# VEGETATION STUDY AND OVERVIEW OF THE CORRIDORS FOR THE PROPOSED NEW 400 kV LINE FROM TABOR SUBSTATION TO A PROPOSED NEW NZHELELE SUBSTATION NORTH OF THE SOUTPANSBERG

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## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| 1. | Introduction | 3 |
| 2. | Methodology | 3 |
| 3. | Vegetation distribution | 4 |
| 3.1 | Natural Vegetation | 4 |
| 3.2 | Brief overview of veldt types important to the corridor alternatives | 5 |
| | 3.2.1 Makhado Sweet bushveld | 5 |
| | 3.2.2 Soutpansberg Mountain bushveld | 5 |
| | 3.2.3 Musina Mopane Bushveld | 6 |
| | 3.2.4 Northern Mistbelt Forest | 8 |
| | 3.2.5 Limpopo Ridge Bushveld | 8 |
| 4. | Results | 17 |
| 5. | Impactof alternatives from a vegetation perspective | 22 |
| 6. | Route Alternative Ranking | 23 |
| 7. | Mitigation and Recommendations | 25 |
| 8. | Reference | 27 |

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## 1. Introduction

In order for Eskom to decide on a preferred route for the new 400kV line between the existing Tabor substation South of Louis Trichardt and the new proposed Nzhelele substation North of the Soutpansberg, various possible corridors are identified, of approximately 1 km wide. This is to ensure that the final alignment can still be adjusted in order to avoid possible sensitive habitats and areas. The precise power line alignment will be done after the corridor with the least negative impact is chosen via the EIA process. A line "walk-down" with a team of specialists will be done after corridor approval. This will ensure that sensitive habitats and areas e.g. areas with red data or protected plant species are avoided as far as possible.

## 2. Methodology

In order for the team of specialists to cover this huge area various methods were used.

An area fly over by Eskom helicopter was done by various specialists, including a botanist. The study included local input from a Soutpansberg vegetation specialist. This specialist accompanied by a current Lidwala team member did a similar study for the current 132 kV line during the 1980's over the Soutpansberg and was approved by the European Development Bank. This bank funded the capital cost of building the 132 kV line.

Due to the importance of the Soutpansberg flora, Lidwala chose to make use of the best knowledge available for this project. The team members for the vegetation study were the following:

- Frank van der Kooy (PrSciNat);
- Antoinette Eyssell (PrSciNat);
- Dr Norbert Hahn (D phil – vegetation of the Soutpansberg);
- Moseketsi Mochesane (B.Sc. Botany);

Due to the extent, approximately 300 $km^2$, of the area to be covered, the desktop study and helicopter fly-over helped to identify possible sensitive habitats in each corridor. These sensitive areas were "ground truthed" to ensure that an informed vegetation comparison between the corridors could be made. The following brief description highlights the vegetation importance of this area.

## 3. Vegetation overview

At present the two proposed main corridors, Tab-Nzh1 and Tab-Nzh4, both traverse across sections of the western Soutpansberg. The Soutpansberg is presently noted as both a centre of plant endemism (Hahn, 2002, van Wyk & Smith, 2001) and for floristic diversity (Hahn, 2006).

Approximately 2 500 to 3 000 vascular plant taxa comprising 1 066 genera and 240 families are known to occur in the mountain. This is a significant number if one compares it to other regions. Arnold & De Wet (1993) recorded 2 604 genera and 353 families for the entire Flora of the southern Africa region (South Africa, Namibia, Botswana, Swaziland and Lesotho). The Soutpansberg therefore contains 41% of all known plant genera and 68% of all plant families of the Flora of the Southern Africa region. Van van Wyk & Smith (2001) noted that among the 18 recognized centres of endemism (endemic = only grows in this area) for southern Africa, the Soutpansberg has the highest generic and family diversity. This underlines the biodiversity importance of the area. Altogether, 38 plants taxa are known to be endemic to the Soutpansberg, comprising 27 genera and 17 families.

Altogether, 594 tree taxa are known in the Soutpansberg, one of the highest counts for Southern Africa, and approximately one third of all known trees of southern Africa. This is a significant number representing 18% to 22% of the known flora of the mountain range. It is therefore no wonder that most vegetation types within the area are predominantly woodlands.

Approximately 85% of the floristic diversity of the Soutpansberg is represented west of the 30° latitude, the area applicable to this study.

### 3.1 Natural Vegetation

The proposed 100km Tabor to Nzhelele 400kV power line bisects three major vegetation units namely Makhado Sweet Bushveld (SVcb 20), Soutpansberg Mountain Bushveld (SVcb 21) and Musina Mopane Bushveld (SVmp 1), Tzaneen sour bushveld (SVI8), Northern Mistbelt (FOz4) and the Limpopo Ridge bushveld (SVmp2). Large areas of the proposed alignments, bisects game and hunting farms which comprise pristine natural vegetation. Certain sections of the alignment occur adjacent to transformed bushveld including agricultural lands, mining activities, forestry activities, as well as degraded bushveld including dense areas of bush encroachment especially to the north of the Tabor substation towards the southern slopes of the Soutpansberg.

## 3.2Brief overview of veldt types important to the corridor alternatives:

### 3.2.1 Makhado Sweet Bushveld (SVcb 20)

- *Distribution:*
  Makhado Sweet Bushveld is distributed in the Limpopo Province straddling the Tropic of Capricorn. It occurs on the plains south of the Soutpansberg, east of the Waterberg and on the apron surrounding the Blouberg and Lerataupje Mountains, and north of the Polokwane Plateau and west of the escarpment, with extensions to Mokopane to the south and to the north of Vivo.

- *Vegetation & Landscape Features:*
  Makhado Sweet Bushveld occurs on slight to moderately undulating plains sloping generally down to the north, with some hills in the southwest. The vegetation is short and shrubby bushveld with a poor developed grass layer. The vegetation around the alignments consists of game and hunting farms as well as cattle grazing activities and small scale agricultural activities.

- *Conservation Status:*
  This vegetation unit is currently considered as Vulnerable. The conservation target is 19%, with just over 1% statutorily conserved mainly in the Bellevue Nature Reserve. Some 27% already transformed, mainly by cultivation, with some urban and built up areas. The south-western half of the unit has densely populated rural communities. (Mucina & Rutherford 2006). The following routes will transverse the vegetation Tab-Nzh1, Tab-Nzh2, Tab-Nzh3, Tab-Nzh1b and Tab-

### 3.2.2 Soutpansberg Mountain Bushveld (SVcb 21)

- *Distribution:*
  Soutpansberg Mountain Bushveld occurs on the lower to higher mountains, highest in the west, splitting into increasing number of lower mountains towards the east. Dense tree layer and poorly developed grass layer. The topography of the east-west-orientated ridges of the mountain changes dramatically over short distances, resulting in orographic rain on the southern ridges, and a rain shadow effect on the northern ridges. Because of this topographic diversity, the Soutpansberg Mountain Bushveld comprises a complex mosaic of sharply contrasting kinds of vegetation within limited areas. The main vegetation variations within the Soutpansberg Mountain Bushveld are subtropical moist thickets (mainly along the lower-lying southern slopes on steep clayey soils of volcanic origin), mist-belt bush clumps (within the mist-belt of the southern and central ridges of the mountain, or rugged quartzitic outcrops with shallow sandy soils), relatively open savanna sand-veld (on

both deep and shallow quartzitic sands along the dry middle and northern slopes of the mountain), and arid mountain bushveld (along the very arid northern ridges of the mountain)(Mucina et al., 2006).

- *Vegetation & Landscape Features:*
  Soutpansberg Mountain Bushveld occurs within the Limpopo Province on the slopes of the Soutpansberg Mountain, Blouberg and Lerataupje Mountains to the west; extending eastwards on the lower ridges including Khaphamalia and Makonde Mountains. Altitude varies between 600-1 500m (Mucina & Rutherford 2006).

- *Conservation Status:*
  This vegetation unit is currently considered as Vulnerable. The conservation target is 24%, with just over 2% formally protected within the Blouberg, Happy Rest and Nwanedi Nature Reserves. A smaller area is conserved in other reserves. Some 21% already transformed, mainly by cultivation (14%) and (6%) plantations. High rural human populations densities, particularly in the eastern section of the unit (Mucina & Rutherford 2006). Tab-Nzh1 and Tab-Nzh 4 transverse this vegetation

### 3.2.3 Musina Mopane Bushveld (SVmp 1)

- *Distribution*
  Limpopo Province on undulating plains from around Baines Drift and Alldays in the west, remaining north of the Soutpansberg and south of the Limpopo River (but also occurring to the north of Zimbabwe), through Musina and Tshipise to Malongavlakte, Masis and Banyini Pan in the east. Altitude is about 300m in the eastern Limpopo Valley and up to 800m.

- *Vegetation and Landscape Features*
  Undulate terrain to very irregular plains, and some hills. In the western section, open woodland to moderately closed shrubveld dominated by *Colophospermum mopane* on clayey bottomlands and *Combretum apiculatum* on hills. In the eastern section on basalt, moderately closed to open shrub-veld is dominated by *Colophospermum mopane* and *Terminalia prunioides*. On areas with deep sandy soils, moderately open savanna dominated by *Colophospermum mopane*, *Terminalia sericea*, *Grewia flava* and *Combretum apiculatum*. Field layer well developed (especially on the basalt), open during the dry season; the herbaceous layer is poorly developed in areas with dense cover of *Colophospermum mopane* shrubs, for example north of Alldays bordering the Limpopo floodplain.

- *Conservation Status*
  Least Threatened. Target 19% with only 2% statutorily conserved in the Mapungubwe National Park as well as Nwanedi and Honnet Nature Reserved. Additionally, about 1% conserved in the Baobab Tree Reserve. Roughly 3% transformed, mainly by cultivation. Erosion is high to moderate. Although least threatened its biodiversity is remarkable high and the areas visited are in pristine condition at least for most part of TAB – Nzh5 and for the Northern part of Tab – Nzh 1 as well as for Tabor – Nzh 4.

### 3.2.4 Northern Mistbelt Forest (FOz4)

- *Distribution*
  Limpopo and Mpumalanga provinces as well as in Swaziland. The mistbelt occurs along the soutpansberg from Blouberg to the Samadou Plateau along the northern escarpment. Also occurs in fire refugia and cooler sheltered areas along the north-south trending lowveld/Highveld transition. Altitude 1050 to 1650 m

- *Vegetation and landscape features*
  These evergreen forests occur mainly on east-facing fire refugia such as ridges and form small, fragmented patches (Figure 1). The vegetation comprises tall trees such as *Podocarpus latifolius, Schefflera umbellifera* and *Searsia chirendensis*. A number of endemic taxa occur here and include *Dombeya pulcra, Streptocarpus davyi* and the epiphyte *Mystachidium brayboniae*

- *Conservation status*
  Least threatened encroaching subsistence agriculture, firewood collection and selective harvesting of bark for medicinal purposes are impacting these forests. About 10% statutorily is conserved in the Blyde river canyon reserve. Tab-Nzh1 transverses a small section of the vegetation.

### 3.2.5 Limpopo Ridge Bushveld (SVmp2)

- *Distribution*

Limpopo province, Vegetation occurs on hills and ridges such as in the lower Mogalakwena River basin. The Altitude from 300m to 700m in the east and the west at around 1000m with the top of a few hills.

- Vegetation and landscape features
  Vegetation occurs on hills and ridges characterized by moderately open savanna where the grass layer is underdeveloped and large trees such as *Adansonia digitata* (Baobab) *and Sclerocarya birrea* subsp caffra (Morula) dominate the landscape.

This vegetation unit is enclosed by the Mussina Mopani Bushveld and therefore share some of the species. Although not threatened, ridges are usually characterized by high biodiversity and therefore their protection contributes to conservation of biodiversity.

- Conservation status
  Least threatened 18% statutorily conserved mainly in the Kruger and Mapungubwe National Parks. About 1% is transformed mainly for cultivation and mining. Tab-Nzh1, Tab-Nzh1a and Tab-Nzh 4 and Tab-Nzh 5 transverse this vegetation

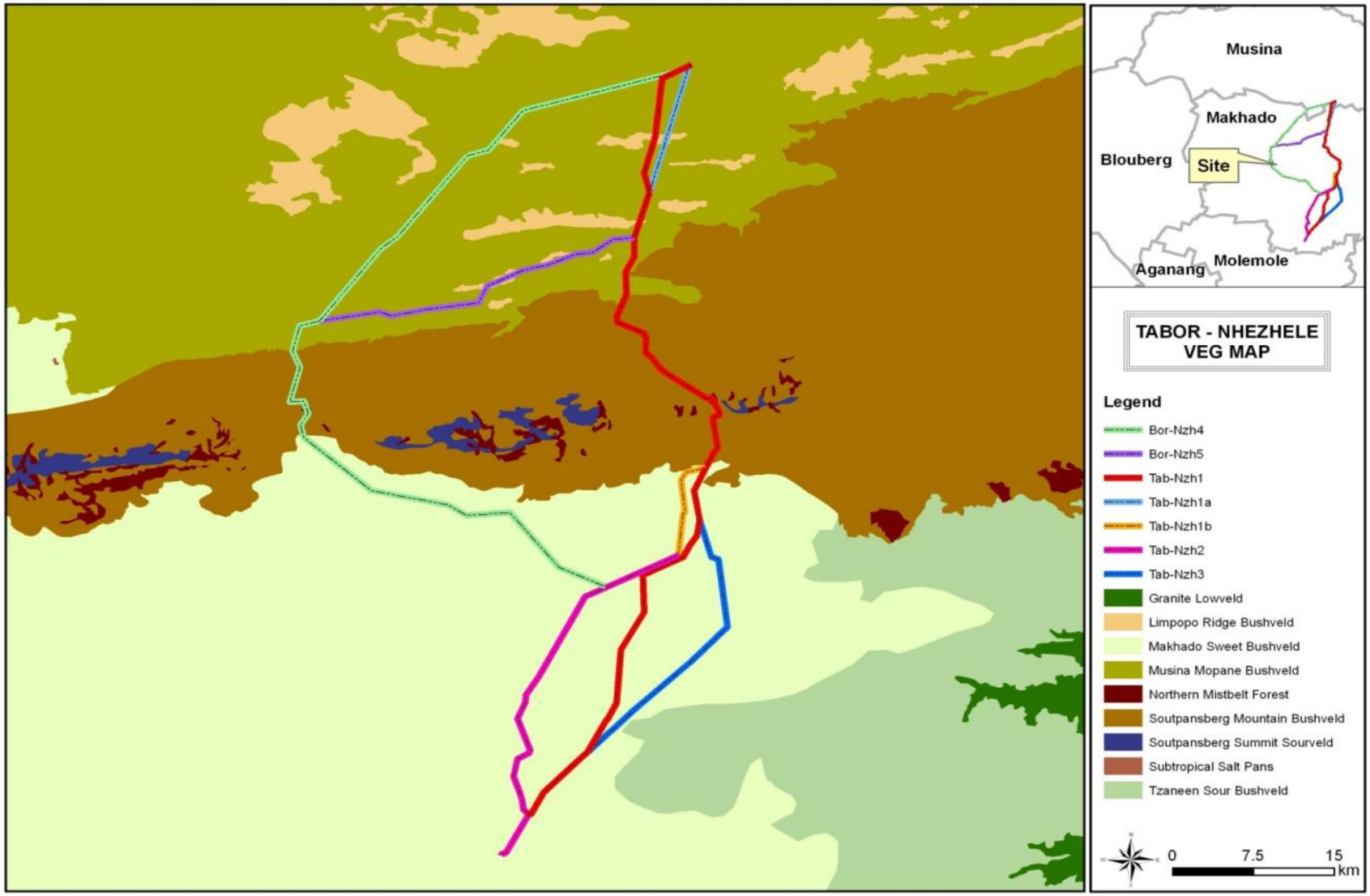
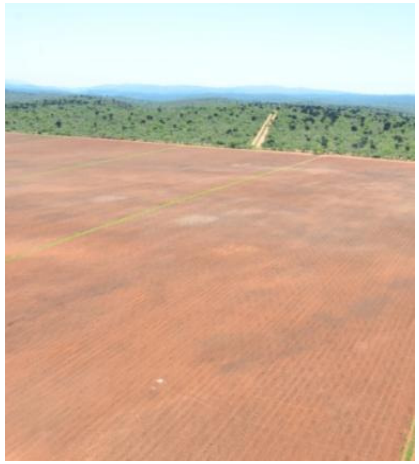



**Figure 1: Vegetation units in the area studies (Mucina & Rutherford, 2006)**

**Makhado Sweet Bushveld -**
**South of the Soutpansberg east of the N1:**

Natural Makhado Sweet Bushveld



Disturbances within the Makhado Sweet Bushveld (grazing, cultivation and tabor substation), and pristine areas such as the Ben Lavin Nature Reserve.

**Makhado Sweet Bushveld**
**Western portion**

Urbanisation / township development within the Makhado Sweet Bushveld

Lower vegetation cover observed in the western portion of the Makhado Sweet Bushveld

**Soutpansberg Mountain Bushveld**
**Southern side of the Soutpansberg, Eastern portion**

Some disturbances noted within the eastern portion of this vegetation unit along Tab-Nzh1 (note existing Eskom line – arrow)

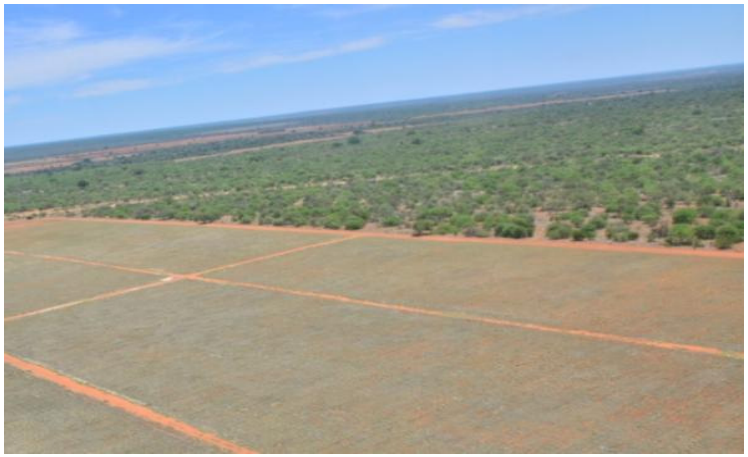
Natural areas along the proposed Tab-Nzh1 powerline

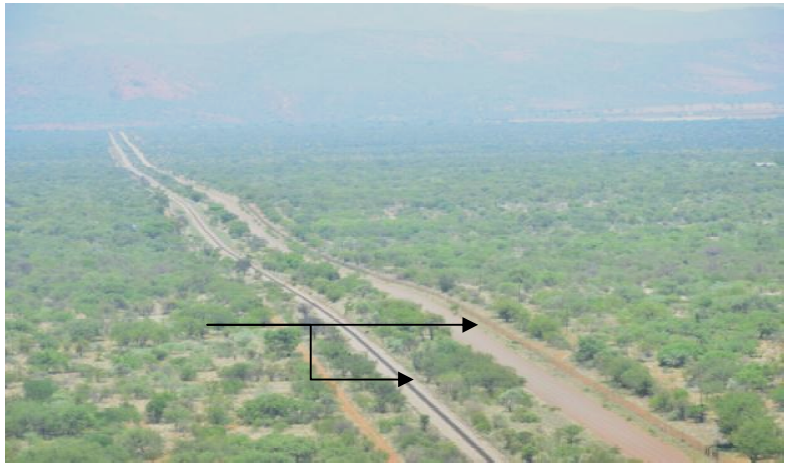
**Soutpansberg Mountain Bushveld**
**Western portion**

Steep valley areas with railway line and watercourse visible.

**Mussina Mopani Bushveld**
**(North of the Soutpansberg)**

Mussina Mopani Bushveld with Baobab trees visible





Cultivated areas and railway and road along the Bor-Nzh5 route (arrow)

**Limpopo Ridge Bushveld**
**Embedded in Mussina Mopani Bushveld**

## 4. Results

**Tab-Nzh1** (*Specific info (Hahn, 2012):*

Much of the extent of this route runs parallel to an existing Eskom line, limiting the impact of access roads. The route aligns with an existing power line in the Vulnerable Makhado Sweet Bushveld as well as the Vulnerable Soutpansberg Mountain Bushveld.

The southern section traverses the low-lying area to the south of the Soutpansberg that is transformed due to agriculture.

The mountain slopes to the south of the Farm Clydesdale have all been transformed due to Silviculture, or "forest-culture", agriculture or bush encroachment

The mist-belt vegetation of the Farm Clydesdale is of concern as the sandy soils are susceptible to trampling and erosion. This area also harbours many of the treated plants mentioned below.

The thicket vegetation along the southern slopes of the Farm Franshoek is susceptible to erosion due to the steep nature of the geography.

The flat lying area at the base of the valley traversing the farms Franshoek, Wallace Dale and Mooiplaas have largely been transformed due to agriculture and bush encroachment. Protected trees were spotted, one a few metres from the servitude of the existing power line **(fig2)** A second protected tree was spotted at the farm Franshoek **(fig 3).**


**Figure 2***: Sclerocarya birrea caffra.*


**Figure 3:** *Boscia albatrunca* and one was also seen in the last part of the corridor closer the Nzhelele substation

**Tab-Nzh 1a**

This route is situated within the Mussina Mopani Bushveld (north of the Soutpansberg) and deviates from Tab-Nzh1, only in the last approximately 13km where it will run parallel to the existing line, whereas Tab-Nzh1 will run parallel to the N1 road

The corridor, 1a, is likely to have less impact as roads and servitudes are largely in place.

**Tab-Nzh 1b**

To the east of the town of Louis Trichardt, Tab-Nzh1b deviates from Tab-Nzh1 for approximate 11km. This route is situated within the Makhado Sweet Bushveld. The area covered by the deviation comprises some natural vegetation, but also include some cultivation. Approximately 4km will run parallel to existing lines

**Tab-Nzh 2**

After the initial 34km this route follows the same alignment as Tab-Nzh1. This route is situated within the Makhado Sweet Bushveld in its southern extent with large areas of vegetation still resembling natural and undisturbed vegetation. However, a large extent of its initial 34 km runs parallel to an existing power line and railway before it joins Tab-Nzh1

This section traverses the low-lying area to the south of the Soutpansberg. Most of the area has been transformed due to agriculture and bush encroachment by the *dichrostachys cinerea* **(fig 4)** (Hahn, 2012).


**Figure 4:** species encroachment by *Dichrostachys cinerea*:

**Tab-Nzh 3**

This route follows much of the same alignment as Tab-Nzh1. However, after the first estimated 15km, this route splits from Tab-Nzh1 in a westerly direction and through the Ben Lavin nature Reserve **(fig 5)**. After about 25km, this route re-joins Tab-Nzh1 and follows the same alignment for the remainder of the route. Much of the vegetation along this route is in a natural state.


**Figure 5:** Ben Lavin nature reserve

**Tab-Nzh 4**

This is likely the longest route and traverses through the Vulnerable Makhado Sweet Bushveld as well as the Vulnerable Soutpansberg Mountain Bushveld. However, the Makhado Sweet Bushveld is largely disturbed by urbanisation, some cultivation and grazing In addition, Tab - Nzh4 is proposed to run parallel to a railway line, likely limiting the number of new access roads needed. Approximately 15 km traverse over game farms with no access routes available where the corridor runs away from the railway line towards the new proposed Nzhelele substation

On the other hand, the portion that this route will traverse through the Vulnerable Soutpansberg Mountain Bushveld was found to be very steep, rocky and in proximity to a watercourse **(fig 6)**. The so-called Waterpoort is seen as extremely high in biodiversity with a high percentage of endemic species.

The northern extent of this route is situated within the Mussina Mopani Bushveld (north of the Soutpansberg) and for the most of this extent is proposed to run parallel to a railway line and existing dirt road .This portion of the route does however traverse some Limpopo Ridge Bushveld and if forming part of the final route, these rocky ridges should be avoided wherever possible. Protected plant spotted *Sclerocarya birrea caffra.*


**Figure 6:** watercourse in the ridge in the Waterpoort with railway line to the right.

**Tab-Nzh 5**

This route is situated within the Mussina Mopani Bushveld (north of the Soutpansberg). A relatively low degree of disturbance was noted such as cultivation and overgrazing. This route does however traverse some Limpopo Ridge Bushveld and if forming part of the final route, these rocky ridges should be avoided wherever possible. Protected plant species were spotted along the route and in high abundance. *Adansonia digitata* **(fig7 and 8)**, *Boscia albatrunca* and *Sclerocarya birrea caffra*


**Figure 7***: Adansonia digitata*


**Figure 8:** Small *Adansonia digitata* within the shrubbery in the servitude where Tab-Nzh5 joins Tab-Nzh 1

## 5. Impact of alternatives from a vegetation perspective

**Tab-Nzh 1**

- Low impact on vegetation as the corridor follows and existing power line and there is an existing servitude which might need to widened by a few metres;
- There are existing access roads with Eskom installed gates;
- The number of pylons might have to be increased as the route gets narrow between the mountains. The stepper the route with more turning points will necessitate more pylons and strain towers;
- Only approximately 5% of the route needs new access roads.

**Tab-Nzh 1a**

- Low impact on vegetation
- Follows existing power line and servitude which will need to be widened;
- Existing access roads.

**Tab-Nzh 1b**

- Low impact on vegetation;
- Follows existing power line and servitude which will need to be widened;
- Existing access roads;

**Tab-Nzh 2**

- Corridor will have low impact on vegetation as most of the area is highly impacted;
- There is an existing power line and servitude which will need to be widened;
- Follows an existing railway line;
- Bush encroachment was also observed on this route and thus the biodiversity has decreased over this area.

**Tab-Nzh 3**

- Corridor will have a high impact on vegetation, the area is pristine with Nature Reserve;
- There are no access roads, creating new roads requires vegetation clearance;
- High in biodiversity;
- Crosses the Ben Lavin nature reserve.

**Tab-Nzh 4**

- Impact will be high along the ridge ;
- The narrow ridge through the Waterpoort is high in biodiversity;
- The Waterpoort ridge is highly inaccessible and new roads of extreme length will have to be constructed;
- There is an access road on the south and the north of the Waterpoort ridge along the railway line;

- More pylons will have to be erected due to the undulate terrain that will necessitate turns and bends that will mean heavier construction methods and stronger towers. Tower sites will have to stabilised which in turn mean bigger sites;

**Tab-Nzh 5**

- The corridor will have a high impact due to no access for most part of the route;
- The area is virtually undisturbed and houses a lot of protected plant species;
- There are no access roads
- No linear infrastructure in this area;
- The area is flat to undulate and fewer pylons will have to be constructed.

## 6. Route Alternative Ranking

In order to identify which of the alternative routes is deemed preferred the specialists were requested to rank the alternatives routes according to a route ranking methodology.

The evaluation and nomination of a preferred route involves a highly interdisciplinary approach. The rating of each route was conducted according to the following system:

1 = Not suitable for development / No-Go (impact of very high significance - negative)
2 = not preferred (impact of high significance - negative)
3 = acceptable (impact of moderate significance - negative)
4 = Preferred (impact of low or negligible significance - negative)

**Table 1** outlines the vegetation criteria for each of the route preference ratings.

**Table 1**: Vegetation Criteria for Route Preference Ratings

| Site preference Rating | Criteria |
|---|---|
| Preferred (4) | A preferred route will be in an area where:<br>• There is limited or no vegetation clearance required;<br>• There is limited or no pristine habitats and areas of high biodiversity;<br>• No red data or protected species;<br>• High encroachment of species |
| Acceptable (3) | An acceptable route will be in an area where:<br>• There is limited vegetation clearance required;<br>• There is limited or less pristine habitat and areas of high biodiversity;<br>• No red data or protected species;<br>• High encroachment of species. |

| | |
|---|---|
| Not Preferred (2) | A route is not preferred if :<br>• There will be high vegetation clearance required( no pre-existing servitudes and or access roads);<br>• There is pristine habitats and areas of high biodiversity;<br>• There is red data or protected species;<br>• There is less or no encroachment of species. |
| No-Go (1) | A no go route will be an area where:<br>• Extensive vegetation clearance will be required<br>• There is a lot of pristine habitats and areas of high biodiversity,<br>• There is an occurrence of red data or protected species more than one species<br>• And there is no encroachment of species |

**Tab-Nzh 1**
This corridor is preferred as it follows an existing power line which has an existing servitude and access roads. Sections of the route may need to be routed in such a way that it will avoid protected plants such as was observed on the farm Franshoek.

**Tab-Nzh 1a**
Most preferred because it follows the existing power line.

**Tab-Nzh 1b**
Most preferred because it follows an existing power line.

**Tab-Nzh 2**
Preferred because of the high disturbance in vegetation, and the existing impact on the biodiversity. and the route follows an existing power line and railway.

**Tab-Nzh 3**
Not preferred – route will impact on un-fragmented and natural Makhado Sweet Bushveld. This corridor could also impact on Tzaneen Sour Bushveld which is an endangered vegetation unit;

**Tab-Nzh 4**
Not preferred due to vegetation's sensitivities associated with the Soutpansberg Mountain Bushveld and the extreme sensitive Waterpoort ridges;

**Tab-Nzh 5**
Not preferred due to vegetation sensitivity.

**Table 2** presents the results of the above conclusions.

**Table 2:** Final Site Ranking from a vegetation perspective

| Study | Alt 1 | Alt 1a | Alt 1b | Alt 2 | Alt3 | Alt 4 | Alt 5 |
|---|---|---|---|---|---|---|---|
| **Flora** | 4 | 4 | 4 | 4 | 1 | 2 | 1 |

## 7. Mitigation and Recommendations

**Vegetation clearance**

- After vegetation clearing, re –growth must be allowed to occur and shall be cut within 50 mm of the ground and the vegetation is not to be disturbed after initial clearing. Indigenous vegetation which does not interfere with the safe construction and operation of the power line should be left undisturbed.
- Existing access roads along the existing servitude should be used as far as possible, for access during construction and operations. Clearing for pylon positions must be the minimum required for the specific tower, not more than a 5m radius around the structure position (Eskom- TRMAGAAZ7)

**Control of invasive/alien vegetation**

Alien vegetation in servitudes shall be managed in terms of the Regulation GNR.1048 of 25 May 1984 (as amended) issued in terms of the Conservation of Agricultural Resources Act, Act 43 of 1983. Weeds and invasive vegetation should be removed prior to construction activities preventing spreading into newly disturbed areas or areas cleared of vegetation. Alien plant species that invade disturbed soils around the newly erected pylons must be controlled. This should be done in such a way as to allow the natural grasses to colonise the disturbed area, thereby keeping the aliens at bay. No chemical control to be used in the control of alien plants or indigenous plants (Eskom-TRMAGAAZ7))

**Soil erosion**

- Access roads and site surfaces must be monitored for deterioration and possible erosion during construction and operations and eroded area must be rehabilated. All areas susceptible to erosion must be installed with temporary and permanent diversion channels and berms to prevent concentration of surface water and scouring of slopes and banks, thereby countering soil erosion.
- All vehicle movement must be along the existing access roads. Surface area under power lines to be mowed and not ploughed. Disturbed surface areas in the construction phase to be restored. No mounds of soils created during construction to be left. After completion of the project all disturbed sites and surfaces to be restored.
- The use of permitted access roads only at all times during construction and operations will play a big role in ensuring that the vegetation re growth can be successful and the area outside the servitude can be rehabilated. All the above mentioned mitigation measures needs to be implemented to the core to ensure that there is no further unnecessary damage or disturbances to the flora/vegetation.

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