classified as **Sourish Mixed Bushveld (VT 19)** (50%) (Acocks 1953) and **Mixed Bushveld (LR 18)** (Low & Rebelo 1996).

Distribution

Situated within the Limpopo and Mpumalanga Provinces on the mountains and undulating hills above the lowlands of the Sekhukhune Plains Bushveld (SVcb 27), including the steep slopes of the Leolo Mountains, Dwars River Mountains and Thaba Sekhukhune, and a number of smaller isolated mountains such as Phepane And Morone. It also occurs of the undulating hills in the valley of the Steelpoort River up to and along the Klip River flowing past Roossenekal.

Altitude

Altitude varies from around 900 m to about 1 600 m

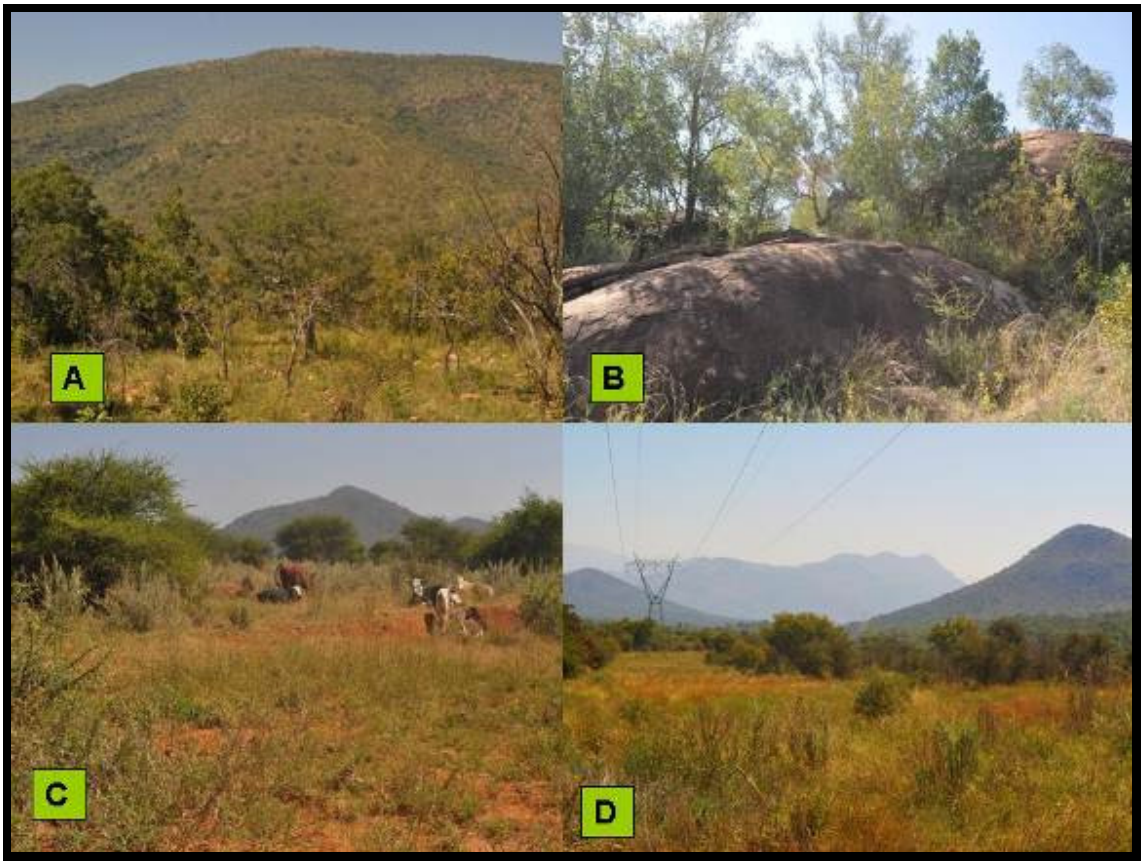


Figure7. A collage of photographs displaying the major habitats observed within the Sekhukhune Mountain Bushveld vegetation unit. A: Dry, open and closed broad-leaved savanna on hills and mountain slopes that form concentric belts parallel to the northeastern escarpment. **B:** Large norite and gabbro boulders provide favourable habitat for several rupicolous plant and animal species. **C:** The lower lying sections along the Sterkfontein River are utilized for livestock grazing activities. Evidence of wood harvesting was observed along the river. **D:** Only one proposed alignment runs adjacent to the Sterkfontein River to the Merensky substation. The proposed alignment follows an existing alignment. The existing alignment is characterized by the complete removal of the tree and shrub layer. Ideally only larger trees which could impact on the line should be removed. The clearance of the tree and shrub layer has a high negative impact on remaining plant and animal; species (especially arboreal species). High diversity of plants and trees were observed as well as several protected Marula *Sclerrocarya birrea* subsp. *caffra.* Ideally the proposed alignment should be shifted approximately 300 m to the west of the Sterkfontein River and follow existing roads and bisect transformed agricultural lands and degraded bushveld habitats.

Vegetation & Landscape Features

Dry, open and closed microphyllous and broad-leaved savanna on hills and mountain slopes that form concentric belts parallel to the north-eastern escarpment. Open bushveld often associated with ultramafic soils on southern aspects. Bushveld on ultramafic soils contain a high diversity of edaphic specialists. Bushveld on mountain slopes generally taller than in the valleys, with a well developed herb layer. Bushveld of valleys and dry northern aspects usually dense like thicket, with a herb layer comprising many short lived perennials. Dry habitats contain a number of species with xerophytic adaptations, such as succulence and underground storage organs. Both man-made and natural erosion dongas occur on footslopes of clay rich in heavy metals. Only one alternative is proposed adjacent to an existing alignment which runs parallel to the Sterkfontein River. The area comprises mainly of natural Sekhukhune Mountain Bushveld especially within the Farm Olifantspoortje 319 to the south of the Merensky substation.

Geology & Soils

Rocks mainly ultramafic intrusives of the lower, critical and main zones of the eastern Rustenburg Layered Suite of the Bushveld Igneous Complex (Vallian). Three sub-suites (zones), namely Croydon, Dwars River and Dsjate consist mainly of norite, pyroxenite, anorthosite and gabbro and are characterized by local intrusions of magnetite, diorite, dunite, bronzitite and harzgurgite. Soils are dominantly shallow, rocky and clayey and typical of the Mispah and Gelnrosa soil forms (lime is present in low-lying areas). Rocky areas with soil are common on steep slopes. The Dwars River Valley is characterized by prismacutanic horizons with melanic structured diagnostic horizons. Around Steelpoort red apedal, freely drained soils occur and these deeper soils, include Hutton, Bonheim and Steendal soil froms. Land types Ib, Ae, Lc and Fb (Mucina *et al.* 2006).

Climate

Summer rainfall with very dry winters. Mean Annual Precipitation (MAP) of 500-700mm, but local topography influences rainfall patterns over short distances. Daily temperatures vary considerably at different localities, with highest temperatures in lower-lying areas and lowest temperatures on southern aspects of mountains.

CONSERVATION

Sekhukhune Mountain Bushveld is currently listed as **Least Threatened**. The conservation target is 24% with none in statutorily conserved areas and 0.4% conserved in the Potlake Nature Reserve. Nearly 15% of this unit has been transformed mainly by cultivation and urban sprawl. Erosion is moderate to high with donga formation in places. An increasing are along the Dwars River Subsuite is under pressure from mining activities and its associated urbanisation (Mucina & Rutherford 2006).

3.6 Sekhukhune Plains Bushveld (SV cb 27)

Vegetation Type	Sekhukhune Plain Bushveld (SVcb 27)	**Tree cover**	0-40 %
Soil	Red Apedal, well-drained soils	**Shrub cover**	0-50 %
Topography	Plains	**Herb cover**	0-40 %
Land use	Mining, Urban & Livestock (Cattle) grazing activities	**Grass cover**	0-90 %
Dominant Tree Species	*Senegalia nigrescens, Vachellia nilotica, Vachellia tortilis subsp. heteracantha, Boscia foetida subsp. rehmananiana, Combretum apiculatum, Combretum molle*, *Schotia latifolia, Cusonia transvaalensis, Terminalia prunoides, Ziziphus mucronata, Euphorbia cooperi, Olea europaea* subsp. *africana, Aloe marlothii*		
Dominant Shrub Species	*Dichrostachys cinerea, Ehretia rigida subsp. rigida, Jatropha sp. , Lantana rugosum, Combretum hereroensis, Senegalia ataxacantha, Grewia vernicosa, Euclea crispa , Aloe spp.*		
Dominant Grass spp.	*Aristida canescens, Aristida congesta, junciformis, Dihetropogon amplectens, Heteropogon contortus, Cynodon dactylon, Panicum maximum, Melinis repens, Setaria sphacelata, Digitaria sanguinalis, Eragrostis curvula, Eragrostis racemosa*		
Dominant Herb spp.	*Commeliana africana, Senecio latifolius, Zinnia peruviana*, Sansevieria hyacinthoides, Hypoxis rigidula, Aloe greatheadii var.*		

	davyana
Alien Invasive Species	*Nicotiana glauca*, Ipomoea indica**, *Ipomoea purpurea**, *Lantana camara**, *Melia azedarach**, *Jacaranda mimosifolia**, *Ricinus communis*, Solanum mauritianum**
Red Data Species	*Dicliptera fruticosa, Elaeodendron transvaalense, Lydenburgia cassinoides, Adenia fruticosa, Searsia sekhukhuniensis, Combretum petrophilum, Euphorbia sekukuniensis, Searsia batophylla, Hypoxis hemerocallidea, Eulophia speciosa* (see attached species list 2430 DA)

The vegetation unit situated around the comprises of **Sekhukhune Mountain Bushveld (SVcb 26)** (Mucina & Rutherford 2006) previously classified as **Sourish Mixed Bushveld (VT 19)** (50%) (Acocks 1953) and **Mixed Bushveld (LR 18)** (Low & Rebelo 1996).

Distribution

Situated within the Limpopo and Mpumalanga Provinces on the mountains and undulating hills above the lowlands of the Sekhukhune Plains Bushveld (SVcb 27), including the steep slopes of the Leolo Mountains, Dwars River Mountains and Thaba Sekhukhune, and a number of smaller isolated mountains such as Phepane And Morone. It also occurs of the undulating hills in the valley of the Steelpoort River up to and along the Klip River flowing past Roossenekal.

Altitude

Altitude varies from around 900 m to about 1 600 m

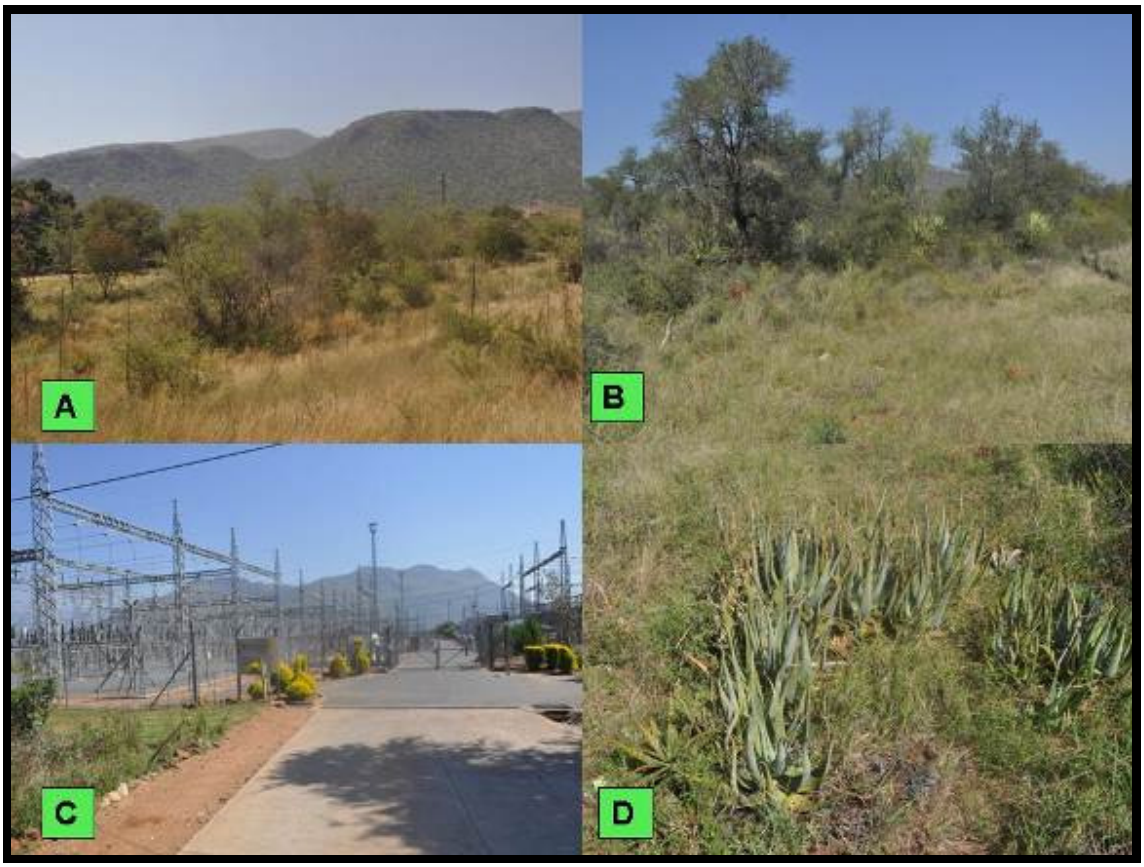


Figure8. A collage of photographs displaying the Sekhukhune Plains Bushveld observed around the proposed alternative 3 alignment. A: There is no alternative alignment to the Merensky substation near Steelpoort and the proposed aliognment bisects mainly transformed and degraded bushveld. **B**: Large areas of the plains adjacent to the R555 have been degraded or completely transformed due to wood harvesting, overgrazing as well as urban expansion, commercial and industrial developments and mining. **C:** The Merensky substation is situated immediately to the north of the R555. The majority of habitat around the substation has been transformed although remnant patches remain on a small rocky outcrop adjacent to the entrance as well as proposed alignment. **D:** Several Aloe species including (*Aloe greatheadii*, *Aloe castanea*, *Aloe cryptopoda* and *Aloe globuligemma*) were observed along the entrance to the substation and adjacent low lying rocky hills. All Aloes are protected plant species.

Vegetation & Landscape Features

Dry, open and closed microphyllous and broad-leaved savanna on hills and mountain slopes that frorm concerntric belts parallel to the northeastern escarpment. Open bushveld often associated with ultramafic soils on southern aspects. Bushveld on ultramafic soils contain a high diversity of edaphic specialists. Bushveld on mountain slopes generally taller than in the valleys, with a well developed herb layer. Bushveld of valleys and dry northern aspects usually dense like thicket, with a herb layer comprising many short lived perennials. Dry habitats contain a number of species with xerophytic adaptations, such as succulence and underground storage organs. Both man-made and natural erosion dongas occur on footslopes of clay rich in heavy metals. Within the study area this bushveld is restricted to the lower-lying valley floors of the Sterkfonteinsruit to the south of the Merensky substation and the Steelpoort River to the north. These bushveld areas have become severely degraded due to edge effects of the adjacent communities as well as urban, commercial and industrial developments.

Geology & Soils

Rocks mainly ultramafic intrusives of the lower, critical and main zones of the eastern Rustenburg Layered Suite of the Bushveld Igneous Complex (Vallian). Three sub-suites (zones), namely Croydon, Dwars River and Dsjate consist mainly of norite, pyroxenite, anorthosite and gabbro and are characterized by local intrusions of magnetite, diorite, dunite, bronzitite and harzgurgite. Soils are dominantly shallow, rocky and clayey and typical of the Mispah and Gelnrosa soil forms (lime is present in low-lying areas). Rocky areas with soil are common on steep slopes. The Dwars River Valley is characterized by prismacutanic horizons with melanic structured diagnostic horizons. AroundSteelpoort red apedal, freely drained soils occur and these deeper soils, include Hutton, Bonheim and Steendal soil froms. Land types Ib, Ae, Lc and Fb (Mucina *et al.* 2006).

Climate

Summer rainfall with very dry winters. Mean Annual Precipitation (MAP) of 500-700mm, but local topography influences rainfall patterns over short distances. Daily temperatures vary considerably at different localities, with highest temperatures in lower-lying areas and lowest temperatures on southern aspects of mountains.

CONSERVATION

Sekhukhune Mountain Bushveld is currently listed as **Least Threatened**. The conservation target is 24% with none in statutorily conserved areas and 0.4% conserved in the Potlake Nature Reserve. Nearly 15% of this unit has been transformed mainly by cultivation and urban sprawl. Erosion is moderate to high with donga formation in places. An increasing are along the Dward River Subsuite is under pressure from mining activities and its associated urbanisation (Mucina & Rutherford 2006).

3.7 SUBTROPICAL FRESHWATER WETLAND (AZf 6)

Vegetation Type	Subtropical Freshwater Wetland (AZf 6)	**Tree cover (riparian species)**	0-60%
Soil	Soils are waterlogged, clayey soils of **Champagne** and **Arcadia Forms,** containing high levels of decomposing organic material, especially in the very productive Phragmites australis beds. Other areas consist of recently “washed in” material which consists of light-brown sandy soils. .	**Shrub cover**	0-20%
Topography	Valley Bottom-Flood Bench of Waterval River	**Herb cover**	10-20%
Land use	Rural-agricultural (Livestock drinking & agricultural lands/irrigated citrus orchards)	**Grass cover**	0-80%

Dominant spp. (mainly upstream from R37) site)	*Ficus sycomorus* ssp. *sycomorus, Ficus sur, Combretum erythrophylum, Celtis africana, Phragmites mauritianus, Phoenix reclinata, Typha capensis*, *Cyperus sexangularis, Thelypteris confluens, Cyclosorus interruptus, Cyperus textilis, Mariscus congestus*, *Juncus* spp., *Scirpus ficinoides, Carex* spp., *Eleocharis* spp., *Pycreus nitidus*, *Senecio speciosus, Monopsis decipiens, Sesbania punicea*, ,Cirsium vulgare*, Setaria sp.*		
Alien Invasive Vegetation	*Melia azedarach*, Arundo donax*, Lantana camara*, Morus alba*, Jacaranda mimosifolia, Ricinus communis*, Senna didymobotrya**		

The proposed alternative 1 alignment bisects a section of floodbench of the Waterval River which comprises of an azonal vegetation unit known as **Subtropical Freshwater Wetlands (AZf 6)** (Mucina *et al*. 2006). This vegetation unit occurs on flat topography supporting low beds dominated by reeds, sedges and rushes, water-logged meadows or hillslope seepage wetlands. It occurs in the Limpopo, North-West, Gauteng, Mpumalanga, KwaZulu-Natal and Eastern Cape Provinces as well as in neighbouring Swaziland.

Geology and Soils

Hydric soils of seasonal and temporary inundation were observed within the floodbench adjacent to the Waterval River. The soils within the floodbenches are waterlogged, clayey soils of **Champagne** and **Arcadia Forms,** containing high levels of decomposing organic material, especially in the very productive *Phragmites* beds. Other areas along the river consist of recently “washed in” or deposited sandy material. The highest water levels are found in summer, during periods of maximum seasonal rainfall.

Climate

Summer rainfall area characterized by high levels of precipitation. Subtropical and tropical temperature regimes are prevalent. High air humidity and with no incidence of frost (except the south).

Conservation

The vegetation unit is classified as **Least-Threatened** with a conservation target of 24%. Some 40-50% is conserved in the Greater St Lucia Wetland Park, Kruger National Park, Ndumo Game Reserve, Tembe Elephant Park, Nylsvley. Approximately 4% has been transformed (largely by cultivation), but the pressure of local grazing and urban sprawl will result in the demise of many subtropical freshwater habitats. Disturbances leads to invasion of alien plants such as *Lantana camara, Chromolaena discolor* and *Melia azedarach* (on the edges of the rivers) and aquatic weeds such as *Eichomia capensis*, *Pistia stratiotes* and *Salvinia molesta* (in waterbodies)

Figure9. A collage of photographs displaying the Subtropical Freshwater Wetlands vegetation unit. A: Situated within the lower-lying areas adjacent to the active channel of the Waterval River is a seasonally inundated flood bench which is dominated by hygrophilous and hydrophilic grasses and sedges**. B:** The riparian zone of the Waterval River is dominated by large *Combretum erythrophyllum* as well as dense patches of White Poplars *Populus alba*. var. *alba*.* **C:** An existing servitude bisects the river and riparian zone. The proposed alignment 1 crossing bisects the riparian zone and will result in the removal of several riparian species including *Combretum erythrophyllum, Vachellia nilotica, Vachellia robusta*. **D:** Medium-High infestations of alien vegetation was observed within the riparian zone including Peanut-Butter Cassia (*Senna didymobotrya**) and **E:** White Mulberry (*Morus alba**) as well as Syringa (*Melia azedarach**).

CONCLUSION

Two red data plants were recorded during the brief field survey namely several *Hypoxis hemerocallidea* and *Aloe cooperi* adjacent to alignments 1 and 3. Several protected Marula *Sclerrocarya birrea* subsp. *caffra* occur within the Sekhukhune Plains and Mountain Bushveld areas. Suitable habitat occurs for Green-Thorn *Balanites maughamii* as well as Shepherds Tree (*Boscia albitrunca*). In terms of the National Forests Act 1998 (Act No 84 of 1998) certain tree species can be identified and declared as protected*. Ideally the powerline should be repositioned wherever possible away from any large Marula trees. If any Marula have to be removed truncheon cuts taken in spring can be replanted away from the proposed powerline. The Marula is one of the fastest growing trees in South Africa. The Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any Marula *Sclerocarya. birrea* ssp. *caffra* as well as several *Aloe* species.

The proposed alignments offer suitable habitat for several red listed species (see Appendix for Tables of red listed plant species). The alternative 1 alignment follows an existing servitude but however bisects open mountainous areas as well as running within the Spekboom River valley. These areas display a more natural bushveld species composition. The proposed alternative 2 alignment bisects a large area of Sekhukhune Montane Grassland which has a high diversity of plant species. The alignment bisects several incised valleys, rocky cliffs and steep slopes and from an ecological perspective is not preferred. The proposed alternative 3 alignment bisects large areas of transformed Lydenburg Thornveld as well as Ohrigstad Mountain Bushveld. The alignment follows the footslopes adjacent to the Waterval River. The proposed alternative 4 runs adjacent to the R37 and bisects transformed as well as natural areas of Lydenburg Thornveld mainly within the private Kudu Nature Reserve northern boundary. Alternative 5a and 5b bisect transformed Lydenburg Thornveld as well as Ohrigstad Mountain Bushveld. The alternative 5b alignment is siatuated adjacent to existing small-holdings as well as mining areas and is the **preferred alternative** from a vegetation perspective.

* The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization.

No alternatives have been suggested for the alignment parallel to the Sterkfontein River and the Lydenburg-Steelpoort road. The proposed alignment follows an existing Eskom servitude which bisects the dense bushveld slopes which offer suitable habitat for several red listed and endemic plant and tree species. The tree and shrub layer has been completely cleared within the current servitude. Ideally the proposed alignment should be re-aligned approximately 300m to the west of the Sterkfontein River and follow existing tracks. The area has been historically transformed and dominated by degraded bushveld vegetation units and transformed agricultural lands with low conservation potential and likelihood or red listed plant species.

4. RESULTS OF THE FAUNAL SURVEY OR HABITAT ASSESSMENT

One general habitat sensitivity scans were carried out on site on the 15th-19th of April 2013. These site visits did not entail intensive surveying or utilisation of any sampling methods and can rather be viewed as being an opportunity to identify sensitive faunal habitats occurring along the proposed alignments. Emphasis was placed on the remaining open grassland habitats, mountainous bushveld habitats, artificially created dams; rivers and streams including the Sterkfontein River, Waterval River, Jood se Loop, Dorps River. Surveys were severely restricted due to timing of survey (late summer months), time and financial constraints as well as the accessibility of the steep mountainous slopes and ravines, closed wooded incised valleys, montane grasslands, closed woodland hillslopes as well as large areas of fenced off private property. Surveys were restricted to unfenced areas with existing access roads along the proposed alignments.

The open and closed bushveld areas are utilised mainly for livestock grazing activities and suffers from extensive overgrazing, mostly from goats and cattle. Their grazing and trampling can encourage thicket growth by *Dichrostachys cinerea* as well as *Acacia melifera* by reducing grass cover. However, the opportunistic feeding patterns of goats can have a severe impact on both the composition and productivity of this ecoregion. In addition, goats are known to be more destructive than cattle at higher stocking densities (Skead 1988). High livestock densities also pose considerable threat to wildlife, since high numbers of domesticated animals generally cause a displacement of game, as there is less suitable habitat available. Furthermore, wild predators and scavengers such as the Black-backed Jackal, Caracal, Leopard and the White-backed Vulture have been eradicated by livestock farmers who see these animals as a threat to their livelihoods. Poisoned carcasses are often used for this purpose; this method is indiscriminate and therefore poses considerable threat to all predators and scavengers; especially the threatened Vulture species. Poaching and illegal hunting (dogs) are further reducing the remnant faunal populations.

Existing Impacts on the fauna on and surrounding the site included:

- Certain sections of the proposed powerline alignments are situated mainly within degraded and transformed bushveld (fallow agricultural lands) which are dominated by completely transformed vegetation with limited habitat diversity.
- High levels of human disturbances associated with the existing villages and habitat degradation and transformation due to present agricultural activities occur adjacent to the alignments. This has resulted in impoverished habitats with limited faunal diversity.
- Existing villages, agricultural, mining as well as formal and informal access roads and pedestrian and livestock pathways occur around the alignments.
- Previous and current agricultural activities (oldlands) have transformed large areas of the lower-lying bushveld and grassland habitat adjacent to the alignments.
- Extensive overgrazing by livestock (especially cattle and goats) result in limited vegetative or grass cover or refuge habitat for remaining faunal species.
- Wood harvesting within the open and closed bushveld vegetation units results in destruction of important habitat for arboreal faunal species.
- Frequent burning of remaining patches of grasslands and bushveld severely restricts vegetative cover and potential refuge habitat for remaining faunal species.
- Hunting with dogs as well as cats around the villages. Dogs and cats have a high impact on remaining faunal species.
- Introduction of exotic and alien vegetation.
- Deterioration in water quality within the surrounding rivers and streams due to adjacent agricultural activities (fertilizers and pesticides).

All animals (mammals (larger), reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings) to identify animals. The majority of mammals were identified by visual observations as well as droppings and various burrow types. The majority of amphibians identified on the site were calling adults as well as incidentally observed adults (under rocks, logs etc) and from dip netting for tadpoles as well as emerging juveniles. Reptiles were actively searched for under suitable refuges such as loosely embedded flat rocks, logs, stumps, dumped building rubble, tyres and carpets and identified by actual specimens observed. A separate avifaunal survey has been conducted by Royal HaskoningDHV.

4.1 MAMMALS

Mpumalanga and Limpopo Provinces are faunally diverse with approximately 163 mammal species consisting of 98 smaller and 64 larger species. It is the objective of the relevant conservation authorities to conserve all of these species *in situ.* The grassland and savanna biomes sustain many endemic and red data mammal species. The grassland biome is one of the biomes in which Red Data Book (RDB) insectivore richness is concentrated (Gelderblom, Bronner, Lombard & Taylor, 1995). High mammalian species richness occurs in savannahs, which could be as a result of the wide variety of habitats available. In Mpumalanga Province, savanna areas with the availability of sufficient cover, karst areas, wetlands, pans and a well-managed mosaic of short and tall grassland, are habitats that significantly contribute towards the ecological requirements of several mammal species.

Certain species in Mpumalanga, towards which conservation efforts for habitat protection should be directed, have been identified. Priority species can be used to flagship or emphasise key habitats, which are of conservation concern. These species thus contribute towards identifying priority areas of conservation importance and in determining the conservation value of land. Anthropogenic land conversion and habitat degradation and fragmentation mainly due to agricultural and mining activities are major threats to the continued existence of endemic and threatened fauna in the province.

No small mammal trappings were conducted due to time constraints and the limitations that the results from single night or brief field surveys would pose. The brief fieldwork was augmented with previous surveys in similar habitats as well as published data. Mammal species recorded within the study area as well as those that may occur within the study area, on the basis of available distribution records and known habitat requirements, are included in the Appendix (see Table).

The majority of larger mammal species are likely to have been eradicated from the unfenced areas or have moved away from the area, as a result of previous agricultural activities, hunting and poaching as well as severe habitat alteration and degradation. Sections of the proposed alignments bisect fenced off private conservation areas which offer suitable habitat for several large mammal species. Evidence of Kudu, Common Duiker, Warthog, Aardvark, Porcupine, Blacked-Back Jackal were recorded around the proposed alignments especially within the Sekhukhune Mountain Bushveld areas along the Sterkfontein River. Larger mammal species likely to occur in these areas include Giraffe, Eland, Plains Zebra, Kudu, Impala, Wildebeest, Common Duiker, Grey Rhebok, Reedbuck, Blesbuck, Bushbuck, Warthogs, Red Hartebeest, Bushpigs, Antbears, Black-backed Jackal, Spotted Hyaena, Leopard, Brown Hyaena, African Civet, Vervet Monkey, Common Warthog and Chacma Baboons.

Low larger mammal species diversity is expected within the transformed vegetation units due to high levels of human activities as well as extensive habitat transformation and degradation on and surrounding the site. The settlements surrounding the site as well as several informal settlements and associated hunting and poaching limits the suitability of the site for larger mammal species. High levels of hunting were noted on and surrounding the site with the use of dogs and wire snares as well as several empty shotgun cartridges adjacent to the Sterkfontein River. Several dog tracks were observed along the existing Eskom servitudes as well as hunting with dogs was observed during the site visit. The collection or harvesting of wood (stumps) and rock material as well as the frequent burning of the vegetation reduces available refuge habitat an exposes remaining smaller terrestrial mammals to increased predation levels. The use of wire snares for high intensity poaching activities will significantly affect remaining smaller mammal species such as rabbits and mongooses. Secondary access roads and vehicles (motor cars, motor cycles, quad bikes) which transverse the area and bisect the mountainous areas increase access to the area as well as potential road fatalities. Major road networks (R37) with high vehicular traffic increase the risk of road fatalities (hedgehogs, hares) of mammals. Smaller mammal species are extremely vulnerable to feral cats and dogs.

Figure10. A Slender Mongoose was observed foraging adjacent to the Sterrkfontein River.

The Yellow and Slender mongooses were observed on the site and prey on the smaller rodents, birds, reptiles and amphibians on the site. They have a precarious existence around Lydenburg due to surrounding road networks as well as illegal hunting with dogs and wire snares. Limited animal burrows (Yellow Mongooses, Highveld Gerbil, Multimmamate Mouse) and African Molerat were observed around the sandy sections of the grasslands around the Lydenburg substation.

Evidence of Cape Clawless Otters (*Aonyx capensis*) as well as Marsh Mongoose (*Atilax paludinosus*) in the form of faeces or spraints as well as quills of Cape Porcupine (*Hystrix africaeustralis*) where also observed along the riparian zone of the Sterkfontein River. Tree Squirrels (*Paraxerus cepapi*) as well as Vervet Monkeys (*Ceropithecus aethiops*) were observed foraging adjacent to the river. Evidence (spoor) of several antelope species were observed along the informal dirt road including Bushbuck (*Tragelaphus scriptus*) and Common Duiker (*Sylvicarpa scrptus*). Slender Mongoose was observed running across the roads. Several low-lying norite and gabbro rocky outcrops and rock sheets were observed adjacent to the Sterkfontein River which offer suitable habitat for rupicolous mammal species such as Rock Hyrax, Eastern Elephant Shrew, Smith's and Jameson's Red Rock Rabbit and Rock Dormouse.

Table1. Mammal species recorded in the study area (*) during the brief field survey and supplemented from previous surveys conducted in similar habitats (introduced species are in bold).

COMMON NAME	**SCIENTIFIC NAME**
Transvaal free-tailed Bat	*Tadarida ventralis*
Eastern Rock Elephant-Shrew	*Elephantulus myurus*
Scrub Hare	*Lepus saxatilis*
House Mouse	***Mus musculus***
*African (Common) Mole-rat	*Cryptomys hottentotus*
Greater Canerat	*Thryonomys swinderianus*
Rock Dormouse	*Graphiurus platyops*
Spiny Mouse	*Acomys spinosissimus*

Four-striped Grass Mouse	*Rhabdomys pumilio*
Desert Pygmy Mouse	*Mus indutus*
Natal Multimammate Mouse	*Mastomys natalensis*
Southern Multimammate Mouse	*Mastomys coucha*
Angoni Vlei Rat	*Otomys angoniensis*
Vlei Rat	*Otomys irroratus*
African Marsh Rat	*Dasymys incomtus*
House Rat	***Rattus rattus***
*Bushveld Gerbil	*Tatera leucogaster*
*Highveld Gerbil	*Tatera brantsii*
*South African Ground Squirrel	*Xenus inauris*
Striped Polecat	*Ictonyx striatus*
South African Large-spotted Genet	*Genetta tigrina*
*Marsh Mongoose	*Atilax paludinosus*
*Yellow Mongoose	*Cynictis penicillata*
*Slender Mongoose	*Galerella sanguinea*
Lesser Bushbaby	*Galago moholi*
*Black-backed Jackal	*Canis mesomelas*
*Cape Porcupine	*Hystrix africaeaustralis*
Smith's Red Rock Rabbit	*Pronolagus saundersiae*

Springhare	*Pedetes capensis*
*Common Duiker	*Sylvicarpa grimmia*
Mountain Reedbuck	*Redunca fulvorufula*
*Kudu	*Tragelaphus strepsiceros*
*Bushbuck	*Tragelaphus scriptus*
*Chacma Baboon	*Papio cynocephalus ursinus*
*Vervet Monkey	*Ceropithecus aethiops*

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Table2. Mammal species of conservation importance possibly occurring on the site using habitat availability and current distribution records according to Skinner and Chimimba (2005) as an indicator of presence.

COMMON NAMES	SCIENTIFIC NAMES	RED LIST	IUCN
*Selous' Mongoose	*Paracynictis selousi*	R	R
*Aardvark (Antbear)	*Orycteropus afer*	V	VU
*South African Hedgehog	*Atelerix frontalis*	V	VU
Ground Pangolin	*Manis temminckii*	LR/nt	LR/nt
Brown Hyaena	*Parahyaena brunnea*	LR/nt	LR/nt

* downgraded to Lower Risk/ Least Concern LR/ LC (Skinner & Chimimba 2005)

SARDB (South African Red Data Book): E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.

IUCN (World Conservation Union): CR = Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient.

As the proposed alignments bisect fenced off large private conservancy areas dominated by open and closed bushveld, rocky outcrops, rivers as well as montane grasslands habitat the majority of mammals should be present. No threatened mammals were recorded during the brief field survey but suitable habitat exists within the mountainous areas for Brown Hyaenas. The open and closed savannah woodlands and rocky hills could potentially offer suitable habitat for Ground Pangolins. Several previously rare or threatened mammal species could potentially occur on the site such as Leopards, Selous' Mongoose, Serval, African Hedgehog, Aardvark which have been down-graded downgraded to Lower Risk/ Least Concern LR/ LC (Skinner & Chimimba 2005)

Although certain areas of the site may be utilized by certain rare or endangered mammal species for breeding, foraging and exploratory movements it is highly unlikely that the proposed clearing of the 22 m servitude forms critical habitat for any rare or threatened mammal species on the site. More intensive surveys conducted over several seasons would be required for the entire area to ascertain their possible presence of these highly secretive species as well as a more representative species list of mammal species occurring on the site.

4.2 REPTILES

Most current knowledge of the reptiles of Mpumalanga is based on a survey done by N.H.G. Jacobsen (1989) providing a detailed account of all reptiles in the then Transvaal province. This survey resulted in descriptions of life histories, habitat requirements and conservation status and maps of the known distributions. Jacobsen's (1989) survey revealed that 154 reptiles occur in the Mpumalanga Province and of these, 86 species are threatened. However, many of these threatened reptiles have relatively wide distributions and thus this study was restricted to Red Data species and species that are largely restricted to Mpumalanga and Limpopo Provinces. Extremely high reptile diversity occurs within the area and 99 species have been recorded from the 2430DA, 2430 DB and 2530DA QDGC's in which the alignments are situated. A list of reptile species recorded from the three grid cells is presented in the Appendix (see Table 16).

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to human presence in the area coupled with increased habitat destruction and disturbances around the alternative sites are all causal factors in the alteration of reptile species occurring within the transformed habitats along the alignments and surrounding areas.

Large areas of low-lying norite and gabbro rock outcrops occur around the Steelpoort area and provide favourable refuges for certain snake and lizard species (rupicolous species). Reptile species recorded from under loosely embedded rocks, fissures between rocks or observed basking on the low-lying rock sheets included Yellow-Throated Plated Lizard (*Gerrhosaurus flavigularis*), Giant Plated Lizard (*Gerrhosaurus validus*), Montane Speckled Skink (*Trachylepis* (*Mabuya*) *punctatissima*), Variable Skink (*Trachylepis (Mabuya) varia*), Southern Rock Agama (Agama atra), Ground Agama (*Agama aculeata*), Sekhukune Falt Lizard (Platysaurus orientalis orientalis), Common Flat Lizard (Platysaurus intermedius itermedius), Common Crag Lizard (Pseudocordylus melanotus melanotus), Transvaal Girdled Lizard (Cordylus vittifer) and Transvaal Thick-toed Gecko (*Pachydactylus affinis)*.

The open and closed bushveld vegetation unit provides suitable habitat for several arboreal reptile species. Arboreal species recorded from trees as well as dead stumps along the alignments included Flap-necked Chameleon (*Chamaeleo dilepis dilepis*), Boomslang (*Dispholidus typus typus*), Spotted Bush Snake (*Philothamnus variegatus*) Southern Tree Agama (*Acanthocercis atricolis*) and Common Dwarf Gecko (*Lygodactylus capensis*). Wahlberg's Snake-eyed Skink (*Panaspis walbergii*) was observed in the loose leaf litter along the riparian zone of the Waterval River. The rivers offer favourable habitat for Nile Monitors (*Varanus niloticus*).

Several termite mounds *Trinervitermes haberlandii* were observed within the grassland vegetation units along and around the proposed alignments towards the Lydenburg substation. Numbers increased away from the agricultural areas (ploughed lands). Termite mounds offer important refuges for numerous frog, lizard and snake species. Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). These mass emergences coincide with the first heavy summer rains and the emergence of the majority of herpetofauna. Moribund termite mounds also provide nesting site for snakes (Striped Harlequin Snake, Yellow Bellied House Snake), lizards (varanids) and refuge habitats for several smaller mammals (shrews) and frogs.

The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically. The frequent burning of the grassland and bushveld vegetation will have a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

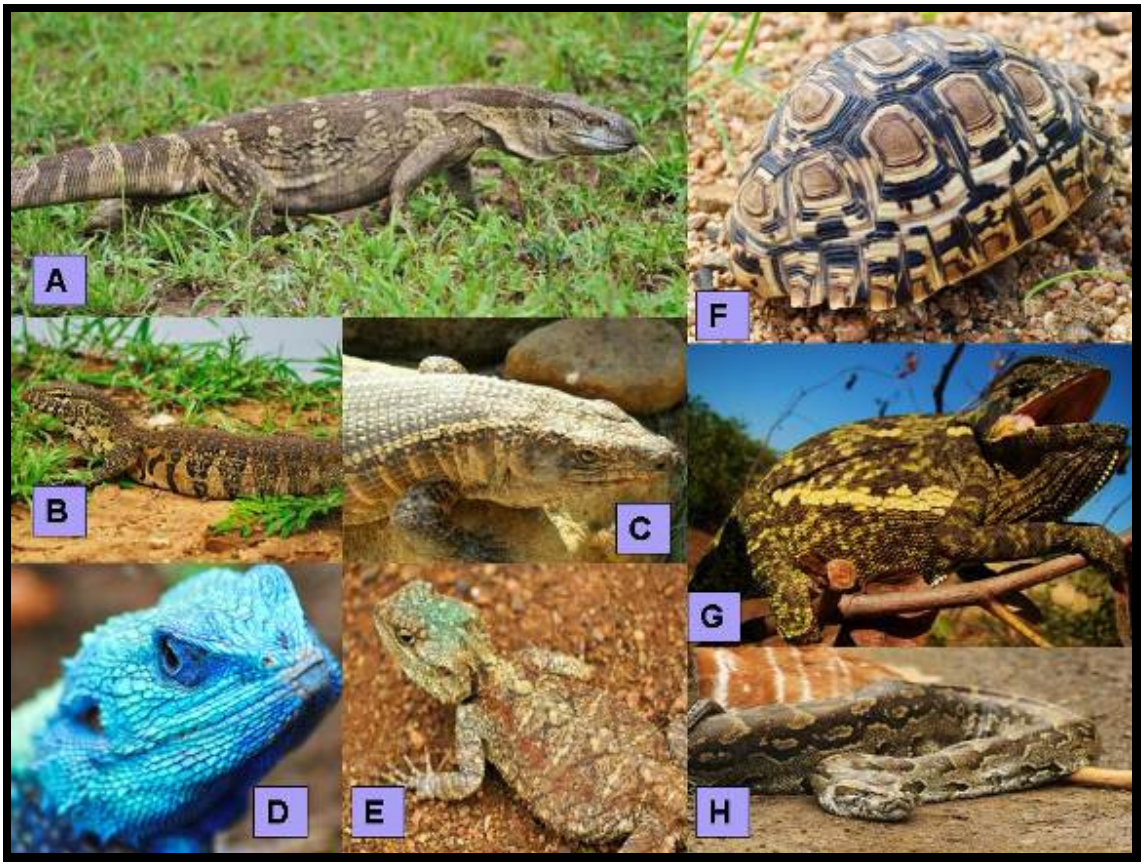


Figure11. A conglomerate of photographs displaying the reptile species recorded from the Lydenburg to Steelpoort area during the current and previous surveys. A: White-throated or Rock Monitor (*Varanus albigularis*), **B:** Nile Monitor (*Varanus niloticus*), **C:** Giant Plated Lizard (*Gerrhosaurus validus validus*), **D:** Male Southern Tree Agama (*Acanthocercus atricolis*), **E:** Female Southern Tree Agama (*Acanthocercus atricolis*), **F:** Leopard Tortoise (*Stigmochelys pardalis*); **G:** Common Flap-Necked Chameleon (*Chamaeleo dilepis dilepis*) and **H:** African Rock Python (*Python natalensis*) road fatality on the R555 between Steelpoort and Burgersfort (2011).

HABITAT AVAIALBLE FOR SENSITIVE OR ENDANGERED SPECIES

Table3. Red listed reptiles species recorded from the 2430DA, 2430 DB and 2530 DA loci (SARCA)

Common Name	Scientific Name	SA Red Data Status (Branch 1988)	IUCN STATUS 1996
Southern African Python	*Python natalensis*	Vulnerable	*Vulnerable
Breyer's Long-tailed Seps	*Tertadactylus breyeri*	Rare	Near-threatened
Yellow-bellied House Snake	*Lamprophis fuscus*	Rare	Near-threatened
Striped Harlequin Snake	*Homoroselaps dorsalis*	Rare	Near-threatened

*It is unlikely that pythons will retain this threat classification when reassessed using the latest IUCN criteria, since it appears to be relatively common in certain areas and has a widespread distribution (Alexander and Marais 2007).

The most current Red Data book for South African reptiles, Branch (1988) lists Breyer's Long-tailed Seps, Yellow-bellied House Snake as well as Striped Harlequin Snake as Rare, though these assessments were performed under now out-of-date criteria. They are all currently listed as Near Threatened by the IUCN (World Conservation Monitoring Centre, 1996), though this assessment is also out-of-date as it was performed under obsolete criteria. The conservation status of all of the above-mentioned reptiles have recently been reviewed by the South African Reptile Conservation Assessment (SARCA) for the updated Atlas and Southern African Red Data Book of Reptiles (in press).

African Rock Pythons *(Python natalensis)*

The African Rock Pythons (*Python natalensis*) are protected in South Africa and their numbers have declined due to habitat destruction, killed for their skins (fashion), illegally collected for pets and the pet industry. The majority of pythons are indiscriminately killed due to fear and ignorance or due to road fatalities. A road fatality of approximately 2.5 m female python was observed by the consultant of the R555 between Burgersfort and Steelpoort (pers. obs. 2011). Pythons have been recorded from the area especially within the open and closed bushveld vegetation units as well as along the rivers and riparian zones.

Breyer's Long-Tailed Seps (*Teradactylus breyeri*)

A secretive slender lizard species occurring in well vegetated grassland areas. More extensive surveys are required to establish habitat requirements and the effects of frequent burning and grazing activities. Suitable habitat remains within the higher lying mountainous plateaus adjacent to Alternative 2 alignment for this species as well as several other rare species such as the Montane Dwarf Burrowing Skink (*Sclelotes mirus*).

Yellow-bellied House Snake *Lamprophis fuscus*

A rare, endemic species known from widely scattered and varied habitats. These snakes are nocturnal and have been collected from moribund termite mounds (pers. obs.) as well as under loosely embedded rocks. More extensive surveys are required to establish habitat requirements and the effects of frequent burning and destruction of termite mounds during agricultural activities. Suitable habitat remains for this species along all the alignments.

Striped Harlequin Snake (*Homoroselaps dorsalis*)

The Striped Harlequin Snake (*Homoroselaps dorsalis*) has been recorded from the 2530 DA grid square (Broadley 1990). According to the habitat description (moribund/old termite mounds and scattered loose rock) provided for this species by Broadley (1990) and Branch (1988); suitable habitat exists in the form of moribund termite mounds as well as limited scattered loosely embedded rock in certain areas of the alignments for the Striped Harlequin Snake. Striped Harlequin Snakes have been recorded in the Lydenburg Montane Grassland (Alternative 2 alignment) as well as Lydenburg Thornveld vegetation units (Alternative 1 alignment).

It is unlikely that the preferred alignment (alternative 5b) comprises significant habitat for the above-mentioned threatened reptile species, at a global or provincial scale, or that the proposed new 132kv line and 22m servitude, will have an impact of more than **low significance** on the conservation status of these species should they indeed occur. The following management recommendations should be incorporated into the environmental management plan (EMP) for the project.

REPTILE MANAGEMENT RECOMMENDATIONS

- No further rock removal should occur adjacent to existing towers. No termite mounds should be intentionally destroyed. If any moribund termite mounds have to be destroyed due to tower position a qualified herpetologist must be present in case any blind snakes, or the red data Striped Harlequin Snake or Yellow-bellied House Snake are unearthed. The termite mounds should be carefully excavated by hand and pick.
- Any animals rescued or recovered will be relocated in suitable habitat away from the distribution tower and power line.
- Trees including stumps; bark and holes in trees are vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors).
- The removal of indigenous tree species as well as vegetation clearance must be kept to the minimum area required and remain in the existing servitude wherever possible. This is especially pertinent for the remnant riparian vegetation along the rivers.
- All alien vegetation should be removed off the site during vegetation clearance. Several invasive tree species were recorded adjacent to the existing alignments including Red Sesbania (*Sesbania punicea*) River Gum (*Eucalyptus camaldulensis*), White Mulberry (*Morus alba*), White Poplar (*Populus alb*a), Grey Poplar (*Populus x canescens*), Black Locust (*Robinia pseudoacacia*), Syringa (*Melia azedarach*), Privet (*Lingustrum sp.*), Bugweed (*Solanum mauritianum*).
- Exotic cleared vegetation should form wood piles and logs and stumps. Dead or decaying wood piles should be created as these will provide valuable refuge areas especially due to the clearance of vegetation cover. Logs and stumps also provide important habitats for several reptile species as well as smaller mammals, amphibians, arachnids and scorpions. With time they will eventually be reduced to valuable compost by several animal species. Dead trees and stumps will also be used for nesting purposes by barbets, hoopoes, owls, hornbills as well as perching or hunting platforms for birds like the kingfisher.
- Any lizards, gecko's, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.
- Several venomous snake species occur along the proposed rebuild lines including Black Mamba (*Dendroaspis polylepis*), Mozambique Spitting Cobra (*Naja*

mossambica), Common or Rhombic Night Adder (*Causus rhombeatus*) and Puff Adder (*Bitis arietans*).

- General avoidance of snakes if the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.
- Appropriate foot wear (sturdy leather boots) should be worn in the field.

4.3 AMPHIBIANS

Amphibian surveys by Jacobsen (1989), as well as recent and current surveys suggest that over 50 species of amphibians currently occur in the Provinces of Limpopo and Mpumalanga. The present study concentrated mainly on Red Data species and species that are threatened or have relatively restricted distributions. Eight species are considered as important for setting conservation priorities in Mpumalanga: *Vandijkophrynus* (*Bufo*) *gariepensis nubicolus* (Karroo toad), *Hadromophryne* (*Heleophryne*) *natalensis* (Cascade Frog/Natal Ghost Frog), *Hemisus guttatus* (Spotted shovel-nosed Frog), *Hyperolius semidiscus* (Yellow-striped Reed Frog); *Strongylopus wageri* (Plain Stream Frog), Giant Bullfrog (*Pycicephalus adspersus*), Greater Leaf-folding Frog (*Afrixalis fornasinii*) and Whistling Rain Frog (*Breviceps sopranus*).

The amphibian populations in Mpumalanga are faced with several environmental threats. Habitat destruction and alien vegetation resulting in fragmentation of populations is probably the major threats facing all frog species. Forestry and agriculture have already resulted in the rapid destruction and fragmentation of the habitat of populations of the species discussed here. Recent mining activities have resulted in severe habitat degradation around Burgesfort and Steelpoort. Overgrazing and severe fires in the grassland catchment areas result in extensive silting up of streams and wetlands, threatening the breeding habitat of these frogs. The biphasic life cycle of most frogs, as well as their semi-permeable skin makes them particularly vulnerable to pollutants and other environmental stresses. Consequently frogs can be used as environmental biomonitors to indicate the quality of the environment. Chemical pollution and acidification constitute a major threat to frog populations. Heavy metals such as aluminium, cadmium, copper, zinc and iron are all toxic to amphibians. It can be inferred from studies on fish that nickel, lead and manganese will also have deleterious effects on frog populations (Bishop 1996).

Herbicides and pesticides often cause developmental abnormalities or mortalities. A recent report has shown that widely used and apparently safe herbicides containing the active ingredient glyphosphate are extremely toxic to tadpoles and frogs (Bishop 1996). These herbicides are widely used in plantations, as well as in nature reserves for alien plant control and the making of firebreaks.

Another threat to the continued survival of these frog species, is the damming of rivers, streams and wetlands. In many cases this action is followed by the introduction of alien fish species, with their associated parasites, for angling purposes in these dams. The preferred breeding habitat of five of the species discussed is natural, shallow, ephemeral pools and streams in palustrine wetlands. Deeper man-made dams and weirs alter and shrink the breeding habitat of these frogs considerably. Invasive predator fish species may also be a threat to the survival of the species.

No actual survey was undertaken due to extreme time constraints for an adequate herpetological survey. Comprehensive herpetological surveys can only be undertaken throughout the duration of the wet season (November-March). It is only during this period that accurate frog lists can be compiled.

The majority of species in Mpumalanga and Limpopo Provinces are classified as explosive breeders completing their short duration reproductive cycle in the early summer months between (November-January). These frog species only emerge after the first heavy summer rainfalls and are dormant during the cold winter months. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles.

The brief amphibian survey was undertaken for 4 days (no nocturnal surveys) during the early summer months (October). Nine frog species were recorded namely Russet-backed Sand Frog (*Tomopterna marmorata*) Bubbling Kassina (*Kassina senegalensis*), Southern Foam Nest Frog (*Chiromantis xerampelina*), Red Toad (*Schismaderma carens*), Bushveld Rain Frog (*Breviceps mossambicus*), Dwarf Puddle Frog (*Phrynobatrachus mababiensis)*, Snoring Puddle Frog (*Phrynobatrachus natalensis*), Eastern Olive Toad (*Amietophrynus garmani*) and Common River Frog (*Amietia angolensi*s). The majority of frog species recorded are common and widespread and typical of a bushveld and grassland environment. The majority of frog species recorded in the area utilise the seasonally inundated pans as well as floodbenches for their short duration breeding events. Thirty-nine (39) frog species have been recorded from the 2430 DA, 2430 DB and 2530 DA QDGC's in which the alignments are situated (see Table 15 Appendix).

Table4. List of frog species recorded by the consultant during previous surveys in the Lydenburg-Steelpoort-Burgersfort areas

COMMON NAME	SCIENTIFIC NAME	BREEDING HABITAT
African Bullfrog	*Pyxicephalus edulis*	Temporary shallow depressions and floodplain areas of the vlei. Also requires undisturbed open veld for foraging and sandy soils for burrowing.
Southern Ornate Frog	*Hildebrandtia ornata*	Shallow temporary pans in dry open woodland.
Tremolo Sand Frog	*Tomopterna cryptotis*	Temporary rain pools, pans and floodplain areas.
Russet-backed Sand Frog	*Tomopterna marmorata*	Temporary and semi-permanent seepage and seasonal pools within slow-flowing streams
Natal Sand Frog	*Tomopterna natalensis*	Seasonal mud pools, small ponds and flooplain areas.
Common Caco	*Cacosternum boettgeri*	Temporary marshes, ditches and grass inundated to a depth of about 2cm.
Bronze Caco	*Cacosternum nanum*	Small ponds, vleis, streams, rain pools alongside roads, inundated grassland and pastures.
Bubbling Kassina	*Kassina senegalensis*	Semi-permanent vleis, pans and shallows around dams.
Brown-backed Tree Frog	*Leptopelis mossambicus*	Shallow pans, pools and streams
Southern Foam Nest Frog	*Chiromantis xerampelina*	Temporary rain pools, pans and floodplain areas.
Red Toad	*Schismaderma carens*	Semi-permanent dams & ponds with water depth of more than one metre.
Eastern Olive Toad	*Ametiophrynus (Bufo) garmani*	Permanent or semi-permanent bodies of water, quiet backwaters of rivers, natural or man-made in open wooded savannah.
Guttural Toad	*Ametiophrynus* (*Bufo*) *gutturalis*	Permanent and semi-permanent ponds and backwaters in open habitat.
Raucous Toad	*Bufo rangeri*	Permanent or semi-permanent bodies of water, natural or man-made.
Northern Pygmy Toad	*Bufo fenoulheti*	Temporary pools on flat rocky outcrops or seasonal rain pools

Tropical Platanna	*Xenopus muelleri*	Permanent or semi-permanent bodies of water, natural or man-made, rivers.
Common Platanna	*Xenopus laevis laevis*	Permanent or semi-permanent bodies of water, natural or man-made.
Common River Frog	*Afrana angolensis*	Present in all major rivers as well as permanent standing water and floodplain areas. Recorded during brief site visit.
Banded Rubber Frog	*Phrynomantis bifasciatus*	Shallow ponds or inundated grass in savanna and Acacia veld.
Dwarf Puddle Frog	*Phrynobatrachus mababiensis*	Shallow stagnant water amongst emergent vegetation on the edges of grassy pans, vleis, marshes and in the back-waters of slow streams.
Snoring Puddle Frog	*Phrynobatrachus natalensis*	Pools or marshy area associated with the vlei
Plain Grass Frog	*Ptychadena anchietae*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams.
Broad-banded Grass Frog	*Ptychadena mossambica*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams, floodplains of rivers.
Sharp-nosed Grass Frog	*Ptychadena oxyrhynchus*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams
Bushveld Rain Frog	*Breviceps adspersus*	Eggs deposited in a subterranean chamber about 30cm below surface.
Mozambique Rain Frog	*Breviceps mossambicus*	Eggs deposited in a subterranean chamber about 30cm below surface.
Mottled Shovel-nosed Frog	*Hemisus marmoratus*	Construct extensive tortuous tunnels in low muddy areas close to the edge of pools
Golden Leaf-folding Frog	*Afrixalus aureus*	Margins of seasonal pools and pans
Painted Reed Frog	*Hyperolius marmoratus*	Temporary pools, pans and vleis as well as permanent bodies of water such as dams, marshes, reedbeds on sluggish rivers and streams.
Water Lily Frog	*Hyperolius pusillus*	Shallow pans, ponds, vleis and dams with water lilies *Nymphaea sp.*

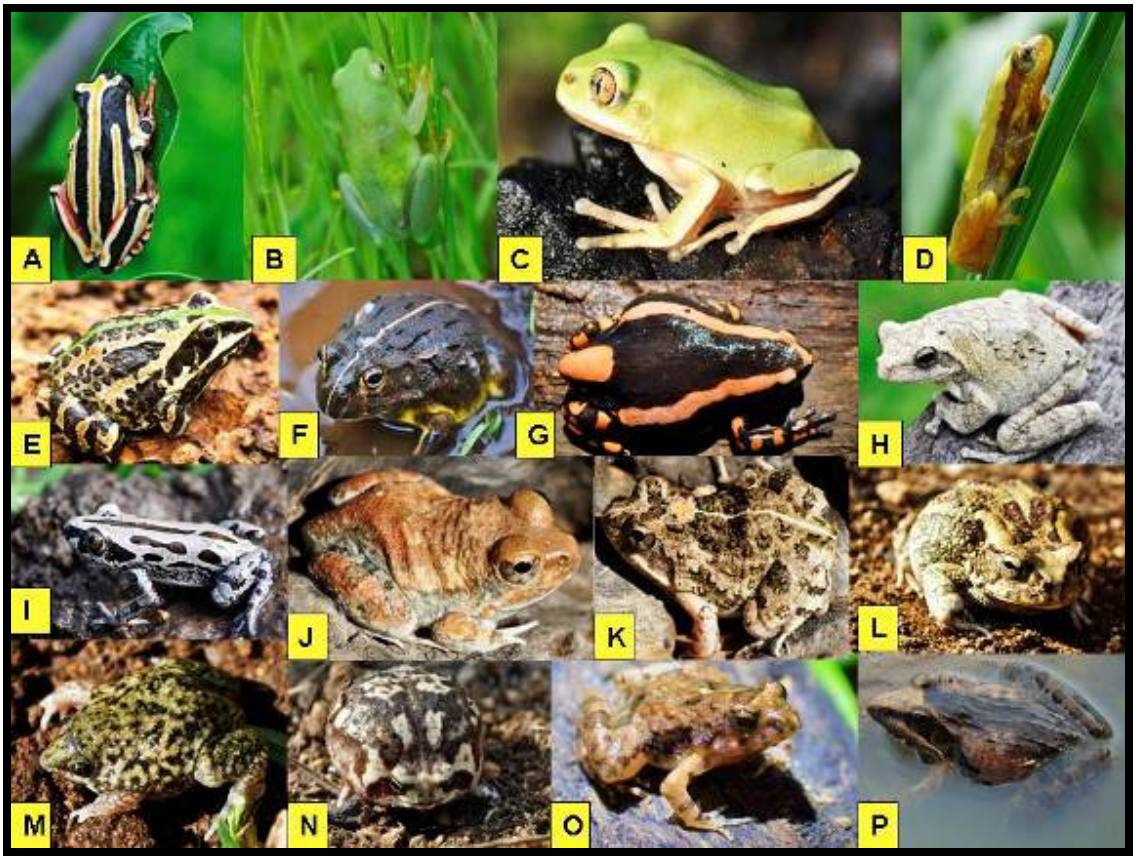


Figure12: A conglomerate of photographs of frog species recorded from the the Lydenburg-Steelpoort area during the recent survey. A: Painted Reed Frog (*Hyperolius marmoratus taeniatus*), **B:** Water Lily Frog (*Hyperolius pusillus*), **C**: Brown-Backed Tree Frog (*Leptopelis mossambicus*) juvenile colouration, **D:** Golden Leaf-Folding Frog (*Afrixalus aureus*); **E:** Southern Ornate Frog (*Hildebrandtia ornata*), **F:** African Bullfrog (*Pyxicephalus edulis*), **G:** Banded Rubber Frog (*Phrynomantis bifasciatus*), **H:** Southern Foam Nest Frog (*Chiromantis xerampelina*), **I:** Bubbling Kassina (*Kassina senegalensis*), **J:** Russet-Backed Sand Frog (*Tomopterna marmorata*), **K:** Tremelo Sand Frog (*Tomopterna cryptotis*), **L:** Eastern Olive Toad (*Amietophrynus garmani*), **M:** Mottled Shovel-nosed Frog (*Hemisus marmoratus*), **N:** Bushveld Rain Frog (*Breviceps adspersus*), **O:** Dwarf Puddle Frog (*Phrynobatrchus mababiensis*) and **P:** Plain Grass Frog (*Ptychadena anchietae*).

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Figure13. Giant Bullfrogs have been recorded from the 2430 DB grid square. Further surveys are required in order to ascertain if the records were of the Giant Bullfrog (*Pyxicephalus adspersus*) or the African Bullfrog (*Pyxicephalus edulis*). No suitable breeding habitat was observed for the Giant Bullfrog along the proposed alignments.

Giant Bullfrog *(Pyxicephalus adspersus)*

As the largest southern African frog, it spends most of the year underground encased in a transparent cocoon, emerging only after heavy thunderstorms in summer. The Bullfrog breeds in shallow, temporary rain-filled pans and small wetlands in grassland and savanna (Passmore and Carruthers 1995), as well as in the Great Karroo (SAFAP). Although the species occurs widespread in southern Africa (Lambiris 1988), the populations in Mpumalanga and Limpopo are threatened by habitat degradation and fragmentation. The predicted distribution of *P. adspersus* was determined using environmental variables such as elevation (800 to 1700 m a.s.l.) and mean annual rainfall of less than 750 mm. It is absent from high lying areas with high rainfall. These habitats are estimated to be more than 40% transformed. Loskopdam Nature Reserve is the only provincial protected reserve where the Giant Bullfrog was recorded (Jacobsen et al 1986). For this reason the species is considered **vulnerable** in the Mpumalanga Province. The Giant Bullfrog is currently assigned as a near-threatened species (IUCN Red List category) (Minter et al. 2004). Giant Bullfrogs have been recorded from the 2430DB grid square during previous the South African Frog Atlas Project (SAFAP).

Bullfrog density commonly varies within certain habitats (open grassland habitat). High densities are often associated with specific microhabitats or patches (hygrophytic or aquatic ephemerophytic grass and sedge dominated temporary pans) that can be identified and randomly sampled. Emphasis must be placed on remaining natural open grassland habitats (important migratory and foraging areas) as well as seasonal wetlands (drainage and marshland vegetation) surrounding the alternative alignments. The seasonal wetland habitats offer the most suitable breeding habitat for Giant Bullfrogs in the area. No Giant Bullfrogs were observed during the brief field survey or during previous surveys conducted in the Lydenburg-Steelpoort areas. Suitable habitat occurs for the smaller African Bullfrog (*Pyxicephalus edulis*) within the Subtropical Freshwater Wetland habitats especially any seasonally inundated pans or depressions. Both the African Bullfrog and the Giant Bullfrog are protected animal species.

It is unlikely that the preferred alignment (alternative 5b) comprises significant habitat for the Giant Bullfrog, at a global or provincial scale, or that the proposed new 132kv line and 22m servitude, will have an impact of more than **low significance** on the conservation status of these species should they indeed occur. The following management recommendations should be incorporated into the environmental management plan (EMP) for the project.

AMPHIBIAN MANAGEMENT RECOMMENDATIONS

- Construction activities of the line should be restricted to daylight hours reducing the potential impact on the nocturnal breeding activities of the majority of amphibian species.
- Ideally the installation of the new towers should be undertaken during the dry winter months (May-September) when the majority of amphibian species are dormant.
- No towers must be placed within any seasonal wetland habitats and especially the floodbenches along the Waterval River.
- Activities within the proposed river and stream crossings must be strictly limited to the current servitude.
- No Giant Bullfrogs must be collected for food or illegal pet trade.
- As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an independent environmental control officer (ECO) should be made aware of the possible presence of certain threatened amphibian species (Giant Bullfrog) prior to the commencement of the construction of the new line.

5. SENSITIVE HABITATS AROUND THE PROPOSED ALIGNMENTS

5.1 LYDENBURG AND SEKHUKUNE MONTANE GRASSLANDS

All primary Lydenburg and Sekhukune Montane Grasslands are considered to be of high conservation importance at a local scale for the following reasons:

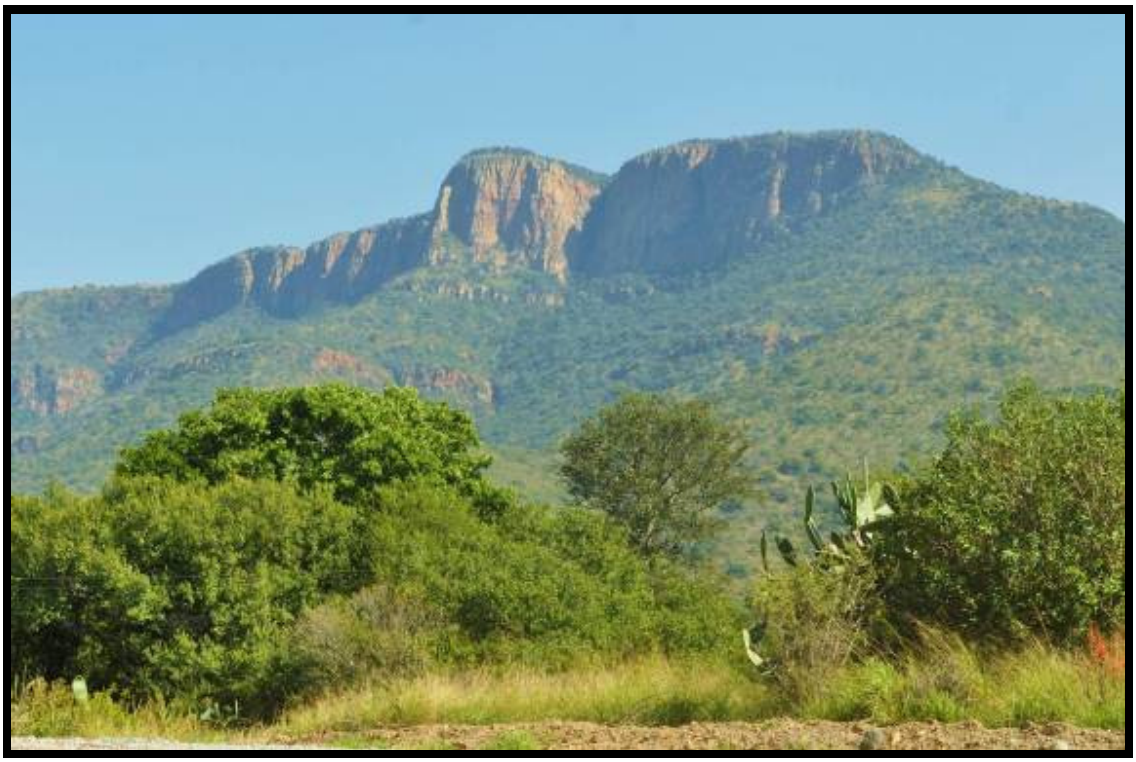
- Lydenburg Montane Grassland is currently listed as **Vulnerable.** The conservation target is 27%, with 2.4% formally protected within reserves (Gustav Klingbiel. Makobulaan, Mt Anderson, Ohrigstad Dam. Sterkspruit and Verlorenvlei) as well as in a number of private conservation areas (Buffelskoof, Crane Creek, mc, In-de-Diepte, Kaalboom, Kalmoesfontein. Mbesan. Mondi Indigenous Forest. Mt Sheba: Waterval etc.). The level of transformation is relatively high at 23% with mostly alien plantations (20%) and cultivated lands (2%).

- Sekhukhune Montane Grassland is currently listed as **Vulnerable**. The conservation target is 24%. There is no formal conservation in this region, although many farmers have embanked on ecotourism initiatives. Approximately 30% of this area in under commercial or subsistence cultivation. Vast areas are mined for vanadium using strip mining, and in recent years mining of gabbro has increased substantially. Erosion very low (56%), moderate (18%) and high (16%) (Mucina & Rutherford 2006). The proposed alternative 2 alignment is not supported from an ecological perspective (least preferred) as it bisects primary montane grassland, steep gorges and rocky cliffs which harbours suitable habitat for several red listed plant and animal species. This is the least preferred alternative from an ecological perspective
- Grasslands in the Mpumalanga and Limpopo Province are highly threatened by afforestation, urbanization, mining and agricultural activities. Only a small fraction of this vital habitat has been formerly conserved. These areas form vital habitats for numerous endemic as well as threatened plant as well as several threatened animal species. All remaining primary grasslands and especially within the higher lying rocky hillslopes and plateaus must be considered as a sensitive environment. These montane grasslands are considered as 'Irreplaceable' Critical Biodiveristy Area (CBA) according to the Mpumalanga Conservation Plan. These are critical areas of the Province from a biodiversity point of view, outside of the protected area network. Some IRREPLACEABLE sites may already be managed carefully and sustainably by well-informed owners with appropriate resources, but there is currently no compelling legal or public pressure for this to be so. Ideally, Conservation Management (Land-Use Type 1) should apply to all IRREPLACEABLE areas (Ferrar *et al.* 2007)
- Activities in all remaining open grasslands must be restricted to the existing servitudes and access roads. Access to surrounding open grassland must be strictly managed to prevent possible poaching, harvesting of medicinal plants and disturbances to remaining fauna. No driving of vehicles through open grassland. No new roads must be created through primary open grassland.

5.2 OHRIGSTAD & SEKHUKUNE MOUNTAIN BUSHVELD

These open and closed woodland or bushveld vegetation units provide important habitat for several endemic plant and tree species as well as suitable habitats for several faunal species (especially reptiles and birds). All remaining large indigenous tree species (>4m) and shrubs (>2m) should be retained wherever possible and the towers and powerline alignment should be shifted to avoid bisecting large of closed woodlands especially adjacent to the Sterkfontein River. Only one alternative is proposed which runs parallel to anexisting powerline servitude. Ideally the alignment should be re-routed approximately 300m to the west of the Sterkfontein River. This area between the Lydenburg-Steelpoort road and the river has become degraded due to historic and current agricultural and mining activities. The alignment should follow existing informal roads and bisect the transformed agricultural lands. Trees form vital habitats for numerous faunal species adapted to their arboreal habitat as well as playing a vital role in erosion stabilization especially within the mid and upper hillslopes which are situated on a shallow soil layer. The soils of the site vary from low erodable to extremely highly erodable; extensive erosion could result without a protective vegetative layer. Habitats such as the open and closed woodlands, scattered low-lying rock outcrops, trees, stumps, termitaria and leaf litter are all vital habitats for numerous animal species. The alignment should ideally avoid these sensitive micro-habitats for remaining faunal species.

5.3 RIDGES AND HILLS



Ridges are characterized 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 (Samways & Hatton, 2000). Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987). Variation in aspect, soil drainage (Burnett *et al*., 1998) and elevation/altitude (Primack, 1995) have 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 the area as well as the rest of Mpumalanga Province. For example, a wide variety of bird groups utilize ridges, koppies and hills for feeding, roosting and breeding. These groups include some owls, falcons, nightjars, swifts, swallows, martins, larks, chats, thrushes, cisticolas, pipits, shrikes, starlings, sunbirds, firefinches, waxbills, buntings, canaries, eagles and vultures.

Ridges provide important habitat for sensitive species such as bats (roosting sites) and the eastern rock elephant shrew. Ridges and kloofs also form caves, an important habitat for highly specialized animals, e.g. bats. Variable microclimate conditions have resulted in a vast array of invertebrate communities associated with the high plant diversity characterizing ridges. Hills and koppies generally have more insects (both in terms of individuals and species) than the immediate surroundings (Samways & Hatton, 2000). All rocky ridges and hills must be considered as a sensitive habitat with unique vegetation as well as fauna. The proposed alternative alignments 1, 2. 3 and to a lesser extent 5a and 5b transverse mountainous slopes as well as deeply incised wooded valleys as well as summits of mountains.

5.4 PERENNIAL RIVERS AND NON-PERENNIAL DRAINAGE LINES OR STREAMS

The perennial rivers including the Sterkfontein River, Waterval River, Jood se Loop, Marabane and Dorps Rivers as well as smaller streams and several non-perennial drainage lines are considered to be of High sensitivity and conservation importance for the following reasons:

- The indigenous vegetation of riverine wetlands within the old Transvaal Province, and wetlands in general throughout the Grassland Biome, is in danger of being completely replaced by alien invasive species (Henderson & Musil 1997, Rutherford & Westfall 1994). Any remaining areas of indigenous riparian vegetation or marshland vegetation within Mpumalanga and Limpopo must therefore be regarded as of high conservation importance.
- Rivers and drainage lines are longitudinal ecosystems, and their condition at any point is a reflection of not only upstream activities, but also of those within adjacent and upstream parts of the catchment (O'Keefe 1986). Any impact on the riverine area within the study area is therefore also likely to impact on upstream and downstream areas.
- Riparian zones have the capacity to act as biological corridors connecting areas of suitable habitat in birds (Whitaker & Metevecchi, 1997), mammals (Cockle & Richardson 2003) reptiles and amphibians (Maritz & Alexander 2007). Riparian zones may act as potential refugia for certain fauna and could allow for possible re-colonisation of rehabilitated habitats. The riparian vegetation plays a vital role in the

re-colonisation of aquatic macro-invertebrates as well as reptiles and amphibians (Maritz & Alexander 2007). The riparian vegetation provides vital refuge, foraging and migratory passages for species migrating to and away from the rivers. The riparian zone comprises plant communities contiguous to and affected by surface and subsurface hydrological features of perennial or intermittent water bodies (rivers and streams).

- The riparian vegetation is dependant on the river for a number of functions including growth, temperature control, seed dispersal, germination and nutrient enrichment. Riparian vegetation comprises a distinct composition of species, often different from that of the surrounding terrestrial vegetation. Tree species are positioned according to their dependence or affinity for water, with the more mesic species (water-loving) being located closest to the river channel, often with their roots in the water, and the less water-loving terrestrial species further away from the river.

The riparian zone, of which vegetation is a major component, has a number of important functions including:

- enhancing water quality in the river by the interception and breakdown of pollutants;
- interception and deposition of nutrients and sediments;
- stabilisation of riverbanks and macro-channel floor;
- flood attenuation;
- provision of habitat and migration routes for fauna and flora;
- provision of fuels, building materials and medicines for communities (if done on a sustainable basis); and
- recreational areas (fishing - rod and line not shade or gill nets; bird watching; picnic areas etc.).
- All the rivers and streams must be considered as sensitive habitats due to ecological functioning as well as providing suitable habitat as well as biological or dispersal corridors for remaining faunal species.

5.5 SUBTROPICAL FRESHWATER WETLANDS

- Indigenous subtropical freshwater marshland vegetation such as that found within the valley bottom wetlands and seasonally inundated floodbeches of the Waterval River and adjacent seasonally inundated depressions/pans in the study area, comprises a habitat which is restricted in extent, highly productive and which contains a high diversity of plants and animals, many of which are restricted or heavily dependant on such habitat. The marshland or seepage vegetation and seasonally inundated depressions comprises the most important habitats, within the study area, for certain threatened animal (Serval, African Bullfrog) and plant species. The red listed "declining" *Crinum bulbispermum* and *Gunnera perpensa* have been recorded within the moist riparian zones to the south of the site.
- The conservation status of many of the faunal species (especially frogs) that are dependant on wetlands reflects the critical status of wetland nationally, with many having already been destroyed. All remaining wetlands (permanent and seasonal) and their associated subtropical hygrophilous vegetation must be considered as a sensitive habitat.

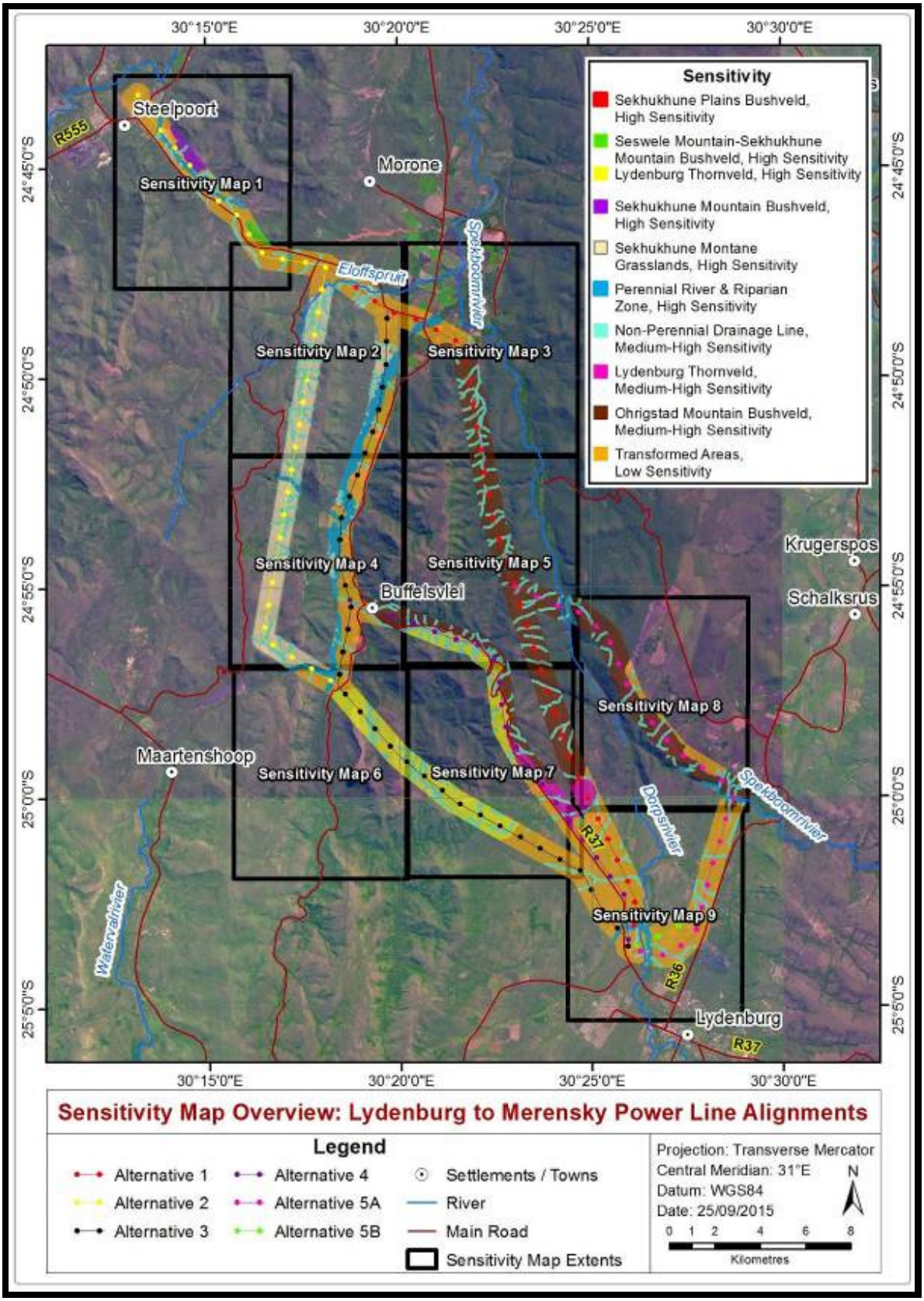
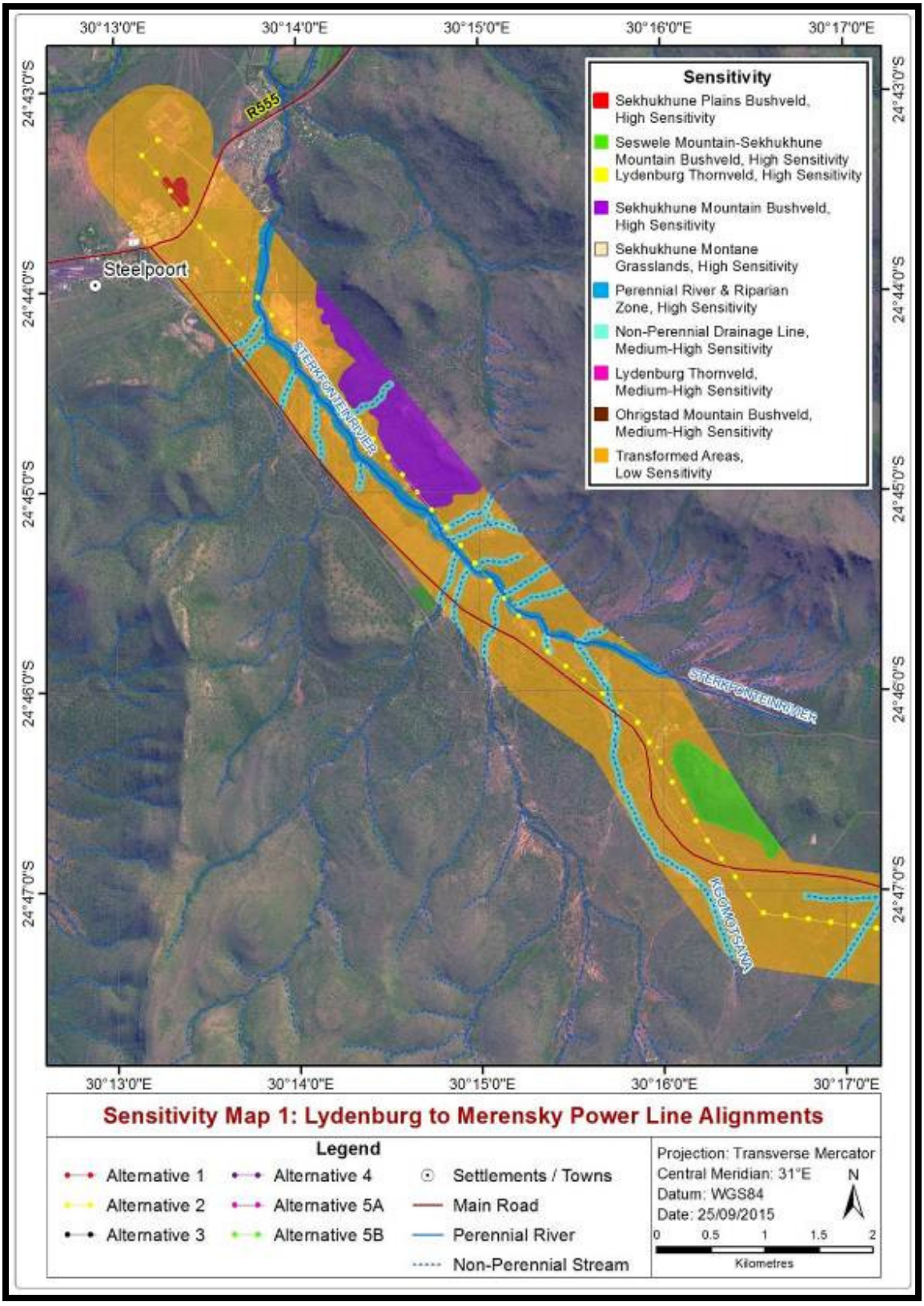


Figure14. An overview of the preliminary sensitivity maps for the Lydenburg-Merensky powerline.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Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
R555
Steelpoort
STERKFONTEINRIVIER
KOMATSAWA
Sensitivity Map 1: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
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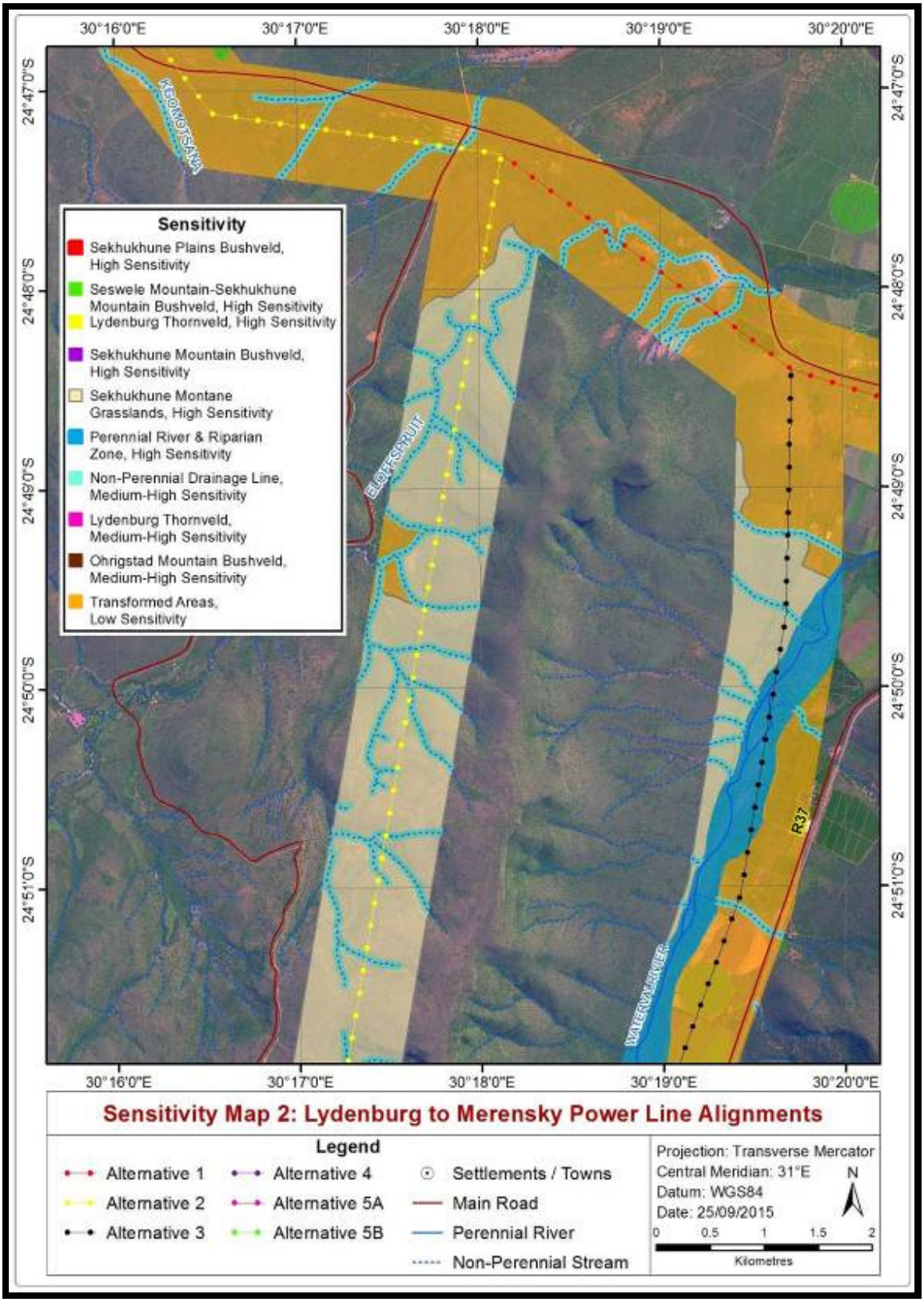
Figure15.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Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
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Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
KOMMISSIE
ELOFFSFRUIT
R37
WATERVALRIVER
Sensitivity Map 2: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
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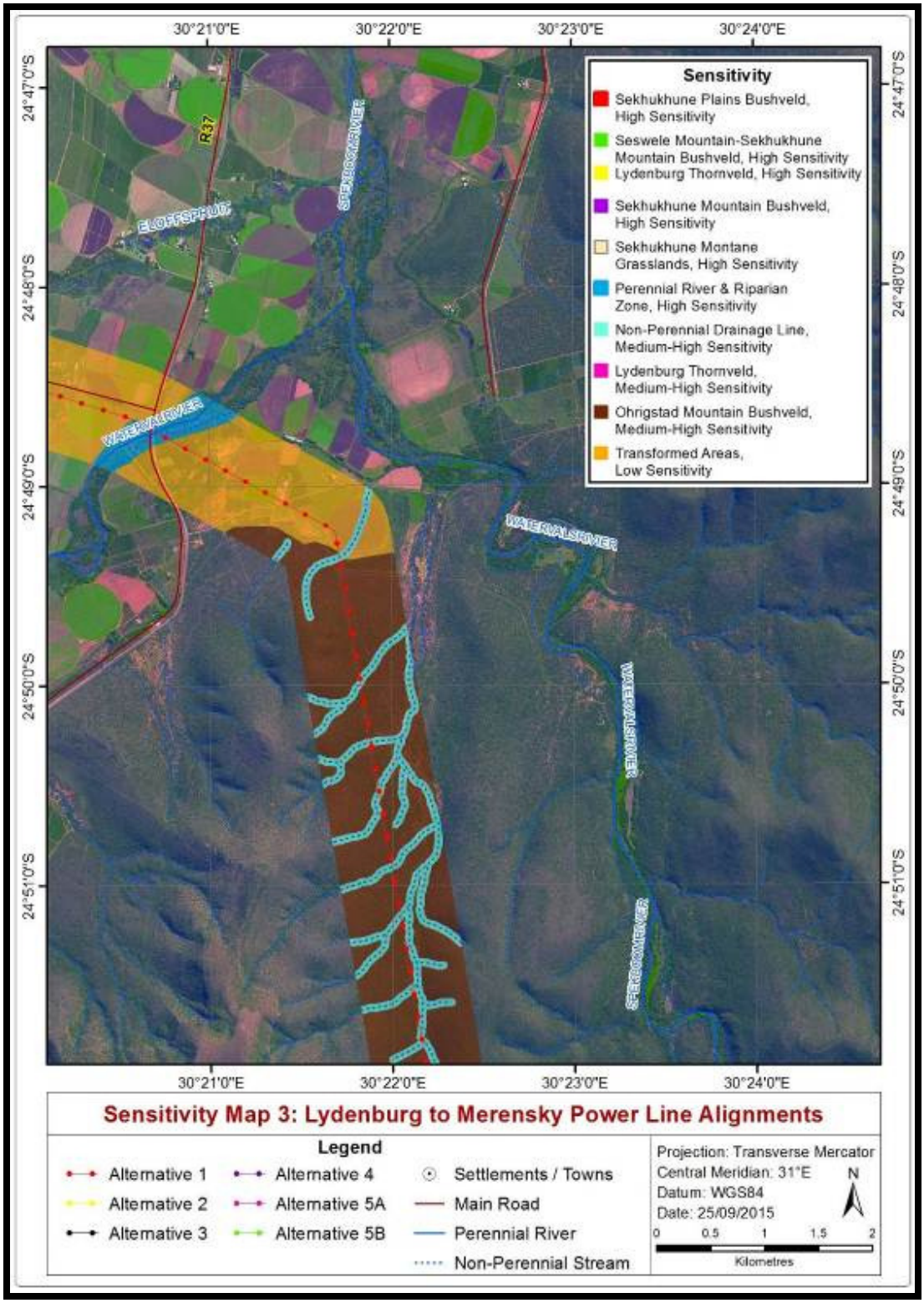
Figure16.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R37
ELOFFSPRUIT
STERKSTROOMRIVER
WATERVALSRIVER
WATERVALSRIVER
WATERVALSRIVER
STERKSTROOMRIVER
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
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Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
Sensitivity Map 3: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
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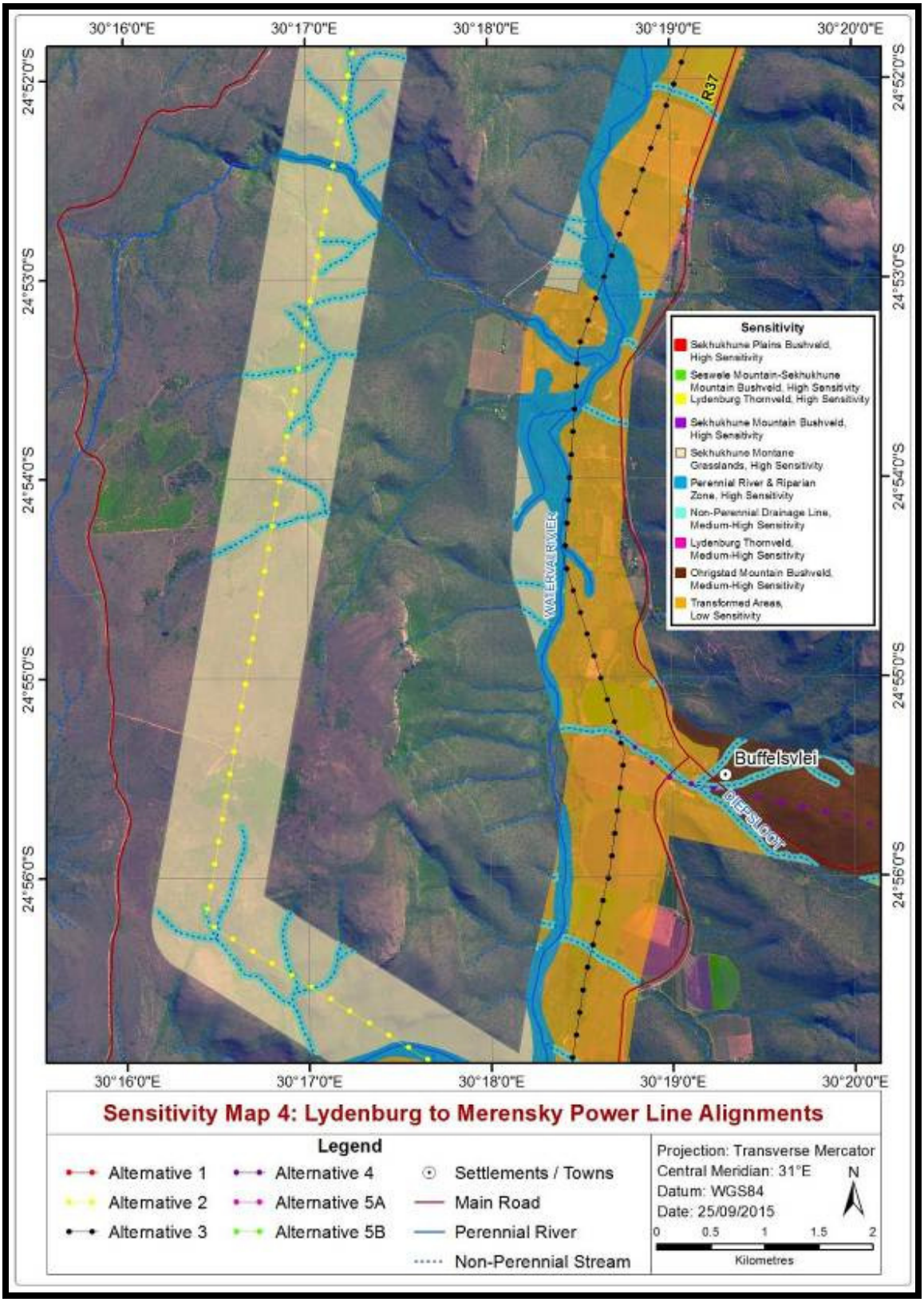
Figure17.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24°55'0"S
24°56'0"S
R37
WATERVAALRIVIER
Buffelsvlei
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
Sensitivity Map 4: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure18.

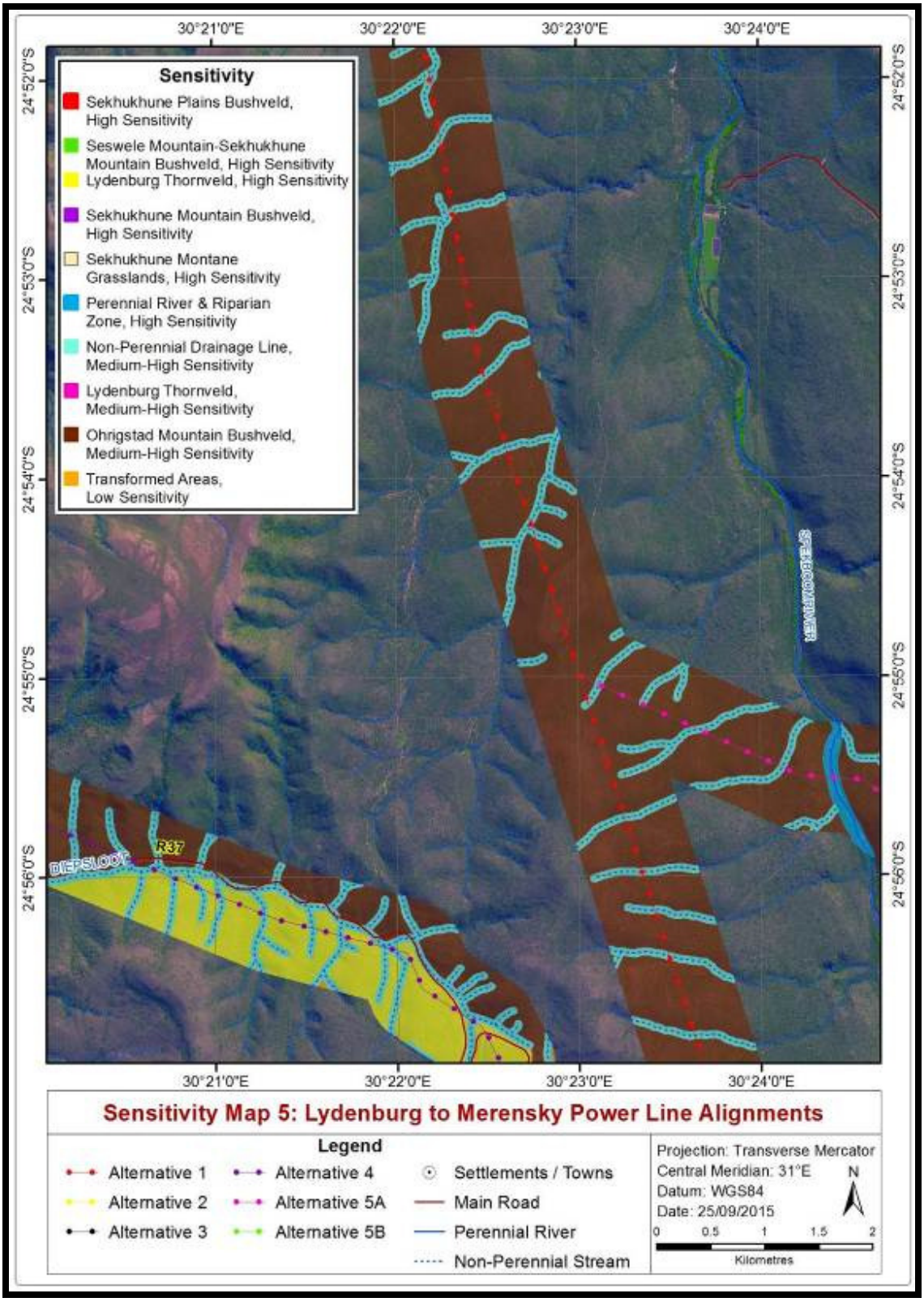
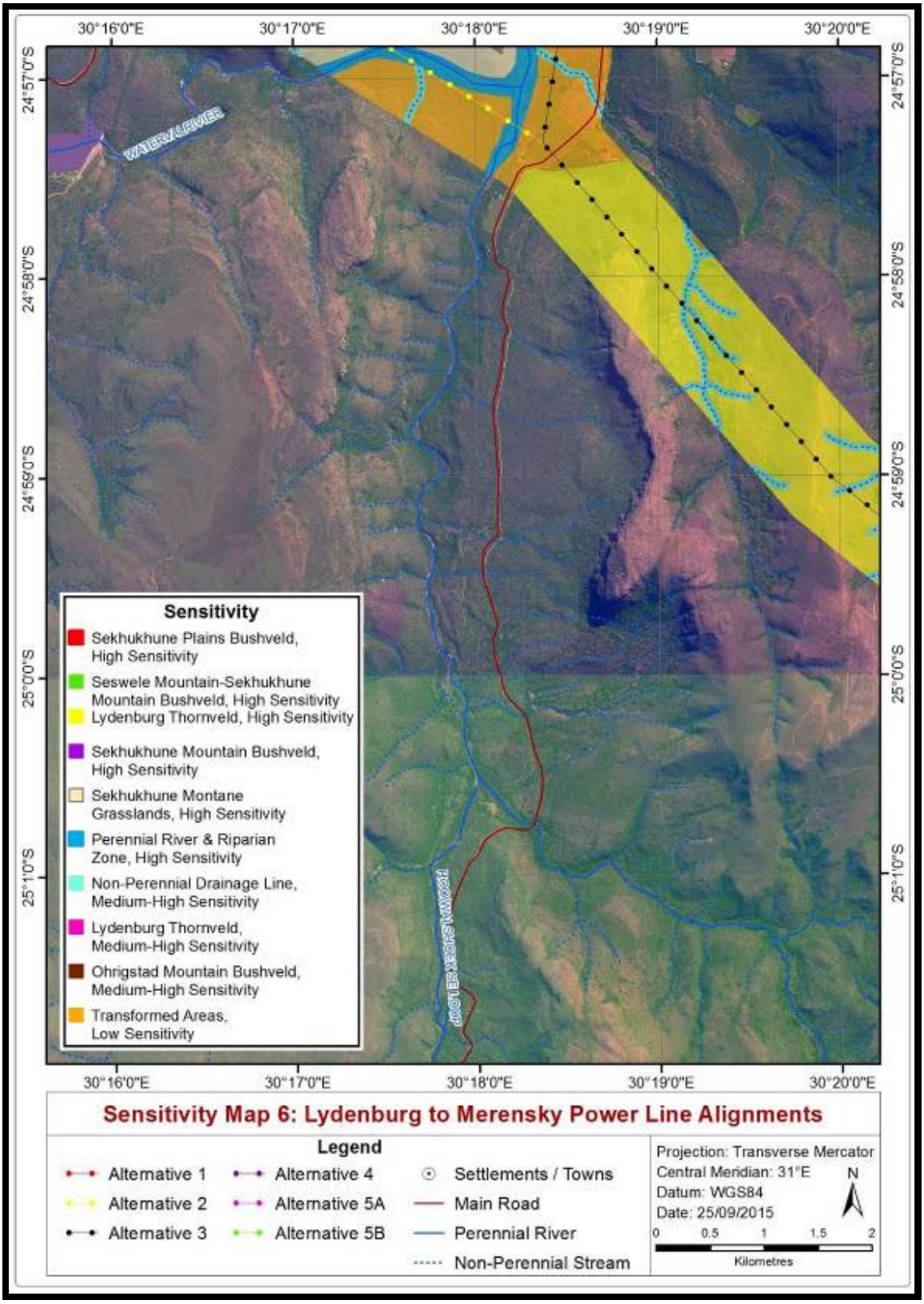

Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
30°21'0"E
30°22'0"E
30°23'0"E
30°24'0"E
24°52'0"S
24°53'0"S
24°54'0"S
24°55'0"S
24°56'0"S
R37
DIEPSLOOT
SEKHOKHUNE
Sensitivity Map 5: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure19.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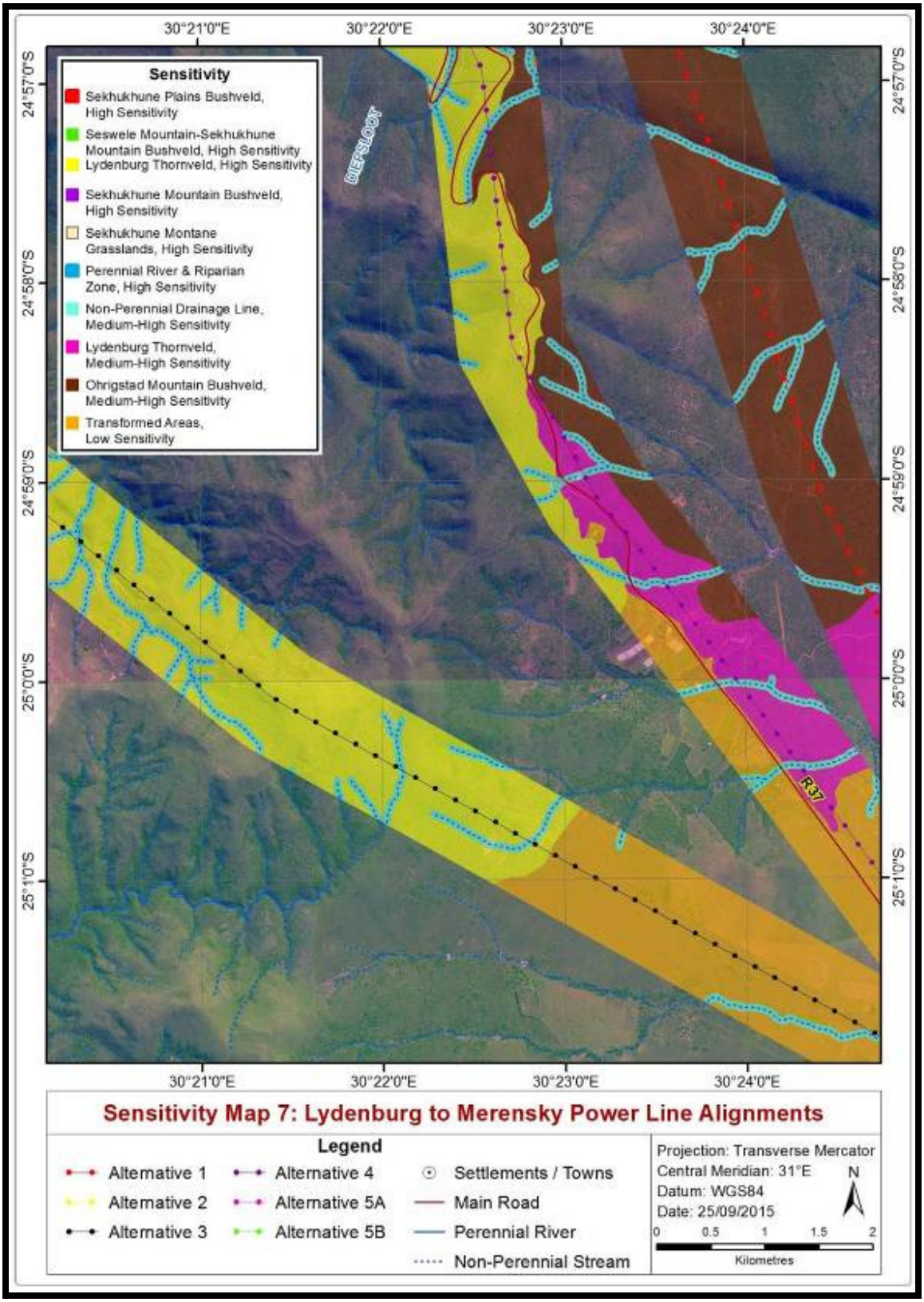
30°19'0"E
30°20'0"E
24°57'0"S
24°58'0"S
24°59'0"S
25°0'0"S
25°1'0"S
WATERVALSPRUIT
PROVINCIAL ROAD P206
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
Sensitivity Map 6: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure20.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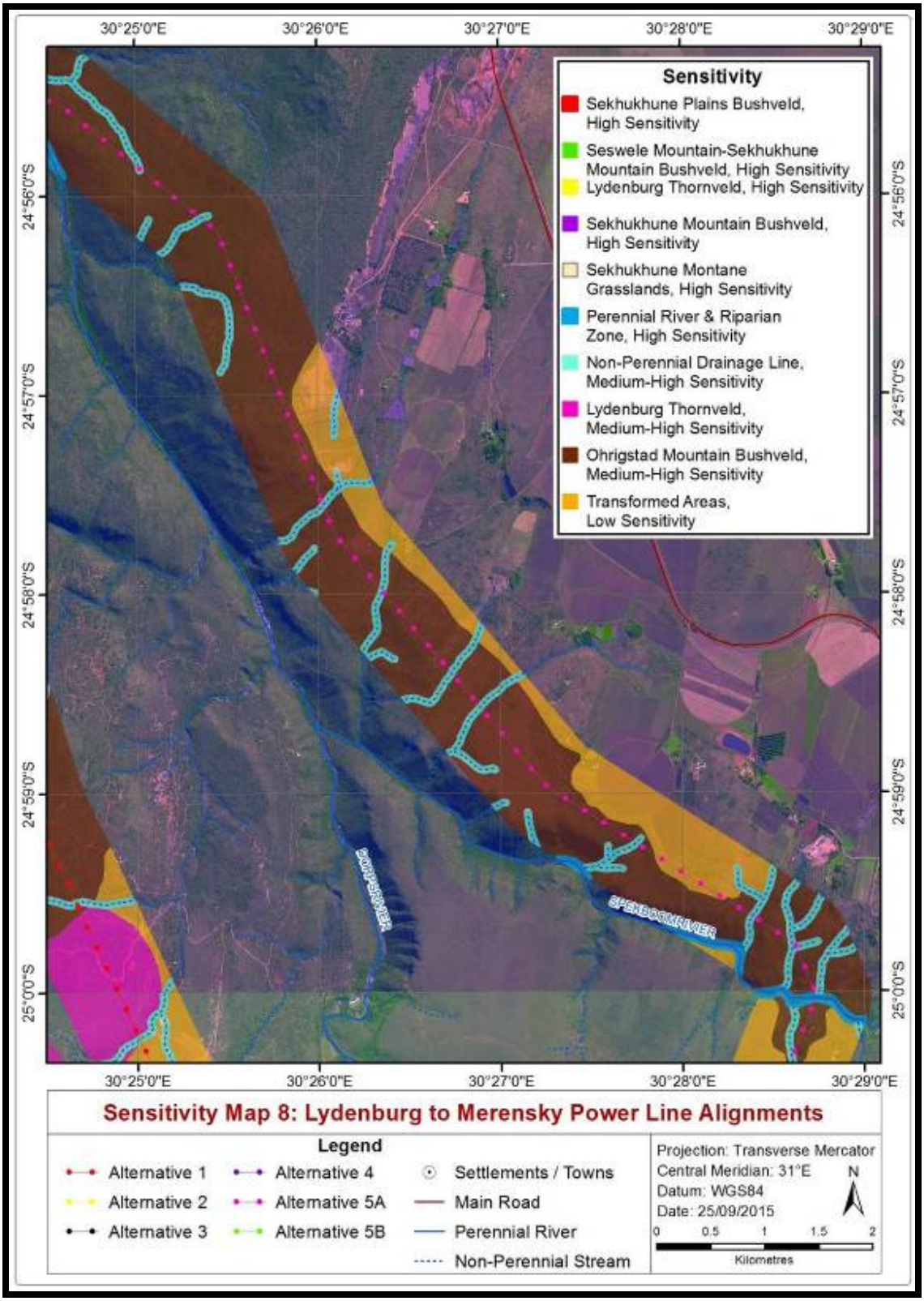
24°57'0"S
24°58'0"S
24°59'0"S
25°0'0"S
25°1'0"S
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
DIEPSLOOT
R37
Sensitivity Map 7: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure21.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24°56'0"S
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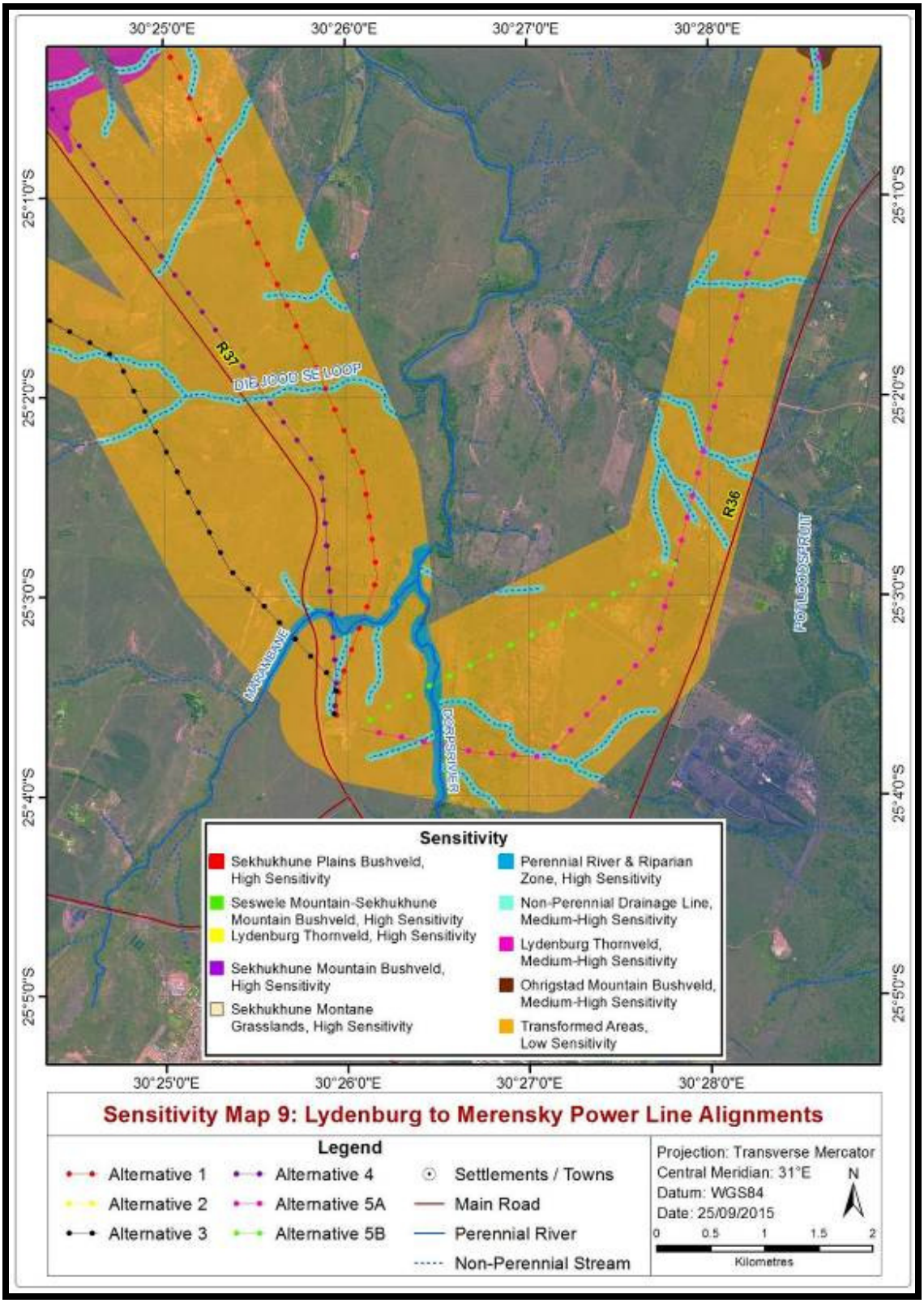
24°59'0"S
25°0'0"S
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
SPEKBOOMRIVER
Sensitivity Map 8: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure22.


30°25'0"E
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30°27'0"E
30°28'0"E
25°10'0"S
25°20'0"S
25°30'0"S
25°40'0"S
25°50'0"S
R37
R36
DIEJOOU SE LOOP
MACADAMIA
DORPSRIVIER
POTLOODSPRUIT
Sensitivity
Sekhukhune Plains Bushveld, High Sensitivity
Seswele Mountain-Sekhukhune Mountain Bushveld, High Sensitivity
Lydenburg Thornveld, High Sensitivity
Sekhukhune Mountain Bushveld, High Sensitivity
Sekhukhune Montane Grasslands, High Sensitivity
Perennial River & Riparian Zone, High Sensitivity
Non-Perennial Drainage Line, Medium-High Sensitivity
Lydenburg Thornveld, Medium-High Sensitivity
Ohrigstad Mountain Bushveld, Medium-High Sensitivity
Transformed Areas, Low Sensitivity
Sensitivity Map 9: Lydenburg to Merensky Power Line Alignments
Legend
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5A
Alternative 5B
Settlements / Towns
Main Road
Perennial River
Non-Perennial Stream
Projection: Transverse Mercator
Central Meridian: 31°E
Datum: WGS84
Date: 25/09/2015
N
0 0.5 1 1.5 2
Kilometres

Figure23.

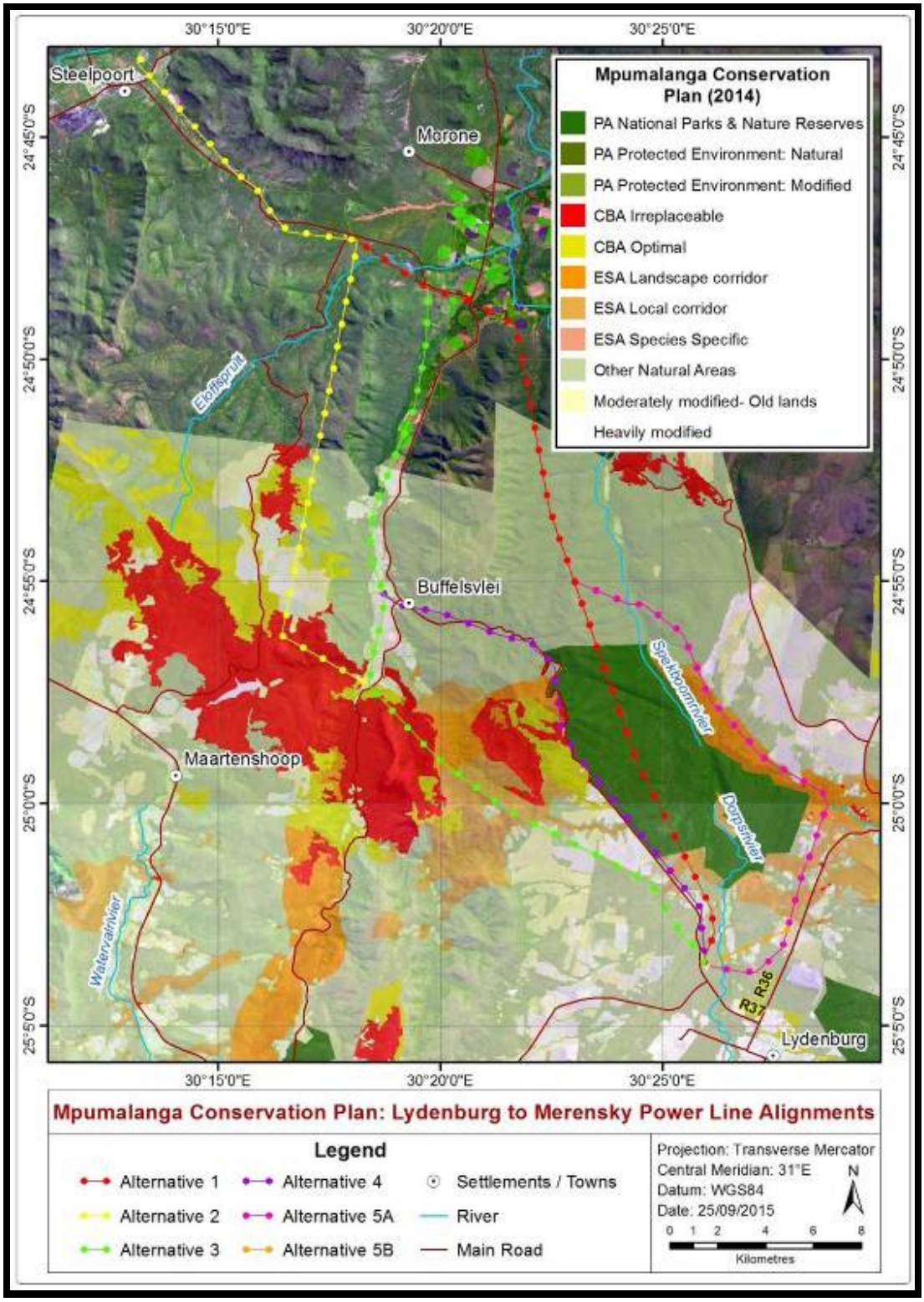

Figure24. The Mpumalanga Conservation Plan (2014) for the Lydenburg-Meresnky alignments.

6. EVALUATION OF THE PREFERRED ALIGNMENTS

As mentioned previously, potential alignments have been identified for the new ~55km 132kV distribution line from the existing Lydenburg Substation to the existing Merensky substation. Factors considered in evaluating and determining the order of preference of the three corridors in terms of vegetation and faunal impacts are listed and discussed below (all approximate measurements were determined with Arcview GIS software):

LYDENBURG-MERENSKY

Line Alternative 1:

- This is the most northerly of the line options from the Lydenburg substation and heads in a north-easterly direction and follows an existing powerline. The proposed new line bisects the Marambana River at approximately 1 km from the substation. The proposed line bisects the Jood Se Loop at 3.1 km.
- The proposed line bisects approximately 27 non-perennial drainage lines as well as running for approximately 6km within a river valley of a tributary of the Spekboom River consisting of Lydenburg Thornveld and Ohrigstad Mountain Bushveld. No formal access roads bisect the mountainous areas as well as the river valley. Informal (4x4) tracks occur within the hillslopes and summit of the mountains.
- The surrounding Lydenburg Thornveld and wooded drainage lines contain suitable habitat for several red listed plant species including several *Hypoxis hemerocallidea* and offer suitable habitat for red listed faunal species.
- The proposed alignment bisects the floodbench and riparian zone of the Waterval River at approximately 29.53 km.
- The proposed alignment bisects the Eloffspruit approximately 32.98 km.
- The alignment then follows the single alternative towards the Merensky substation to the west. This is the **3rd least preferred** or **4th preferred** option from an **ecological perspective** as the alignment bisects the mountainous areas of the Kudu Private Nature Reserve which is classified as a 'Protected Area' (PA) and large natural open Lydenburg Thornveld and Ohrigstad Mountain Bushveld areas.

Line Alternative 2:

- From the Lydenburg substation this alternative is proposed for the alternatives 2 and 3 and runs to the north of the substation for 300m and then deviates towards the north-west for 3.99 km. It bisects the Manamfana River and tributary as well as Jood se Loop
- The alignment then runs in a north-westerly direction through Lydenburg Thornveld for approximately 3.35 km. It runs through Lydenburg Montane Grassland for approximately 9.64 km. Several existing informal tracks occus within the slopes and summits of the mountains. The alignment only bisects 5 small non-perennial drainage lines.
- The alternative alignment 1 heads towards the west of alignment 3 through Sekhukune Montane Grassland as well as Sekhukune Mountain Bushveld for approximately 19.4 km.
- The surrounding grasslands, closed and open wooded ravines, rocky cliffs, hillslope seepage wetlands as well as valley bottoms have a high diversity of habitats as well as offering suitable habitat for several endemic and red listed plant species. This is the **least preferred** option or **sixth preferred option** from an **ecological perspective** as the proposed alignment bisects mountainous areas which have been classified as “Irreplaceable” Critical Biodiveristy Area (CBA) as well as “Optimal” Critical Biodiveristy Area (CBA) with high diversity of endemic and threatened plant and animal species.

Line Alternative 3:

- This alternative follows alternative 2 from the Lydenburg substation for approximately 18 km and then heads in a northerly direction along the Waterval River.
- Large areas adjacent to the proposed alignment have been historically transformed into centre-pivot irrigated lands and citrus orchards.
- The alignment bisects several seasonal tributaries of the Waterval River. The remnant riparian zones are however extremely narrow (<150m) and can easily be spanned by towers. Large areas of the riparian zones have already been cleared or are heavily invaded with alien invasive vegetation.
- The surrounding grasslands, closed and open wooded ravines, rocky cliffs, hillslope seepage wetlands as well as valley bottoms have a high diversity of habitats as well as offering suitable habitat for several endemic and red listed plant species. This is the **second least preferred** option or **fifth preferred option** from an **ecological perspective** as the proposed alignment bisects mountainous areas as the proposed alignment bisects mountainous areas which have been classified as “Irreplaceable” Critical Biodiveristy Area (CBA) as well as

"Optimal" Critical Biodiveristy Area (CBA) with high diversity of endemic and threatened plant and animal species with high diversity of endemic and threatened plant and animal species.

Line Alternative 4

- This alternative heads north and then north-east from the Lydenburg substation and bisects a small non-perennial line at approximately 400 m and the Manamfana River at 875 m.
- The alignment is siatuated adjacent to the R37 and bisects Lydenburg Thornveld in various stages of transformation and degradation for approximately 6.2km.
- The alignment runs on the western boundary of the Kudu Private Nature Reserve for approximately 4.9 km which displays a more natural representative of Lydenburg Thornveld as well as several wooded non-perennial drainage lines.
- The alignment bisects open Ohrigstad Mountain Bushveld for approximately 7.5km and several wooded non-perennial drainage lines and ravines.
- The alignmens joins the alternative 3 alignment at the foothills of the Waterval River within transformed agricultural lands.
- As a large section of the the alignment is siatuated within a privately owned nature reserve or 'Protected Area' (PA) as well as bisecting natural Ohrigstade Mountain Bushveld and wooded ravines and non-perennial drainage lines this is the **3rd preferred option** from an **ecological perspective**.

Line Alternative 5a

- This alignments heads in an easterly direction from the Lydenburg substation through Lydenburg Thornveld displaying various levels of transformation and degradation and bisects three small tributaries or non-perennial drainage lines of the Dorps River at 500 m, 733 m and 1739 m.
- The alignment turns towards the north for approximately 6.8 km and bisects agricultural small-holdings as well as four narrow non-perennial tributaries of the Dorps River.
- The alignment turns towards the north-west and bisects Ohrigstad Mountain Bushveld which is classified as a Landscape 'Ecological Support Area" (ESA) as well as 13 narrow non-perennial drainage lines. The non-perennial drainage lines are not heavily wooded and will result in minimal riparian vegetation clearance. The alignment runs on the plateau adjacent to existing mining operations as well as informal access roads. The alignment avoids the sensitive rocky wooded ravines adjacent to the lower-lying non-perennial drainage lines.

- The alignment joins up with alternative 1 and bisects 17 narrow non-perennial drainage lines and follows an existing powerline servitude through the mountainous areas.
- This is the **second preferred** option from an **ecological perspective** as the alignment bisects transformed Lydenburg Thornveld and adjacent to existing access roads as well as powerline servitude which will ameliorate the potential impacts of new access roads and further vegetation clearance.

Line Alternative 5b

- This alignments heads in an easterly direction from the Lydenburg substation through Lydenburg Thornveld displaying various levels of transformation and degradation and bisects only one tributary or non-perennial drainage lines of the Dorps River at 795m. The vegetation has been transformed into agricultural lands and agricultural small-holdings.
- The alignment turns towards the north for approximately 6.8 km and bisects agricultural small-holdings as well as four narrow non-perennial tributaries of the Dorps River.
- The alignment turns towards the north-west and bisects Ohrigstad Mountain Bushveld as well as 13 narrow non-perennial drainage lines. The non-perennial drainage lines are not heavily wooded and will result in minimal riparian vegetation clearance. The alignment runs on the plateau adjacent to existing mining operations as well as informal access roads. The alignment avoids the sensitive rocky wooded ravines.
- The alignment joins up with alternative 1 and bisects 17 narrow non-perennial drainage lines and follows an existing powerline servitude through the mountainous areas.
- This is the **preferred** option from an **ecological perspective** as the alignment bisects transformed Lydenburg Thornveld and adjacent to existing access roads as well as powerline servitude which will ameliorate the potential impacts of new access roads and further vegetation clearance. Although the alignment bisects Ecological Support Areas or biological corridors within a local and landcape scale; the alignment does not bisect a 'Critical Biodiveristy Area' (CBA) or 'Protected Area'.

In order to rank these alternatives a table was compiled and the three corridors given a rating on a scale of 1 to 5, with 1 being the least preferred and 5 being the most highly preferred option.

Table5: Preference rating for the 5 Uitkoms to Kliphoek alternative alignments.

Line Alternative	Preference Rating
1	2.5
2	1
3	1.5
4	3
5a	4
5b	4.5

As can be seen from the discussions and table above, line **alternative 5b** is slightly preferred over **alternative 5a**. This is because it only bisect one non-perennial drainage line or tributary of the Dorps River adjacent to the Lydenburg substation where Alternative 5a bisects three. **Alternative 2** and **Alternative 3** bisect large portions of mountainous grassland areas which are classified as "Irreplaceable" Critical Biodiversity Areas (CBA) and are the **least favourite** alternatives from an ecological perspective. **Alternatives 1** and **Alternative 4** bisect more natural representatives of Lydenburg Thornveld as well as Orighstad Mountainous bushveld as well as the private Kudu Nature Reserve or 'Protected Area' (PA). An alternative alignment is recommended for the section of the alignment towards the Merensky substation adjacent to the Stekfontein River. This area has a high diversity of plants, shrubs and trees as well as offering suitable habitat for several red listed faunal species. The proposed alignment follows an existing alignment which has resulted in the complete removal of the shrub and tree layer. This has a high visual as well as ecological impact associated vegetation and faunal communities (especially arboreal and closed woodland species)

Figure25. Only one alternative alignment occurs adjacent to the Sterkfontein River towards the Merensky substation. The proposed alignment should be shifted approximately 200-300 m to the west of the Sterkfontein River and bisect the transformed bushveld areas. The existing servitude has resulted in the clearance of all shrubs and tree layer. High diversity of endemic plant, shrub and tree species occur in this area.

7. GENERIC DESCRIPTION OF POTENTIAL IMPACTS OF POWER LINES ON ASSOCIATED FAUNA

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in Southern Africa are electrocution of birds (and other animals) and disturbance and habitat destruction during construction and maintenance activities.

7.1 Habitat destruction and disturbance

During the construction phase and maintenance of powerlines, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on fauna breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity.

Mitigation and Recommendations

The following general recommendations are made to minimise the impacts of powerline construction on the vegetation as well as associated fauna:

- As a precautionary measure a summer walkthrough should be conducted during the EMP phase of the project by a suitably qualified botanist. The walkthrough should be conducted along the entire preferred alignment through any primary Lydenburg Montane Grassland, Lydenburg Thonveld, Ohrigstad Mountain Bushveld, Sekhukune Montane Grassland, Sekhukhune Mountain Bushveld and Sekhukune Plains Bushveld as well as proposed tower positions in order to identify any rare or threatened plant species as well as to provide ‘in situ’ or ‘ex situ’ mitigatory measures such as rescue and recovery programme undertaken in conjunction with relevant conservation authorities.
- As a precautionary measure a walk through conducted during the wet summer months of the preferred alignment as well as tower positions should be conducted during the EMP phase of the project by a suitable qualified zoologist; in order to ascertain for the presence of any animal species within or in close proximity to the construction areas (tower supports) for the presence of any

animal burrows (including spiders and scorpions), rocky outcrops, logs, stumps and other debris and relocate any affected animals to appropriate habitat away from the servitude or tower.

- Close site supervision must be maintained during construction.
- During the **CONSTRUCTION** phase workers must be limited to areas under construction and access to the undeveloped areas, especially the surrounding open areas must be strictly regulated ("no-go" areas during construction activities).
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) water in the area. Mobile toilets must be provided in order to minimise unauthorised traffic of construction workers outside of the designated areas.
- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the site to prevent further invasion.
- Access to the powerline servitude must be restricted. Access to the powerline servitude should ideally be fenced off and gated along the main access roads. No quad-bikes, motorcycles or off road vehicles and illegal hunting should be permitted in the adjacent properties.
- Firearms or any other hunting weapons must be prohibited on site.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Educational programmes for the contractor's staff must be implemented to ensure that project workers are alerted to the possibility of snakes being found during vegetation clearance. The construction team must be briefed about the management of snakes in such instances. In particular, construction workers are to go through ongoing refresher courses to ensure that threatened snakes, such as pythons, are not killed or persecuted when found.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm wild animals.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.
- No specific recommendations are made for the protection of burrowing red data mammals. Consideration could be given to rescuing the animals where there burrows are found in advance of construction. This is not recommended as a general prescription since the chances of digging out live Aardwolf or Antbear are small. Aardwolf are likely to vacate their burrows in the face of the advancing construction. There is also a risk associated with capturing animals dug out of

burrows, and holding them in captivity. If a section of many active burrows is found then mitigation could be considered (minor deviation to the powerline alignment or rescue operation for the animals).

7.2 VEGETATION/FLORA

Protected or endangered species occur along the proposed alignments. Special care should be taken not to damage or remove any such species unless absolutely necessary. Permits for removal must be obtained from Provincial Nature Conservation should such species be affected. All plants not interfering with the operation of the line shall be left undisturbed. Collection of firewood and traditional medicinal plants is strictly prohibited. No area should be cleared of trees, bushes and other vegetation for the purpose of a camping site.

Management objective

- Minimal disturbance to vegetation where such vegetation does not interfere with construction and operation of the line
- No unnecessary destruction to surrounding vegetation
- Protection of any protected or endangered plant species
- Prevention of litigation concerning removal of vegetation

Measurable targets

- Adequate protection of any endangered or threatened plant or tree species
- No litigation due to removal of vegetation without the necessary permits

Mitigation and recommendation

A rescue and recovery programme should be initiated for any rare or threatened plant species occurring within the construction area of the pylons. Remaining indigenous bulbous geophytes and Aloes should be retained or replanted wherever possible. Where herbicides are used to clear vegetation, specimen-specific chemicals should be applied to individual plants only. General spraying should be prohibited.

All alien vegetation should be eradicated over a five-year period. Invasive species should be given the highest priority. No dumping of any materials in undeveloped open areas and neighbouring properties. Activities in the surrounding open undeveloped areas (especially open grasslands, closed and open bushveld, seasonal streams and rivers) must be strictly regulated and managed.

The construction of the proposed 132kV powerline will result in extensive opening-up of the vegetal cover especially within the Sekhukhune and Ohrigstad Mountain Bushveld vegetation units during the construction phase. The opening up of existing vegetated areas, thereby creating corridors along which animals can move, may result in increased predation levels on small mammals, reptiles, amphibians, arachnids and scorpions along these corridors. The limitation of the disturbance of vegetation cover as well as any rocky outcrops, logs, stumps, termite mounds within sensitive areas will ameliorate this impact. Impact will be short-long term depending on the amount of vegetation to be cleared. Excessive habitat destruction during construction could reduce the amount of habitat available. This impact is anticipated to be localised, of a long-term nature and of medium significance, provided that appropriate mitigation measures are implemented (e.g. the limitation of vegetation clearance within sensitive areas as well as an alternative alignment through the Olifantspoortjie section).

7.3 VEGETATION CLEARANCE

Management objective

- Minimise damage to surrounding vegetation
- Minimise damage to topsoil
- Successful rehabilitation of barren areas

Measurable targets

- No damage to vegetation outside the powerline servitude
- No loss of topsoil
- No visible erosion three months after completion of the contract
- All disturbed areas successfully rehabilitated three months after completion of the contract

The object of vegetation clearing is to trim, cut or clear the minimum number of trees and vegetation necessary for the safe mechanical construction and electrical operation of the distribution line. Only an 8 m strip may be cleared flush with the ground to allow vehicular passage during construction. No scalping shall be allowed on any part of the servitude road unless absolutely necessary. The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed.

Vegetation clearing on tower sites must be kept to a minimum. Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. Any vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower.

No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river- and stream banks (riparian zone) except for the removal of alien invasive species such as Black Wattle (Acacia mearnsii*), Syringa (Melia azedarach*), White Mulberry (*Morus alba**) . Vegetation shall only be cut to allow for the passage of the pilot-cables and headboard. Trees and vegetation not interfering with the statutory clearance to the conductors can be left under the line. Dense vegetation under the line which could cause a fire hazard, particularly in the middle third of the span in the vicinity of the lowest point of the conductors, will be considered as a separate case. With permission of the landowner, the total servitude under the line and up to 5m outside the outer phases can be cleared.

Protected or endangered species of plants shall not be removed unless they are interfering with a structure. Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation. All protected species not to be removed must be clearly marked and such areas fenced off if required.

Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. It must be added that certain of the vegetation units cannot be successfully rehabilitated including Sehukhune Mounatin and Plains Bushveld.

The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier’s specifications.

Upon completion of the stringing operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the line shall be removed / cut down. All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. Ideally the mowing or cutting of grasses should be restricted to the transformed grassland areas and not within the valley bottom wetlands and hillslope seepage areas. The removal of rank grassland vegetation could have a potentially negative impact on secretive species such as the African Grass Owl which prefers rank grassland for nesting and roosting activities.

It is recommended that a contractor for vegetation clearing should comply with the following parameters:

- the contractor must have the necessary knowledge to be able to identify protected species as well as species not interfering with the operation of the line due to their height and growth rate.
- the contractor must also be able to identify declared weeds and alien species that can be totally eradicated.
- the contractor must be in possession of a valid herbicide applicators license.

7.4 REVEGETATION

Where necessary a suitable mixture of grass seed shall be used to re-seed damaged areas. Badly damaged areas shall be fenced in to enhance rehabilitation. Areas to be rehabilitated must be planted with a mixture of endemic pioneer grass species endemic to the area, as soon as the new growing season starts. To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the Dept of Agriculture. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the Environmental Control Officer, unless specifically requested by a Landowner.

Management objective

- Minimise damage to topsoil and environment at tower positions
- Successful rehabilitation of all damaged areas
- Prevention of erosion

Measurable targets

- No loss of topsoil due to construction activities
- All disturbed areas successfully rehabilitated within three months of completion of the contract
- No visible erosion scars three months after completion of the contract

A mixture of seed can be used provided the mixture is carefully selected to ensure the following:

a) Annual and perennial plants are chosen.
b) Pioneer species are included.
c) All the plants shall not be edible.
d) Species chosen will grow in the area without many problems.
e) Root systems must have a binding effect on the soil.
f) The final product should not cause an ecological imbalance in the area.

CONSTRUCTION PHASE

- Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion.
- Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer.

7.5 Surrounding Farming Activities

Domestic Livestock

Construction activities must be planned carefully so as not to interfere with the calving and lambing season for most animal species. The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners. Interference with any wildlife without the applicable permits shall not be allowed. The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities. Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner. Speed limits must be restricted especially on farm roads (30km/hr) preventing unnecessary road fatalities of surrounding livestock.

Management objective

- Minimise disruption of surrounding farming activities
- Minimise disturbance of fauna
- Minimise interruption of breeding patterns of fauna

Measurable targets

- No hunting and poaching or intentional killing of animals (including snakes, scorpions, spiders)
- No stock losses where construction is underway
- No complaints from Landowners or Nature Conservation
- No litigation concerning stock losses and animal deaths

7.6 ACCESS ROADS

Planning of access routes must be done in conjunction between the Contractor, Eskom and the Landowner. All access to private farmland must be negotiated in advance with land-owners. All agreements reached shall be documented in writing and no verbal agreements should be made. The condition of existing access / private roads to be used shall be documented with photographs.

The Contractor shall properly mark all access roads. Markers shall show the direction of travel as well as tower numbers to which the road leads. Roads not to be used shall be marked with a "**NO ENTRY**" sign. Unnecessary traversing of agricultural and natural open land is discouraged. Where required, speed limits shall be indicated on the roads (30km). All speed limits shall be strictly adhered to at all time.

Vehicle access to the powerline servitude must as far as possible be limited to existing roads. If a new access roads need to be constructed it should follow cleared areas such as cattle pathways.

7.7 DANGEROUS ANIMALS

Numerous dangerous wild animals and arachnids and scorpions occur around the substation site and along the proposed loop-in-line and thus safety measures must be implemented to ensure the safety of the contractors and sub-contractors.

ARACHNIDS

During the construction phase care must be taken not to destroy any trap-door or baboon spider burrows. Prior to excavations a thorough inspection of the cleared areas must be undertaken to determine the presences of any baboon spider burrows, loosely embedded rocks or stumps in the proposed cleared areas. Several species of Baboon and Trapdoor species have been recorded in the area.

Conservation

Of the mygalomorphs, it is mainly the larger Baboon Spiders that are in great demand as pets and are consequently regarded as commercially threatened by the International Union for Conservation of International Trade in Endangered Species (CITES) (De Wet & Schoonbee 1991). The genera *Ceratogyrus, Harpactira* and *Pterinochilus* were added to schedule V11 of the Transvaal Provincial Nature Conservation Ordinance of 1983 as Protected Invertebrate Animals. Eskom must ensure that no baboon spiders are illegally collected or intentionally destroyed throughout all stages of the project.

Scorpions

Several species of scorpions are recorded from the area. These scorpions construct burrows or scrapes under rocks as well as found under loose bark, wood piles and other surface debris. The majority of these scorpions possess a painful sting they are not of medical importance except *Parabuthus spp.* which are amongst South Africa's most venomous scorpion species. Care should be taken when removing stumps, logs or rock material. Any scorpions encountered on the site should be left alone and allowed free access away from the activity or safely removed from the area. No scorpions should be intentionally killed. Standard precautions or safety measures includes wearing sturdy leather boots and gloves in the field and close inspection of sleeping areas and bedding, clothes, shoes etc. for any scorpions. Stings from mildly venomous scorpions cause localised pain and swelling, with little systematic reaction. The affected limb should be immobilized and an ice pack should be applied, if possible, to the site of the sting. The site of the sting should be cleaned and never cut open. Venom sprayed in the eyes (certain *Parabuthus* species are able to spray venom) produces an intense burning sensation and may result in temporary blindness if the eyes are not washed out thoroughly with clean water or some other neutral liquid such as milk

SNAKES

Several venomous snake species occur along the proposed route including Southern or Bibron's Burrowing Asp (*Actractaspis bibronii*), Mozambique Spitting Cobra (*Naja mossambica*), Puff Adder (*Bitis arietans*), Rinkhals (*Haemachatus haemachatus*), Common or Rhombic Night Adder (*Causus rhombeatus*). General avoidance of snakes if the best policy if encountered. Snakes should not be harmed or killed and allowed free movement away from the area. Safety precaution measure must be implemented especially during the vegetation clearance phase which could result in encounters with several venomous snake species. Appropriate foot wear (sturdy leather boots) should be worn in the field.

7.8 Fire Prevention

The frequent burning of the vegetation will have a high impact on remaining reptile species. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Management objective

- Minimise risk of veld fires
- Minimise damage to grazing
- Prevent runaway fires

Measurable targets

- No veld fires started by the Contractor's work force
- No claims from Landowners for damages due to veld fires
- No litigation

Mitigation and recommendations

No open fires shall be allowed on site under any circumstance. The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.

7.9 Threatened animals

At a local scale the study site and surrounding areas comprises suitable habitat for certain threatened animal species including Giant Bullfrog, Ground Pangolin, Aardvark, Aardwolf, Striped Harlequin Snake, Yellow-bellied House Snake, Breyer's Long-Tailed Seps. The high levels of habitat transformation as well as anthropogenic activities around the preferred alternative alignment 3; significantly reduces the likelihood of any major populations of threatened faunal species. Activities within open grassland and bushveld, palustrine wetlands including valley bottom wetlands, seasonally inundated drainage lines and perennial rivers and associated riparian zones must be strictly managed ("no-go" areas).

Mitigation and recommendations

As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an independent environmental control officer should be made aware of the possible presence of certain threatened animal species (Giant Bullfrog, Striped Harlequin Snake, Yellow-bellied House Snake) prior to the commencement of construction activities. In the event that any of the above-mentioned species are discovered relevant conservation authorities should be informed and activities surrounding the site suspended until further investigations have been conducted.

8. IMPACT RANKING OF POTENTIAL IMPACTS TO ASSOCIATED FAUNA

The activities associated with a given development project may have impacts during the construction and/or operational phases. In this report, the assessment of impacts was divided into three phases associated with a project. These are i) the *status quo* or present situation taking consideration of existing impacts not associated with the proposed development, ii) the *construction phase* including surveying and other activities associated with the planning of the project, construction and all the activities associated with construction until the contractor leaves the site and iii) the *operational phase* which includes all activities associated with the operation and maintenance of the proposed development. The criteria against which the activities were assessed are presented below.

Assessment criteria

Extent of the impact:

The spatial scale of the impacts are described as either:

- local (i.e. within the boundaries of the alignment or site),
- regional (i.e. the impact could affect the greater Lydenburg-Steelpoort area and other nearby towns and villages, conservation areas etc.), or
- national (i.e. South Africa)

Intensity of the impact

The intensity or severity of the impacts within the context of all the activities and other impacts associated with the project and is indicated as either:

- **low** (i.e. where the impact affects the environment in such a way that physical, biological, cultural, social and economic functioning and processes are not affected),
- **medium** (i.e. where the affected environment is altered but physical, biological, cultural, social and economic functioning and processes continue albeit in a modified way), or
- **high** (where physical, biological, cultural, social and economic functioning and processes are altered to the extent that they will temporarily or permanently cease).

Probability of occurrence

The likelihood of the impact actually occurring throughout or during any stage of the life cycle of the activity, is indicated as either:

- **improbable** (the possibility of the impact materialising is very low as result of design or historic experience),
- **probable** (there is a distinct possibility that the impact will occur and mitigation measures are required),
- **highly probable** (it is most likely that the impact will occur), or
- **definite** (the impact will occur regardless of the implementation of any prevention measures and mitigatory measures are required to contain the effect).

Duration of the impact

The life span of the impact is described as either:

- **short term**, the impact will either disappear with mitigation or will be mitigated through natural processes (0-5 years),
- **medium term** (6-15 years),
- **long term** (where the impact will last the entire operational life of the powerline, but would be mitigated by direct human action or by natural processes thereafter), or
- **permanent** (the impact will persist beyond the operational life of the powerline).

Significance of the impact

Based on a synthesis of the information contained in points i - iv above, the potential impacts are assessed in terms of the following significance criteria:

- **low** (i.e. where the impact would not have any influence on the decision to continue with the proposed project)
- **moderate** (i.e. where the impact should influence the decision to continue with the proposed development in the area unless it is effectively mitigated to acceptable levels),
- **high** (i.e. where the impact must influence the decision to continue with the proposed development regardless of any mitigation measures).

Table6. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 1 alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of Protected or rare plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-High	Medium
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium-High	Medium
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium-High	Medium
Increased Human Presence	Medium-Low	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-low	Local	Definite	Short-term during construction and maintenance	Medium-High	Medium
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and adjacent grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

Table7. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 2 alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of rare or protected plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-High	Medium
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium-High	Medium
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium-High	Medium
Increased Human Presence	Medium-Low	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium
Vegetation Clearance	Medium-low	Local	Definite	Short-term during construction and maintenance	Medium-High	Medium
Re-vegetation	Medium-Low	Local	Probable	Short duration	High	Medium
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

Table8. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 3 alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of rare or protected plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-Low	Low
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium	Medium-Low
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-High	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-High	Local	Definite	Short-term during construction as well as maintenance	Medium-High	Medium-Low
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

Table9. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 4 alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of rare or protected plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-Low	Low
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium	Medium-Low
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-High	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-High	Local	Definite	Short-term during construction as well as maintenance	Medium-High	Medium-Low
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

Table10. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 5a alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of rare or protected plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-Low	Low
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium	Medium-Low
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-High	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-High	Local	Definite	Short-term during construction as well as maintenance	Medium-High	Medium-Low
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

Table11. Summary table of ranking of potential impacts of the proposed Lydenburg-Merensky 132kV Alternative 5b alignment on vegetation and associated fauna.

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of rare or protected plant species	Medium-Low	Localized along powerline and access roads servitude.	Probable	Short-Long Term during construction and maintenance	Medium-Low	Low
Loss of Faunal Habitat	Medium-High	Localized along powerline and servitude.	Definite	Short-long term	Medium	Medium-Low
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-High	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-High	Local	Definite	Short-term during construction as well as maintenance	Medium-High	Medium-Low
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

9. REFERENCES

ACOCKS, J.P.H. 1988. *Veld Types of South Africa*. Memoirs of the Botanical Survey of South Africa, No.57: 1-146. Botanical Research Institute, Pretoria.

BISHOP, P. 1996. *Arena: Friends in Low Places*, Vol.3 No. 8. TA Publications, University of the Witwatersrand, Private Bag 3, WITS, 2050.

BRANCH, W.R. 1988. *Field Guide to the Snakes and other Reptiles of Southern Africa*. Struik Publishers, Cape Town.

BRONNER, G.N. 1996. Geographic patterns of morphometric variation in the Hottentot golden mole, *Amblysomus hottentotus* (Insectivora: Chrysochloridae). A multivariate analysis. *Mammalia* 60(4): 729-751.

BRONNER, G.N. 2000. New species and subspecies of Golden Mole (Chrysochloridae: *Amblysomus*) from Mpumalanga, South Africa. *Mammalia,* 64: 41-54.

CARRUTHERS, V.C. 2001. *Frogs and Frogging in South Africa*. Struik Publishers, Cape Town.

COOK, C.L. 1996. *Aspects of the breeding biology and ecology of the Giant Bullfrog Pyxicephalus adspersus*. Unpublished MSc. Thesis, University of Pretoria, Pretoria.

DE GRAAF, G. 1981. *The rodents of southern Africa*. Butterworth Press, Pretoria.

EMERY, A.J; LÖTTER, M AND WILLIAMSON, S.D. 2002. *Determining the conservation value of land in Mpumalanga*. DWAF/DFID STRATEGIC ENVIRONMENTAL ASSESSMENT

JACOBSEN, N.H.G. 1989. A herpetological survey of the Transvaal. Unpublished Ph.D. thesis, University of Natal, Durban.

IUCN. 2000a. *IUCN Red List Categories*. Prepared by the IUCN Species Survival Commission, IUCN, Gland, Switzerland.

IUCN. 2000b. *The 2000 IUCN Red List of Threatened Species*.

LOW, A.B. and REBELO, A.G. 1998. *Vegetation of South Africa, Lesotho and Swaziland*. D.E.A. &T., Pretoria.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAAK, H.H, BISHOP, P.J, AND KLOEPFER, D. 2004. *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland.* SI/MAB Series 9. Smithsonian Institution, Washington, DC.

MEESTER, J.A.J., RAUTENBACH, I.L., DIPPENAAR, N.J. & BAKER, C.M. 1986. Classification of southern African mammals. *Transvaal Museum Monograph* 5: 1-359.

MUCINA, L AND RUTHERFORD, M.C. (eds) 2006. The *vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. SANBI, Pretoria.

PASSMORE, N.I. and CARRUTHERS, V.C. 1995. *Frogs of South Africa. A Complete Guide*. Wits University Press, Witwatersrand.

ROBERTS, A. 1951. *The mammals of South Africa*. Central News Agency, Cape Town.

SIEBERT, S.J. 2001. *Vegetation on the ultramafic soils of the Sekhukhuneland Centre of Endemism.* Unpublished PhD thesis, University of Pretoria.

SIEGFIED, W.R. 1989. *Preservation of species in southern African nature reserves*. In: Huntley, B.J. (Ed). *Biotic Diversity in Southern Africa*, 186-201. Cape Town: Oxford University Press.

SKINNER, J.D. and SMITHERS, R.H.N. 1990. *The Mammals of the Southern African Subregion*. University of Pretoria, Pretoria.

SKINNER, J.D., and CHIMIMBA, C.T. 2005. *The Mammals of the Southern African Subregion* 3rd ed. Cambridge University Press.

SMITHERS, R.H.N. 1986. *South African Red Data Book-Terrestrial Mammals*. South African National Scientific Programmes Report No.125: 1-214.

THERON, J. AND BRAACK, H.H, 2001. *An Amphibian Survey of Mpumalanga*.

10. APPENDIX

Table12. Red listed plant species recorded from the 2430 DA Quarter Degree Grid Cell (SANBI, POSA Website http://posa.sanbi.org downloaded on the 16th of June 2014)

FAMILY	SPECIES	STATUS	HABITAT	PROBABILITY OF OCCURRENCE
APOCYNACEAE	*Huernia blyderiverensis*	Rare	This range-restricted (EOO 193 km²), habitat specialist is endemic to Poung Dolomite Mountain Bushveld. Hills along the southern banks of the Olifants River to the slopes of the mountains	Low
APOCYNACEA	*Orbea gerstneri* subsp. *gerstneri*	Rare	Known from only four collections in northern KwaZulu-Natal and Swaziland, occurs in savannas that are not severely threatened because the many game farms between Nongoma, Mkuze and along the	Low
COMBRETACEAE	*Combretum petrophilum*	Rare	Waterberg, Strydpoort Mountains, Loskop Dam and Mpumalanga Drakensberg Mountains. Rocky outcrops in	High
DRACAENACEAE	*Dracaena transvaalensis*	Rare	Quartzite or dolomite lithosols, sometimes in deep rock cracks, hot and dry exposed slopes covered in deciduous woodland, occasionally in light shade in evergreen tall woodland on mountain slopes, 750-1000 m.	High

IRIDACEAE	*Gladiolus macneilii*	Critically Endangered B1ab(iii)+2ab(iii)	Confined to a small area on dolomites at the summit of Abel Erasmus Pass (EOO<20 km² and AOO<10 km²). The location is communally owned and severely	None
IRIDACEAE	*Gladiolus pavonia*	Critically Endangered B1ab(iii)+2ab(iii)	This species is confined to a small area on dolomites at the summit of Abel Erasmus Pass, which is communally owned and severely overgrazed and over-utilised for firewood to such an extent that all	None
MESEMBRYANTHEMACEAE	*Khadia alticola*	Rare	Montane grassland in shallow, sandy, humus-rich soil pockets and crevices between rock plates above 2000 m in the Steenkampsberg, Utrecht and	None
PASSIFLORACEAE	*Adenia fruticosa*	Near Threatened A2c; B1ab(iii,v)+2ab(iii,v)	Strydpoort Mountains southwards to Ohrigstad and the Steelpoort River Valley. Arid woodland, rocky outcrops, slopes and sandy flats, on dolomite, granite and	High
SANTALACEAE	*Thesium davidsonae*	Vulnerable D2	Two known locations are potentially threatened by overgrazing situated in bushveld on the dolomites around Abel	None
VITACEAE	*Rhoicissus laetans*	*Rare*	Montane grassland or in steep, wooded ravines, occasionally in riverine forest within the Blyde River Canyon.	Low

Table13. Red listed plant species recorded from the 2430 DA Quarter Degree Grid Cell (SANBI, POSA Website http://posa.sanbi.org downloaded on the 16th of June 2014)

FAMILY	SPECIES	STATUS	HABITAT	PROBABILITY OF OCCURRENCE
ALLIACEAE	*Tulbaghia coddii*	Rare	Montane grassland (Mariepskop to Mount Sheba and Graskop) on damp, shallow soils over sheet rocks or in	Low
AMARYLLIDACEAE	Clivia caulescens	Near Threatened A3d	Forest patches and forest margins.	Low
AMARYLLIDACEAE	*Crinum macowanii*	Rare	Mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats.	High
AMARYLLIDACEAE	*Haemanthus pauculifolius*	Rare	Savanna and cliffs in forested kloofs, on humus-rich ledges.	Low
APOCYNACEAE	*Brachystelma parvulum*	Vulnerable D2	Known from two locations within the Bourke's Luck Potholes and Abel Erasmus Pass. And are potentially threatened by livestock	None
AQUIFOLIACEAE	*Ilex mitis* var. *mitis*	Declining	Along rivers and streams in forest and thickets, sometimes in the open.	High
ASPHODELACEAE	*Aloe hardyi*	Rare	Vertical dolomite cliffs in mistbelt	None

ASPHODELACEAE	*Aloe integra*	Vulnerable B1ab(ii,iii,iv,v)	Mpumalanga, from Vaalhoek north of Pilgrim's Rest southwards to Amsterdam. Also at Mankayane in Swaziland. Dry highveld grassland, on exposed, rocky sites with short grass on	Low
ASPHODELACEAE	*Kniphofia triangularis subsp. obtusiloba*	Vulnerable D2	Known from 10 sites, mostly from Mpumalanga Drakensberg but with one record from Ngome in KwaZulu-Natal. Quartzitic rocky outcrops in montane	Low
ASTERACEAE	*Helichrysum homilochrysum*	Rare	Mpumalanga Escarpment around Lydenburg, recorded from Mariepskop to Mac Mac between Graskop and Sabie. Cliff faces and ledges,	Medium-Low (Possibly adjacent to Alternative 2)
CANELLACEAE	*Warburgia salutaris*	Endangered A2acd	Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets	Low
CELASTRACEAE	Elaeodendron transvaalense	Near Threatened A4ad	Savanna or bushveld, from open woodland to thickets, often on termite mounds.	High
CELASTRACEAE	*Pterocelastrus rostratus*	Declining	Forest and montane scrub in forest margins and on mountain sides.	High

COMBRETACEAE	*Combretum petrophilum*	Rare	Waterberg, Strydpoort Mountains, Loskop Dam and Mpumalanga Drakensberg Mountains. Rocky outcrops in mountain bushveld	High
CYATHEACEAE	*Alsophila capensis*	Declining	Forest, near waterfalls, streams and permanently moist seepages.	Low
DIPSACACEAE	*Scabiosa transvaalensis*	Threatened	Terrestrial species endemic to Mpumalanga	High
EBENACEAE	*Euclea dewinteri*	Critically Rare	Quartzite hill slopes, often rooted in crevices between boulders, in grasslands. Known from one site, the only subpopulation occurs entirely within a formally protected provincial nature	None
ERICACEAE	*Erica atherstonei*	Near Threatened (NT) D2	Rocky areas (quartzite) in montane grassland at edge of escarpment or on steep slopes, occasionally in moist areas, 1500-2500 m.	High especially along alternative alignment 2
FABACEAE	*Argyrolobium megarrhizum*	Near Threatened B1ab(ii,iii,v)	Occurs on stony slopes in grassland with scattered bush. This species relies on pollination by carpenter bees and the ongoing habitat loss will impact on the population dynamics of these insects and is likely to affect pollination rates.	High

			In addition, changes in fire regimes as a result of habitat loss and degradation will impact this species as it only flowers profusely after fire.	
GERANIACEAE	*Pelargonium album*	Rare	Grows on humus-rich soils, in shady rock crevices on dolomite hills in the Pilgrims Rest area.	None
GUNNERACEAE	*Gunnera perpensa*	Declining	Damp marshy area and vleis from coast to 2400 m.	High
HYACINTHACEAE	*Merwilla plumbea*	Near Threatened A2bd	Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	High
HYPOXIDACEAE	*Hypoxis hemerocallidea*	Declining	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant.	Confirmed at several localities along the proposed alignments.
IRIDACEAE	*Crocosmia mathewsiana*	Vulnerable D2	Damp, shady places along streams and forest margins within Mpumalanga Drakensberg Escarpment, Mariepskop to Mac	None

LAMIACEAE	*Syncolostemon rugosifolius*	Rare	Grasslands on rocky quartzite ridges and outcrops	Low
LAURACEAE	*Cryptocarya transvaalensis*	Declining	Limited to Afromontane forests up to 1700 m	None
LAURACEAE	*Ocotea bullata*	Endangered A2bd	High, cool, evergreen Afromontane forests.	None
LOBELIACEAE	*Monopsis kowynensis*	Vulnerable D2	Mistbelt grassland in the Graskop area	None
MYRSINACEAE	*Rapanea melanophloeos*	Declining	Coastal, swamp and mountain forest, on forest margins and bush clumps, exposed rocky areas often in damp areas from coast to mountains.	High
PASSIFLORACEAE	*Adenia gummifera var. gummifera*	Declining	Forested ravines, forest patches and forest margins, forest scrub, miombo woodland, savanna, dune forest, on stony slopes, termitaria and	High
PROTEACEAE	*Faurea macnaughtoni*	Rare	Afromontane Forests	None
PROTEACEAE	*Leucospermum saxosum*	Endangered D	Habitat is not well known, plants tend to occur on rocky quartzitic soil al altitudes between 1	Low
PROTEACEAE	*Protea laetans*	Vulnerable B1ab(iv)+2ab(iv)	Largely confined to Northern Escarpment Quartzite Sourveld in the Blyde River Canyon	None

PROTEACEAE	*Protea parvula*	Near Threatened A2c	Most prominent in Lydenburg montane grassland in leached soils.	High within alternative 2 alignment
RHIZOPHORACEAE	*Cassipourea malosana*	Declining	In the understorey of Afromontane forest or in thickets on rocky outcrops in Mpumalanga, also in coastal and midland forests in KwaZulu	High
ROSACEAE	*Prunus africana*	Vulnerable	Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100 m	None
SCROPHULARIACEAE	*Jamesbrittenia macrantha*	Near-Threatened	Grassy slopes with other scattered shrubs, restricted to norite.	Likely
VITACEAE	*Rhoicissus laetans*	Declining	Montane grassland or in steep, wooded ravines, occasionally in riverine forest. in the Blyde River Canyon.	None
ZAMIACEAE	*Encephalartos cupidus*	Critically Endangered CR A2acde	Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests in the Blyde River Canyon.	None
ZAMIACEAE	Encephalartos laevifolius	Critically Endangered A2acde	Restricted to high mountain peaks in eastern Mpumalanga and parts of Swaziland. Locally extinct in Limpopo,	None
ZAMIACEAE	Encephalartos lanatus	Near Threatened B1ab(iii)+2ab(iii)	Sheltered, wooded ravines in sandstone ridges, 1 200-1 500 m.	None

ZAMIACEAE	*Siphonochilus aethiopicus*	Critically Endangered A4acd	Tall open or closed woodland, wooded grassland or bushveld.	Low

Table14. Red listed plant species recorded from the 2530 AB Quarter Degree Grid Cell (SANBI, POSA Website http://posa.sanbi.org downloaded on the 16th of June 2014)

FAMILY	SPECIES	STATUS	HABITAT	PROBABILITY OF OCCURRENCE
ACANTHACEAE	*Dyschoriste perrottetii*	Vulnerable D2	Grassland especially Sekhukhune Montane grassland.	High (alternative alignment 2)
AMARYLLIDACEAE	*Crinum macowanii*	Rare	Mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats.	High
ANACARDIACEAE	*Searsia sekhukhuniensis*	Rare	Rocky hillsides in bushveld, on pyroxenitic substrates of the	High
APOCYNACEAE	*Brachystelma stellatum*	Vulnerable D2	Montane grassland in the Steenkampsberg, Ohrigstad Dam Nature Reserve and Long	Low
AQUIFOLIACEAE	*Ilex mitis* var. *mitis*	Declining	Along rivers and streams in forest and thickets, sometimes in the open.	High
ARACEAE	*Zantedeschia pentlandii*	Vulnerable B1ab(v)	Rocky hillsides and along streams	High
ASPHODELACEAE	*Aloe cooperi subsp. cooperi*	Declining	Occupies a wide variety of habitats in grasslands, from marshy areas to dry and well-drained, often wedges in shallow pockets among rocks, but also on hillsides in open	High
ASPHODELACEAE	*Aloe integra*	Vulnerable B1ab(ii,iii,iv,v)	Dry highveld grassland, on exposed, rocky sites with short grass on north- and northwest-facing slopes	Low

ASPHODELACEAE	*Aloe reitzii*	Near Threatened B1ab(iii)	Granite outcrops and rocky slopes in montane grassland.	
ASPHODELACEAE	*Kniphofia triangularis subsp. obtusiloba*	Vulnerable D2	Known from 10 sites, mostly from Mpumalanga Drakensberg but with one record from Ngome in KwaZulu-Natal. Quartzitic rocky outcrops in montane grasslands, 1200-2200 m.	Low
CELASTRACEAE	*Lydenburgia cassinoides*	Near Threatened B1ab(ii,iii,v)	Exposed norite bedrock and dolomite on dry hillslopes and riverine fringes.	High
HYACINTHACEAE	*Eucomis vandermerwei*	Vulnerable B1ab(i,ii,iii,iv,v)+2 ab(i,ii,iii,iv,v)	Short, sour montane grassland on sandy, low-pH soils derived from quartzitic rocky outcrops. In rock crevices or under overhanging rocks, confined to outcrops on slopes and plateaus of higher peaks, predominantly on north-facing slopes, 2000-2500 m.	Low
HYACINTHACEAE	*Merwilla plumbea*	Near Threatened A2bd	Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	High
HYPOXIDACEAE	*Hypoxis hemerocallidea*	Declining	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant.	Confirmed at several localities along the proposed alignments.

IRIDACEAE	*Gladiolus rufomarginatus*	Rare	Grasslands, either in the open or in light shade on stony shale ground, sometimes in crevices in bare shale outcrops.	High
ORCHIDACEAE	*Disa extinctoria*	Near Threatened B1ab(iii,iv,v)	Crest of the escarpment in damp grassland and swamps, 1000-1300 m.	Low
ORCHIDACEAE	*Schizochilus lilacinus*	Rare	Occurs among rocks or on narrow ledges on steep rocky slopes in damp areas. 1600-2300 m.	High
PASSIFLORACEAE	*Adenia wilmsii*	Endangered	Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	Medium in Lydenburg area
RHIZOPHORACEAE	*Cassipourea malosana*	Declining	In the understorey of Afromontane forest or in thickets on rocky outcrops in Mpumalanga, also in coastal and midland forests in	High
THYMELAEACEAE	*Gnidia variabilis*	Vulnerable D2	Well-drained grassland, 900-1800 m in Lydenburg area	High

Table15. Frog species found for the combined locus = 2430DA, 2430DB, 2530AB

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Arthroleptidae	*Leptopelis*	*mossambicus*	Brown-backed Tree Frog	Least Concern	0
Brevicepitidae	*Breviceps*	*adspersus*	Bushevld Rain Frog	Least Concern	0
Brevicepitidae	*Breviceps*	*mossambicus*	Mozambique Rain Frog	Least Concern	0
Brevicepitidae	*Breviceps*	*verrucosus*	Plaintive Rain Frog	Least Concern	0
Bufonidae	*Amietophrynus*	*garmani*	Eastern Olive Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*gutturalis*	Guttural Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*maculatus*	Flat-backed Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern	0
Bufonidae	*Poyntonophrynus*	*fenoulheti*	Northern Pygmy Toad	Least Concern	0
Bufonidae	*Schismaderma*	*carens*	Red Toad	Least Concern	0
Heleophrynidae	*Hadromophryne*	*natalensis*	Cascade Frog	Least Concern	0
Hemisotidae	*Hemisus*	*marmoratus*	Mottled Shovel-nose Frog	Least Concern	0
Hyperoliidae	*Afrixalus*	*aureus*	Golden Leaf-folding Frog	Least Concern	0
Hyperoliidae	*Hyperolius*	*marmoratus*	Painted Reed Frog	Least Concern	0
Hyperoliidae	*Hyperolius*	*pusillus*	Water Lily Frog	Least Concern	0
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern	0
Hyperoliidae	*Semnodactylus*	*wealii*	Rattling Frog	Least Concern	0
Microhylidae	*Phrynomantis*	*bifasciatus*	Banded Rubber Frog	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*mababiensis*	Dwarf Puddle Frog	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*natalensis*	Snoring Puddle Frog	Least Concern	0
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	0
Pipidae	*Xenopus*	*muelleri*	Tropical Platanna	Least	0

				Concern	
Ptychadenidae	*Hildebrandtia*	*ornata*	Ornate Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*anchietae*	Plain Grass Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*mossambica*	Banded Grass Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*oxyrhynchus*	Sharp-nosed Grass Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*porosissima*	Striped Grass Frog	Least Concern	0
Pyxicephalidae	*Amietia*	*angolensis*	Common or Angola River Frog	Least Concern	0
Pyxicephalidae	*Amietia*	*fuscigula*	Cape River Frog	Least Concern	0
Pyxicephalidae	*Cacosternum*	*boettgeri*	Boettger's Caco	Least Concern	0
Pyxicephalidae	*Cacosternum*	*nanum*	Bronze Caco	Least Concern	0
Pyxicephalidae	*Pyxicephalus*	*adspersus*	Giant Bullfrog	Least Concern	0
Pyxicephalidae	*Pyxicephalus*	*edulis*	African Bullfrog	Least Concern	0
Pyxicephalidae	*Strongylopus*	*fasciatus*	Striped Stream Frog	Least Concern	0
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*marmorata*	Russet-backed Sand Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*natalensis*	Natal Sand Frog	Least Concern	0
Rhacophoridae	*Chiromantis*	*xerampelina*	Southern Foam Nest Frog	Least Concern	0

Red listing source: Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Table16. Reptile species found for the combined locus = 2430DA, 2430DB, 2530AB.
Red listing source: 1996 IUCN global listing

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	*Acanthocercus*	*atricollis*	*atricollis*	Southern Tree Agama	Not Evaluated	0
Agamidae	*Agama*	*aculeata*	*distanti*	Distant's Ground Agama	Not Evaluated	1
Agamidae	*Agama*	*atra*		Southern Rock Agama	Not Evaluated	0
Atractaspididae	*Amblyodipsas*	*polylepis*	*polylepis*	Common Purple-glossed Snake	Not Evaluated	0
Atractaspididae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	Not Evaluated	0
Atractaspididae	*Aparallactus*	*lunulatus*	*lunulatus*	Reticulated Centipede-eater	Not Evaluated	0
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Not Evaluated	0
Atractaspididae	***Homoroselaps***	***dorsalis***		**Striped Harlequin Snake**	**Lower Risk: Near Threatened**	1
Boidae	*Python*	*natalensis*		Southern African Python	Not Evaluated	0
Chamaeleonidae	*Bradypodion*	*transvaalense*		Wolkberg Dwarf Chameleon	Not Evaluated	1
Chamaeleonidae	*Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Not Evaluated	0
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Not Evaluated	0
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Not Evaluated	0
Colubridae	*Dasypeltis*	*inornata*		Southern Brown Egg-eater	Not Evaluated	1
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Not Evaluated	0
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Not Evaluated	0
Colubridae	*Duberria*	*lutrix*	*lutrix*	South African Slug-eater	Not Evaluated	1
Colubridae	*Lamprophis*	*aurora*		Aurora House Snake	Not Evaluated	1
Colubridae	***Lamprophis***	***fuscus***		**Yellow-bellied House Snake**	**Lower Risk: Near Threatened**	1
Colubridae	*Lamprophis*	*guttatus*		Spotted House Snake	Not Evaluated	0
Colubridae	*Lycodonomorphus*	*inornatus*		Olive House	Not Evaluated	1

				Snake		
Colubridae	*Lycodonomorphus*	*laevissimus*		Dusky-bellied Water Snake	Not Evaluated	1
Colubridae	*Lycodonomorphus*	*rufulus*		Brown Water Snake	Not Evaluated	0
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Not Evaluated	0
Colubridae	*Lycophidion*	*variegatum*		Variegated Wolf Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*hoplogaster*		South Eastern Green Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*natalensis*	*occidentalis*	Western Natal Green Snake	Not Evaluated	1
Colubridae	*Philothamnus*	*semivariegatus*		Spotted Bush Snake	Not Evaluated	0
Colubridae	*Prosymna*	*lineata*		Lined Shovel-snout	Not Evaluated	0
Colubridae	*Psammophis*	*brevirostris*		Short-snouted Grass Snake	Not Evaluated	0
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Not Evaluated	0
Colubridae	*Psammophis*	*mossambicus*		Olive Grass Snake	Not Evaluated	0
Colubridae	*Psammophis*	*subtaeniatus*		Western Yellow-bellied Sand Snake	Not Evaluated	0
Colubridae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Not Evaluated	0
Colubridae	*Psammophylax*	*tritaeniatus*		Striped Grass Snake	Not Evaluated	0
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Not Evaluated	0
Colubridae	*Telescopus*	*semiannulatus*	*semiannulatus*	Eastern Tiger Snake	Not Evaluated	0
Colubridae	*Thelotornis*	*capensis*	*capensis*	Southern Twig Snake	Not Evaluated	0
Cordylidae	*Chamaesaura*	*aenea*		Coppery Grass Lizard	Not Evaluated	1
Cordylidae	*Chamaesaura*	*anguina*	*anguina*	Cape Grass Lizard	Not Evaluated	1
Cordylidae	*Cordylus*	*jonesii*		Jones' Girdled Lizard	Not Evaluated	0
Cordylidae	*Cordylus*	*vittifer*		Common Girdled Lizard	Not Evaluated	0
Cordylidae	*Platysaurus*	*intermedius*	*intermedius*	Common Flat Lizard	Not Evaluated	1
Cordylidae	*Platysaurus*	*intermedius*	*wilhelmi*	Wilhelm's Flat Lizard	Not Evaluated	1
Cordylidae	*Platysaurus*	*orientalis*	*orientalis*	Sekhukhune Flat Lizard	Not Evaluated	1

Cordylidae	*Pseudocordylus*	*melanotus*	*melanotus*	Common Crag Lizard	Not Evaluated	1
Cordylidae	*Smaug*	*vandami*		Van Dam's Girdled Lizard	Not Evaluated	1
Crocodylidae	*Crocodylus*	*niloticus*		Nile Crocodile	Lower Risk: Least Concern	0
Elapidae	*Aspidelaps*	*scutatus*	*intermedius*	Intermediate Shield Cobra	Not listed	1
Elapidae	*Dendroaspis*	*polylepis*		Black Mamba	Not Evaluated	0
Elapidae	*Elapsoidea*	*sundevallii*	*media*	Highveld Garter Snake	Not listed	0
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Not Evaluated	0
Elapidae	*Naja*	*mossambica*		Mozambique Spitting Cobra	Not Evaluated	0
Gekkonidae	*Afroedura*	*nov sp. 2 (mariepi)*		Flat Gecko sp. 2 (mariepi)	Not listed	0
Gekkonidae	*Afroedura*	*nov sp. 3 (rupestris)*		Flat Gecko sp. 3 (rupestris)	Not listed	0
Gekkonidae	*Afroedura*	*nov sp. 6 (rondavelica)*		Flat Gecko sp. 6 (rondavelica)	Not listed	0
Gekkonidae	*Chondrodactylus*	*turneri*		Turner's Gecko	Not Evaluated	0
Gekkonidae	*Hemidactylus*	*mabouia*		Common Tropical House Gecko	Not Evaluated	0
Gekkonidae	*Homopholis*	*wahlbergii*		Wahlberg's Velvet Gecko	Not Evaluated	0
Gekkonidae	*Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Not Evaluated	0
Gekkonidae	*Lygodactylus*	*nigropunctatus*	*nigropunctatus*	Black-spotted Dwarf Gecko	Not Evaluated	1
Gekkonidae	*Lygodactylus*	*ocellatus*		Spotted Dwarf Gecko	Not listed	0
Gekkonidae	*Lygodactylus*	*ocellatus*	*ocellatus*	Spotted Dwarf Gecko	Not Evaluated	1
Gekkonidae	*Pachydactylus*	*affinis*		Transvaal Gecko	Not Evaluated	1
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Not Evaluated	0
Gekkonidae	*Pachydactylus*	*punctatus*		Speckled Gecko	Not Evaluated	0
Gekkonidae	*Pachydactylus*	*vansoni*		Van Son's Gecko	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*flavigularis*		Yellow-throated Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*nigrolineatus*		Black-lined Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*validus*	*validus*	Common Giant Plated Lizard	Not Evaluated	0
Gerrhosauridae	***Tetradactylus***	***breyeri***		**Breyer's Long-tailed Seps**	**Vulnerable**	1
Lacertidae	*Nucras*	*holubi*		Holub's Sandveld	Not Evaluated	0

				Lizard		
Lacertidae	*Nucras*	*intertexta*		Spotted Sandveld Lizard	Not Evaluated	0
Lacertidae	*Nucras*	*lalandii*		Delalande's Sandveld Lizard	Not Evaluated	1
Lacertidae	*Nucras*	*ornata*		Ornate Sandveld Lizard	Not Evaluated	0
Leptotyphlopidae	*Leptotyphlops*	*incognitus*		Incognito Thread Snake	Not Evaluated	0
Leptotyphlopidae	*Leptotyphlops*	*jacobseni*		Jacobsen's Thread Snake	Not Evaluated	1
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*conjunctus*	Eastern Thread Snake	Not listed	0
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*scutifrons*	Peters' Thread Snake	Not listed	0
Scincidae	*Acontias*	*plumbeus*		Giant Legless Skink	Not Evaluated	0
Scincidae	*Afroablepharus*	*wahlbergii*		Wahlberg's Snake-eyed Skink	Not Evaluated	0
Scincidae	*Mochlus*	*sundevallii*	*sundevallii*	Sundevall's Writhing Skink	Not Evaluated	0
Scincidae	*Scelotes*	*bidigittatus*		Lowveld Dwarf Burrowing Skink	Not Evaluated	1
Scincidae	*Scelotes*	*mirus*		Montane Dwarf Burrowing Skink	Not Evaluated	1
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*margaritifer*		Rainbow Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*punctatissima*		Speckled Rock Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*striata*		Striped Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*varia*		Variable Skink	Not Evaluated	0
Testudinidae	*Kinixys*	*lobatsiana*		Lobatse Hinged Tortoise	Not Evaluated	0
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Not Evaluated	0
Typhlopidae	*Afrotyphlops*	*bibronii*		Bibron's Blind Snake	Not Evaluated	0
Typhlopidae	*Megatyphlops*	*schlegelii*		Schlegel's Beaked Blind Snake	Not Evaluated	0
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Not Evaluated	0
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Not Evaluated	0
Viperidae	*Bitis*	*atropos*		Cape Berg Adder	Not Evaluated	0
Viperidae	*Causus*	*defilippii*		Snouted Night Adder	Not Evaluated	0
Viperidae	*Causus*	*rhombeatus*		Rhombic Night Adder	Not Evaluated	0

Table17. Mammals found for the combined locus = 2430DA, 2430DB, 2530AB (MammalMAP)

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Bovidae	*Cephalophus*	*natalensis*		Red Duiker	Least Concern	0
Bovidae	*Tragelaphus*	*scriptus*		Bushbuck	Least Concern	0
Felidae	*Panthera*	*pardus*		Leopard	Least Concern	0
Muridae	*Dendromus*	*melanotis*		Grey Climbing Mouse	Least Concern	0
Suidae	*Potamochoerus*	*porcus*	*koiropotamus*	Bushpig	Least Concern	0

Red listing source: Friedmann, Y. & Daly, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.