PROPOSED 400 KV TRANSMISSION LINE FROM BORUTHO SUBSTATION IN MOKOPANE TO BOKMAKIERIE SUBSTATION IN NZHELELE, LIMPOPO PROVINCE
DEA REFERENCE NO. 14/12/16/3/3/2/287, NEAS REFERENCE NO. DEAT/EIA/0001049/2012

VISUAL IMPACT ASSESSMENT

PREPARED FOR:

NZUMBULULO HERITAGE SOLUTIONS

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EXECUTIVE SUMMARY

Nzumbululo Heritage Solutions South Africa (HESSA) was appointed by Eskom Transmission, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed construction of a new 400kV Power Line from the proposed Borutho Substation near Mokopane to the proposed Bokmakierie Substation, Limpopo Province.

Axis Landscape Architecture cc was appointed by Nzumbululo Heritage Solutions as a sub-consultant to complete a Visual Impact Assessment. This Visual Impact Assessment (VIA) is a specialist study that forms part of the EIA and addresses the visual affects of the proposed line and substation on the receiving environment.

Gerhard Griesel, the principal Landscape Architect and Visual Specialist from Axis Landscape Architecture cc undertook this VIA. He is a registered Professional Landscape Architect at the South African Council of Landscape Architects, SACLAP no 20161. Gerhard has been involved as Visual Impact Specialist since 2005.

Neither the author, nor Axis Landscape Architects will benefit from the outcome of the project decision-making.

Three Alternative alignments have been proposed for the line. The alternatives stretch over approximately 250km.

The study area contains the extent of all the alternative alignments and substations and includes an approximate 5 km buffer area around the alternatives.

PROJECT DESCRIPTION

The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

- Construction camps and lay-down yards;
- Access roads
- The Borutho and Bokmakierie Substations; and
- Transmission line.

Of the three project components, the towers of the transmission line and the substation are expected to cause the greatest impacts. A brief description of the tower characteristics, the three alternatives and their individual routes are discussed in the following tables.

Types and typical characteristics of proposed towers			
Type	**Guyed suspension tower**	**Self-supporting suspension tower**	**Cross-rope tower**
Maximum Height	38 m	30 m	38 m
Concrete footings	2	4	2
Servitude width	55 m	47 m	80 m

DESCRIPTION OF ALTERNATIVE ALIGNMENTS	
ALTERNATIVES	**DESCRIPTION**
Alternative 1	Alternative 1 is proposed to run from the proposed Borutho Substation in a north western direction for 35km, turns north east till it cross the R37, turn more east, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.
Alternative 2	Alternative 2 is proposed to run from the proposed Borutho Substation in a north eastern direction crossing the R37, turn north west till it meets up with alternative 1, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.
Alternative 3	Alternative 3 is proposed to run from the proposed Borutho Substation in a north western direction for 18km, turn north east till it meets up with alternative 1, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Broadly speaking, the study area consist of both vacant undeveloped, as well as cultivated, residential and subsistence farming. Extensive game faming is located more to the northern side of the study area and agricultural and residential activities to the south. Subsistence farming activities are more intense further south and east of the study area. Human settlements are scattered throughout the study area and the landscape are degraded around these settlements

The landscape character changes considerably through the study area. The study area is divided into distinct landscape types, which are areas within the study area that are relatively homogenous in character (Swanwick, 2002). Landscape types are distinguished by differences in topographical features, vegetation communities and patterns, land use and human settlement patterns.

The following broad scale landscape types have been identified in the study area:

- Capricorn Agricultural;
- Capricorn Rural Settlements; and
- Capricorn Bushveld.

FINDINGS AND RECOMMENDATIONS

LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of " the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002).

The landscape character sensitivity of the different landscape types is categorised according to a rating system adapted from the England Government Office of the South-West (GOSW) (2006). A summary of the rating system can be found in the main report, Table 7.

The majority of the study area is considered to have a *high* landscape character sensitivity due to the relatively undeveloped and bushveld condition of the landscape, the generally high visual quality and the related tourism value that is placed on the visual resource.

The landscape character of the different landscape types is considered highly susceptible to change, whether it is a low intensity change over an extensive area or an acute change over a limited area. Generally, the vegetation occurring in the study area is not resilient and recovers very slowly from surface disturbances. This often results in long periods of exposed soil and a reduction in visual quality.

Certain areas in the study area have previously been disturbed by human activities. These areas have undergone a loss in landscape character sensitivity and do not portray the same level of visual quality as the rest of the study area. The reduced sensitivities of the different landscape characters are localised and do not account for the entire landscape type. These areas and the reduced sensitivities are summarised in Table 8.

SIGNIFICANCE OF LANDSCAPE IMPACTS

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types it traverses.

The following table provides a summary of the anticipated landscape impacts that may occur as a result of the construction of the transmission line.

LANDSCAPE IMPACT								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due to the presence of foreign elements and a loss of vegetation cover.	Localised impacts over an extensive area	Permanent if not mitigated	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the presence of a transmission line.	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Construction phase

The activities that are expected to cause landscape impacts and that are associated with the construction phase, are the establishment of the construction camp, construction of access roads and the clearance of the servitude. These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The extent of the disturbances will generally affect a relative small footprint area. Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. During construction, the area around the individual towers will be disturbed. Vegetation will be trampled and may take years to recover.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the severity of the landscape impact. Due to a lack of technical information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in a undeveloped landscape will cause a temporary and localised alteration to the landscape character. A construction camp located in or adjacent to an existing town or settlement will be easily associated with the town and therefore the presence of the town, mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is.

Servitudes will generally be cleared of higher growing and dense vegetation to reduce biomass that may cause a fire hazard if ignited. The complete removal of high growing vegetation and scrubs will result in disturbed areas of exposed soil and difference in texture.

The exposed soil and change in texture will contrast severely with the intact vegetation around the disturbance footprint and servitudes.

The presence of the roads and existing power lines has caused a localised reduction in the visual quality of the landscape types. Areas along these routes are occupied by active or fallow cropland, which further reduces the quality of the landscape. The VAC between Borutho and Bokmakierie is also considered moderate due to the varied topography. These factors limit the *severity of landscape impact* to a *low* degree.

Considering the moderate to low VAC throughout most of the study area, the undeveloped condition of great parts of the landscape and the slow recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be *moderate* for all the Alternatives. The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it transects landscape types of varying VAC. Surface disturbances are also minimised through, for example, utilising existing roads.

Operational phase

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers. The industrial character and the near monumental vertical scale of the towers will severely contrast with the uniform landscape character that prevails through most of the study area.

All the Alternatives is aligned along the existing linear infrastructure such as the existing transmission line servitude and existing transmission lines as well as various routes. The co-existence of transport routes and transmission lines is a common sight in South Africa. These two man-made features are often associated with each other and are considered compatible land uses. A localised reduction of landscape character sensitivity occurs along the existing servitudes and N1 routes which will result in a *moderately low* significance of landscape impact.

VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a, commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys. The sensitivity of the identified visual receptors is discussed in Section 5.2.1.

SIGNIFICANCE OF VISUAL IMPACTS

Empirical research indicates that the visibility of a transmission tower, and hence the severity of visual impact, decreases as the distance between the observer and the tower increases. The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The following tables summarise the visual impacts on residents, tourists and motorists.

VISUAL IMPACTS ON RESIDENTS

VISUAL IMPACT ON RESIDENTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yards may cause unsightly views.	Local	Temporary	Moderate	Probable	Moderate	Low	High
Alternative 2				Moderate	Probable	Moderate	Low	High
Alternative 3				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape.	Regional	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Generally, the study area is moderately populated, especially the informal settlements and farming communities in the south. These communities are normally situated along main transportation routes, near agricultural areas or adjacent rivers or water resources.

Numerous other farm residents will experience an intrusion on their views due to the presence of the proposed transmission line. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

Considering the transmission of residents across the study area, it can be concluded that the entire study area has a moderate density of residents with the exception of higher concentrations of residents in the towns and rural settlements.

Construction phase

During the construction phase, unsightly views may be created by the presence of the construction camp and the lay-down yards. The uncertainty pertaining to the number, location and size of the construction camps, relates to a low level of confidence in the assessment of the visual impact. The duration of the potential visual impact will be temporary which will result in an anticipated *moderate* significance of visual impact for all the alternatives.

Operational phase

The residents of the rural settlements and farming communities along the existing servitudes and power lines may experience a moderate degree of visual intrusion due to their proximity to all the Alternatives. These residents are within 5 km and in some instances within 1 km from the proposed alignments. This is considered the zone of highest visibility in which the highest degree of visual intrusion can be expected. All the Alternatives southern alignment will affect the largest number of residents compared to the northern alignment. Visual exposure is considered high due to the proximity of the alignment to the informal settlements and the high level of visibility that can be expected.

The VAC of the different landscape types plays a major role in the visibility of the proposed transmission line. As discussed in Section 5.2.2, a diverse land cover and topographically varied terrain does have the ability to decrease the severity of visual impact (Bishop *et al,* 1985) by creating a backdrop. The steel frame of the towers presents a high degree of visual permeability, and hence a low degree of visual obstruction. This characteristic of the towers allows it to readily blend with the background colours and patterns of the landscape. This results in a reduced ZVI because the visibility of the individual towers is limited to a smaller distance.

The presence of a transmission line in the visual field of the residents in this part of the study area will spoil the uncluttered panoramic views they currently experience. The silhouette of a transmission line on the horizon will be visible from a great distance and thus increase the ZVI considerably, potentially impacting on more residents.

VISUAL IMPACTS ON TOURISTS

VISUAL IMPACT ON TOURISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yards may cause unsightly views and spoil the undisturbed views over the landscape.	At a number of point locations	Temporary	Moderate	Probable	Moderate	Low	High
Alternative 2				High	Highly Probable	High	Moderate	High
Alternative 3				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape	Local	Permanent	Low	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Low	Definite	Low	Low	High

The study area is renowned for its biodiversity and Bushveld landscapes. These characteristics provide the basis for the tourism industry which plays a major role in the economy of the Limpopo Province. The entire study area is considered to have a high tourism potential.

The type of tourist that visits the Bushveld is expected to travel considerably through the study area by vehicle. This implies that they will experience a large part of the study area in a relative short time span.

Construction phase

The temporary duration of the construction phase is not expected to cause major visual impacts. The location, number and size of the construction camps and lay-down yards will be crucial in regulating the impact. Detail information is not available and it is anticipated that the visual impact will occur localised and that a small number of tourists will be adversely affected by these project components during construction.

The construction camps may however cause a higher visual intrusion on tourists visiting the mostly vacant, eastern areas of the study area where the possibility of integrating it with existing settlements/towns, is low. This could potentially be the case during the construction of all the alternatives. Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised.

The potential visual impact on tourists during the construction phase of the proposed project can be mitigated with relative ease. The greatest factor to consider is the location of the construction camp out of potential views that may be experienced from scenic routes or tourist hotspots.

Operational phase

Considering the short length of the proposed alternatives, a limited number of tourists will be affected during their visit to the Capricorn Tourism Region. Although it is difficult to pinpoint particular locations in the study area that are of specific tourist value, since the entire study area bares value, the most obvious concentration of tourists can be expected in the Northern part of the study area. For these tourists, all the alternatives will create alterations to their views. The landscape is very photogenic and is the majority of many tourists' photographic memorabilia.

It can be concluded that alternatives 2 will cause visual intrusion for tourists travelling through the study area. The southern part of the study area generally has a low VAC which will cause a greater ZVI (Reference is made to the discussion in Section 5.2.2.1). The severity of the visual impact will be *moderately* severe, causing a *moderately* significant visual impact.

VISUAL IMPACTS ON MOTORISTS

VISUAL IMPACT ON MOTORISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	At a number of point locations	Short period	Low	Probable	Low	Low	High
Alternative 2				Moderate	Highly Probable	Moderate	Low	High
Alternative 3				Low	Probable	Low	Low	High
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Intermittent	Low	Definite	Low	Low	High
Alternative 2			Intermittent	Medium	Definite	Moderate	Low	High
Alternative 3			Intermittent	Low	Definite	Low	Low	High

The major routes in the study area are the N1, N11 and R37 connecting the towns and informal settlements. Secondary and tertiary routes form a loose network of gravel roads in the remote areas, linking smaller settlements. This assessment will be limited to motorists utilising the main routes, as the countless smaller roads are considered as scenic routes, mostly utilised by tourists (Discussed in Section 5.2.1.2).

Construction phase

The potential visual impact that may be experienced by motorists during the construction phase is considered to be minimal. Limited information is available and the number, location and size of the construction camps and lay-down yards are essential for accurately assessing the visual impact. It is anticipated that views of the construction camps and lay-down yards of Alternative 2 may be visible from the N1. The likeliness of a construction camp at this location is high and can be motivated from an accessibility point of view, due to the proximity to a major route.

The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure to the impact will be brief and the severity of visual impact will be *low*. The significance of potential visual impact is expected to be *low*.

Operational phase

Of these routes, the N1, N11 and R37 is the most prominent, carrying the highest volume of traffic. Alternative 2 will be the most visible from the N1. The severity and significance of visual impact for the proposed alternative 1 and 3 on motorists will be *low*. The speed at which motorists travel also has a moderating effect on the severity of the visual impact and further reduces visual exposure. The severity and significance of visual impact for the proposed alternative 3 on motorists will be *moderate*.

RECOMMENDED MITIGATION MEASURES

In most cases, the landscape and visual impacts occurring during the construction phase, can be mitigated relatively effectively. Rehabilitation of the disturbed areas will prevent the exposure of soil, which may cause a reduction in the visual quality of the study area. Sensitive positioning of the construction camps and lay-down yards should take advantage of the natural screening capacity of the study area by locating the camps outside of the views of sensitive visual receptors.

Alternatives 1, 2 and 3 traverse landscapes with both a medium and low VAC. Little or no screening will be provided by the landscape types through which the above mentioned alternatives cross. The Capricorn Bushveld expresses some terrain variability and slight re-alignment of the transmission line can reduce the impacts considerably. The screening capacity of the topography will be able to screen the transmission line from sensitive visual receptors, but have to be delineated on site.

CONCLUSION

The three alternative alignments have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternatives are rated according to preference by using a three-point rating system in Table 10, one (1) being the most preferred, to three (3) being the least preferred.

ALTERNATIVES	PREFERENCE RATING
Alternative 1	1
Alternative 2	3
Alternative 3	2

Alternative 1 is regarded as the most preferred alternative. Its alignment along the existing transmission line and transmission servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The impact of Alternative 1 on visual receptors varies between residents, tourists and motorists. Alternative 1's great advantage lies in the less significant visual impact on tourists as compared to the other alternatives. The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable.

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LIST OF ABBREVIATIONS

EIA	Environmental Impact Assessment.
FHWA	Federal Highway Administration of the United States Department of Transportation. The publishers of the guide "*Visual Impact Assessment for High Projects*" 1981.
LCA	Landscape Character Assessment.
LT	Landscape Type
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment.
ULI	Urban Land Institute
ZVI	Zone of Visual Influence.

1. INTRODUCTION

Nzumbululo Heritage Solutions South Africa (HESSA) was appointed by Eskom Transmission, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed construction of a new 400kV Power Line from the proposed Borutho Substation near Mokopane to the proposed Bokmakierie Substation, Limpopo Province.

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Neither the author, nor Axis Landscape Architects will benefit from the outcome of the project decision-making.

Three Alternative alignments have been proposed for the line. The alternatives stretch over approximately 250km.

The study area contains the extent of all the alternative alignments and substations and includes an approximate 5 km buffer area around the alternatives.

1.1. BACKGROUND AND BRIEF

This VIA will conform to the requirements of a level three assessment which requires the realisation of the following objectives (Adapted from Oberholzer (2005)):

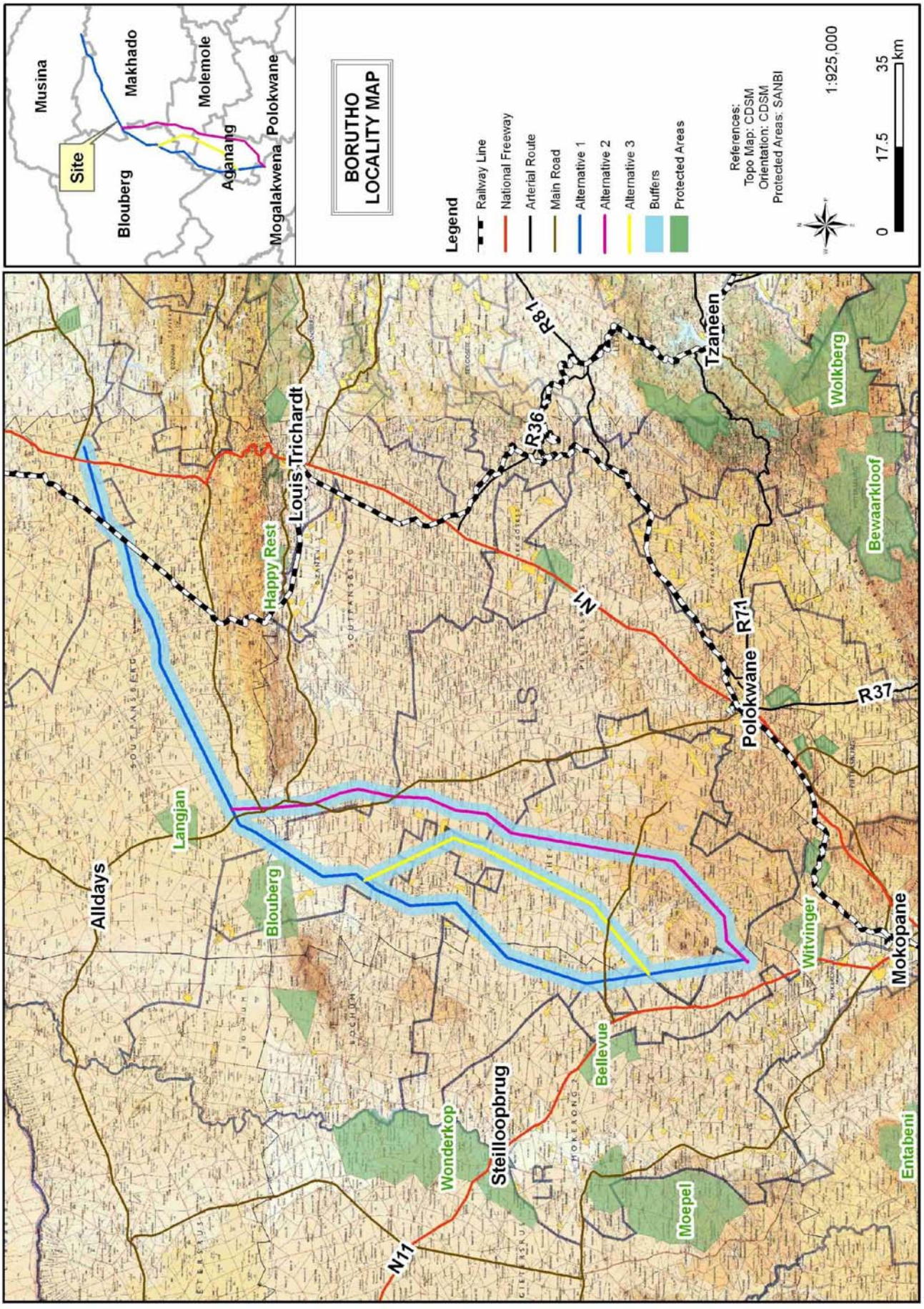
- Determination of the extent of the study area;
- Description of the proposed project and the receiving environment;
- Identification and description of the landscape character of the study area;
- Identification of the elements of particular visual value and -quality that could be affected by the proposed project;
- Identification of landscape- and visual receptors in the study area that will be affected by the proposed project and assess their sensitivity;
- Indication of potential landscape- and visual impacts;
- Assessment of the significance of the landscape- and visual impacts;
- Recommendations of mitigation measures to reduce and/or alleviate the potential adverse landscape- and visual impacts.

1.2. STUDY AREA

The study area includes the entire area covered by the alternative alignments. It stretches from the proposed Borutho substation north west of Mokopane in a north eastern direction to the proposed Bokmakierie substation north of Louis Trichardt (

Figure 1).

Figure 1: Locality Plan



2. STUDY APPROACH

2.1. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town and ECOGIS (2012) respectively;
- Observations made and photographs taken during site visits;
- Technical information received from Eskom Transmission;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

2.2. ASSUMPTIONS AND LIMITATIONS

This assessment was undertaken during the conceptual stage of the project and is based on information available at the time.

- An exact commencement date for the construction phase is unknown. Construction is expected to commence as soon as public participation is complete and approval is received from the relevant authorities;
- The exact location, size and number of construction camps and material lay-down yards are not yet specified at this stage of the project. It is anticipated that construction camps will be set up on farms at central locations along the preferred alignment. The construction camps will consist of temporary structures such as tents or temporary buildings. Ablution facilities will also be associated with the construction camps and are expected to be portable toilets and temporary shower facilities;
- The exact alignment of the proposed transmission lines and position of the pylons are not yet determined and the alternatives only specify proposed corridors. The visibility results have been generated from the anticipated alignment and may deviate from the route for the final approved alignment. The differences are considered omissible;
- This level of assessment excludes surveys to establish viewer preference and thereby their sensitivity. Viewer sensitivity is determined by means of a commonly used rating system (Table 12).

2.3. LEVEL OF CONFIDENCE

The level of confidence assigned to the findings of this assessment is based on:

- The level of information available and/or understanding of the study area (rated 2); and
- The information available and/or knowledge and experience of the project (rated 3).

This visual impact assessment is rated with a general confidence level of 6. This rating indicates that the author's general confidence in the accuracy of the findings is *high* (Table 11). Where the confidence level of specific findings is not regarded as high, it is noted in the last column of each impact assessment table.

2.4. METHOD

A broad overview of the approach and methodology used in this assessment is provided below:

- The extent of the study area is determined and indicated in

Figure 1;

- The site is visited to establish a photographic record of the site, views and areas of particular visual quality and or -value;
- The project components and activities are described and assessed as potential elements of visual and landscape impacts;
- The receiving environment is described in terms of its prevailing landscape- and visual character;
- Landscape- and visual receptors that may be affected by the proposed project are identified and described;
- The sensitivity of the landscape- and visual receptors is assessed;
- The severity of the landscape- and visual impacts is determined;
- The significance of the visual and landscape impacts is assessed;
- Mitigation measures are proposed to reduce adverse impacts; and
- The findings of the study are documented in this Visual Impact Assessment.

3. PROJECT DESCRIPTION

3.1. OVERVIEW OF DEVELOPMENT

The project involves the construction of a 400 kV transmission line from the proposed Borutho substation north of Mokopane, to the proposed Bokmakierie substation in the Nzhelele area in the Limpopo Province. The servitude required for the development along the route is 36m wide and 250km in length between the origin and the end of the line.

3.2. ALTERNATIVE ALIGNMENTS

Table 1: Description of alternative alignments

ALTERNATIVES	DESCRIPTION (Refer to Figure 1)
Alternative 1	Alternative 1 is proposed to run from the proposed Borutho Substation in a north western direction for 35km, turns north east till it cross the R37, turn more east, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.
Alternative 2	Alternative 2 is proposed to run from the proposed Borutho Substation in a north eastern direction crossing the R37, turn north west till it meets up with alternative 1, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.
Alternative 3	Alternative 3 is proposed to run from the proposed Borutho Substation in a north western direction for 18km, turn north east till it meets up with alternative 1, crossing a railway line, the N1 and joins up with the proposed Bokmakierie Substation.

3.3. PROJECT COMPONENTS AND ACTIVITIES

Each project component and activity will affect the receiving environment differently and is therefore discussed separately. The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

3.3.1. CONSTRUCTION CAMPS AND LAY-DOWN YARDS

The construction phase is expected to continue for 8 months from the commencement date. Temporary construction camps will be present for the duration of the construction period. The appointed contractor will set up construction camps along the alignment where practical. The material lay-down yards are expected to be located adjacent the construction camps and will serve as storage areas for the construction material and equipment (

Figure 2).

Various types of construction equipment will be required to erect the transmission towers and suspend the electrical cables between them. A TLB, cement truck and mobile crane will be used during the construction phase in conjunction with between 10 and 40 labourers (

Figure 3).

3.3.2. ACCESS ROADS

Where no access roads are available and vehicular access is required, roads will be constructed. Access may be by means of a two-track dirt road or a cleared corridor through dense thickets. It is expected that roads will be rehabilitated after the construction phase or maintained to facilitate access during periodic maintenance visits (

Figure 2).

3.3.3. TRANSMISSION LINE

The completed transmission line will connect the Borutho substation to the Bokmakierie substation. The direct linear distance between the Tabor and Botlokwa substations is approximately 250 km (

Figure 1).

Table 2: Types and typical characteristics of proposed towers

Type	Guyed suspension tower	Self-supporting suspension tower	Cross-rope tower
Maximum Height	38 m	30 m	38 m
Concrete footings	2	4	2
Servitude width	55 m	47 m	80 m

3.4. VISUAL CHARACTERISTICS OF PROJECT COMPONENTS

Visual character is based on human perception and the observer's response to the relationships between and composition of the visible project components. The transmission line, i.e. the towers and the cables suspended between each tower, is the most visible and permanent project component and is discussed in this section.

The towers have an elegant industrial character enforced by the slender steel lattice framework and the electrical cables between the towers. It has a near monumental scale if compared to the predominantly bushveld landscape. The entire transmission line will be perceived as a rhythmic arrangement of vertical towers forming a linear element through the landscape. The electrical cables emphasise the linear character of the transmission line but are easily absorbed in the background when viewed from distances greater than 1 km.

Figure 2: Example of construction camps

Example of site offices

Example of bush clearing

Example of a construction camp

EXAMPLE OF CONSTRUCTION CAMPS PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 3: Typical construction equipment

CRANE

HELICOPTER

TENSIONER STATION

TYPICAL CONSTRUCTION EQUIPMENT PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the visual resource (landscape) and on the viewers. The former are impacts on the physical landscape that may result in changes to landscape character while the latter are impacts on the viewers themselves and the views they experience.

4.1. VISUAL RESOURCE

Visual resource is an encompassing term relating to the visible landscape and its recognisable elements which, through their co-existence, result in a particular landscape character.

4.1.1. LANDSCAPE CHARACTER

The Limpopo province is a land of dramatic contrasts characterised by hot savannah plains and mist-clad mountains; age-old indigenous forests and cycads alongside latter-day plantations.

It celebrates a rich cultural heritage and at many archaeological sites the mysteries of the past and ancient peoples are still being unearthed.

The study area is consists of both vacant and uninterrupted land as well as cultivated, residential and subsistence farming. Extensive game faming is located more to the northern side of the study area and agricultural and residential activities to the south east. Subsistence farming activities are more intense further south and east of the study area. Human settlements are scattered throughout the study area and the landscape are degraded around these settlements.

The landscape character changes through the study area. The study area is divided into distinct landscape types which are areas within the study area that are relatively homogenous in character (Swanwick, 2002). Landscape types are distinguished by differences in topographical features, vegetation communities and patterns, land use and human settlement patterns (Refer to Figure 5).

The following broad scale landscape types have been delineated in the study area. The assessment is done on a macro-scale and discusses the predominant landscape conditions and visual characteristics found in a particular landscape type. Each landscape type is given a descriptive name which relates to the vegetation type, topography and/or land use of the region (Adapted from Van Riet *et al,* 1997);

- Capricorn Agricultural;
- Capricorn Rural Settlements; and
- Capricorn Bushveld.

Capricorn Agricultural

Capricorn Agricultural is the combination of all the agricultural farms that are scattered through the study area. The agricultural practices vary from formalised commercial farms to subsistence farming.

The concentration of these agricultural farms varies in the study area. There is a lower concentration of the agricultural farms in the northern part of the study area. These agricultural farms form pockets of developed and some degraded areas in the surrounding uniform bushveld character. The south eastern part of the study area has a higher concentration of farms. These farms are surrounded more by informal settlements and degraded land.

Capricorn Rural Settlements

Capricorn Rural settlements are evenly spaced along the southern boundary, none of these villages along the northern boundary can be found. Approximately 8% of households live in proclaimed towns while 73% live in rural villages, with the remainder resident on farms and in informal settlements.

Capricorn Bushveld

The Capricorn bushveld consist of mixed Bushveld vegetation that varies from a dense, short bushveld to a rather open tree savannah.

In some areas granite outcrops where exposed. The height of these outcrops varied from a few metres to 20 m in height. The majority of these outcrops were relatively far away from the footprint of the proposed development.

4.1.2. LANDSCAPE AMENITIES

Landscape amenities are those perceivable landscapes and/or elements of the landscape that greatly contribute to the prevailing landscape character and/or visual quality and –value of the study area.

The Limpopo is an eco-tourist destination where mountain ranges rise suddenly and dramatically out of bushveld plains. On the slopes of these mountains are indigenous forests, placid streams and beautiful waterfalls.

The northern part of the study area is unspoilt providing sanctuary to large numbers of game. Game reserves are scattered through the northern part of the study area.

The granite outcrops between the typical bushveld character contributes to the high tourism value of the Limpopo province.

The openness of the landscape is greatly responsible for the simplistic and essentially secluded landscape character. Vast landscapes and vistas are dominated by medium to low growing vegetation. The panoramic bushveld landscape is an amenity that greatly contributes to the pristine and remote character of the landscape.

4.1.3. VISUAL QUALITY

Visual quality is a qualitative evaluation of the composition of landscape components and their excellence in scenic attractiveness. Many factors contribute to the visual quality of the landscape and are grouped under the following main categories (Table 3) that are internationally accepted indicators of visual quality (FHWA, 1981):

Table 3: Criteria of Visual Quality (FHWA, 1981)

INDICATOR	CRITERIA
Vividness	The memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern.
Intactness	The integrity of visual order in the natural and man-built landscape, and the extent to which the landscape is free from visual encroachment.
Unity	The degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony of inter-compatibility between landscape elements.

The landscape is allocated a rating from an evaluation scale of 1 to 7 and divided by 3 to get an average. The evaluation scale is as follows: Very Low =1; Low =2; Moderately Low =3; Moderate =4; Moderately High =5; High =6; Very High =7;

The landscape types are assessed against each indicator separately. All three indicators should be *high* to obtain a *high* visual quality. The visual quality is assessed on a regional scale and therefore expresses the predominant visual quality of each landscape type. The evaluation is summarised in Table 4.

Table 4: Visual Quality of the regional landscape

LANDSCAPE TYPE	VIVIDNESS	INTACTNESS	UNITY	VISUAL QUALITY
Capricorn Agricultural	4	4	3	Moderate
Capricorn Rural Settlements	2	2	3	Low
Capricorn Bushveld	5	4	6	Moderately High

4.1.4. VISUAL VALUE

Visual value relates to those attributes of the landscape or elements in the landscape to which people attach values that, though not visually perceivable, still contribute to the value of the visual resource. These visual values are derived from ecological, historical, social and/or cultural importance and are described in terms of their uniqueness, scarcity, naturalness and/or conservation status. The importance of visual value of a landscape or an element in the landscape is measured against its value on an international, national or local level.

The study area falls within the Capricorn Tourism Region. This region is part of the four tourism regions in the Limpopo Province. The Capricorn region stretches from the Ysterberg, all along the foothills of the lush Wolkberg, to the tropic of Capricorn in the north. The region's position makes it a perfect stopover between Gauteng and the northern areas of the province and between the country's north-western areas and the world-renowned Kruger National Park. It is also in close proximity to the neighbouring countries of Botswana, Zimbabwe, Mozambique and Swaziland

4.1.5. VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as:

- Degree of visual screening:
  - A degree of visual screening is provided by landforms, vegetation cover and/or structures such as buildings. For example, a high degree of visual screening is present in an area that is mountainous and is covered with a forest compared to an undulating an mundane landscape covered in grass;

- Terrain variability:
  - Terrain variability reflects the magnitude of topographic elevation and diversity in slope variation. A highly variable terrain will be recognised as one with great elevation differences and a diversity of slope variation creating talus slopes, cliffs and valleys. An undulating landscape with a monotonous and repetitive landform will be an example of a low terrain variability;
- Land cover:
  - Land cover refers to the perceivable surface of the landscape and the diversity of patterns, colours and textures that are presented by the particular land cover (i.e. urbanised, cultivated, forested, etc.);

A basic rating system is used to evaluate each landscape type against the three VAC parameters. The values are relative and relate to the type of project that is proposed and how it may be absorbed in the landscape (Table 5). A three value range is used; three (3) being the highest potential to absorb an element in the landscape and one (1) being the lowest potential. The values are counted together and categorised in a *high*, *medium* or *low* VAC rating.

Table 5: Visual Absorption Capacity evaluation

LANDSCAPE TYPE	VISUAL SCREENING	TERRAIN VARIABILITY	LAND COVER	VAC
Capricorn Agricultural	2	1	1	Low
Capricorn Rural Settlements	3	2	2	Moderate
Capricorn Bushveld	2	2	2	Moderate

Figure 4: Elevation map of study area

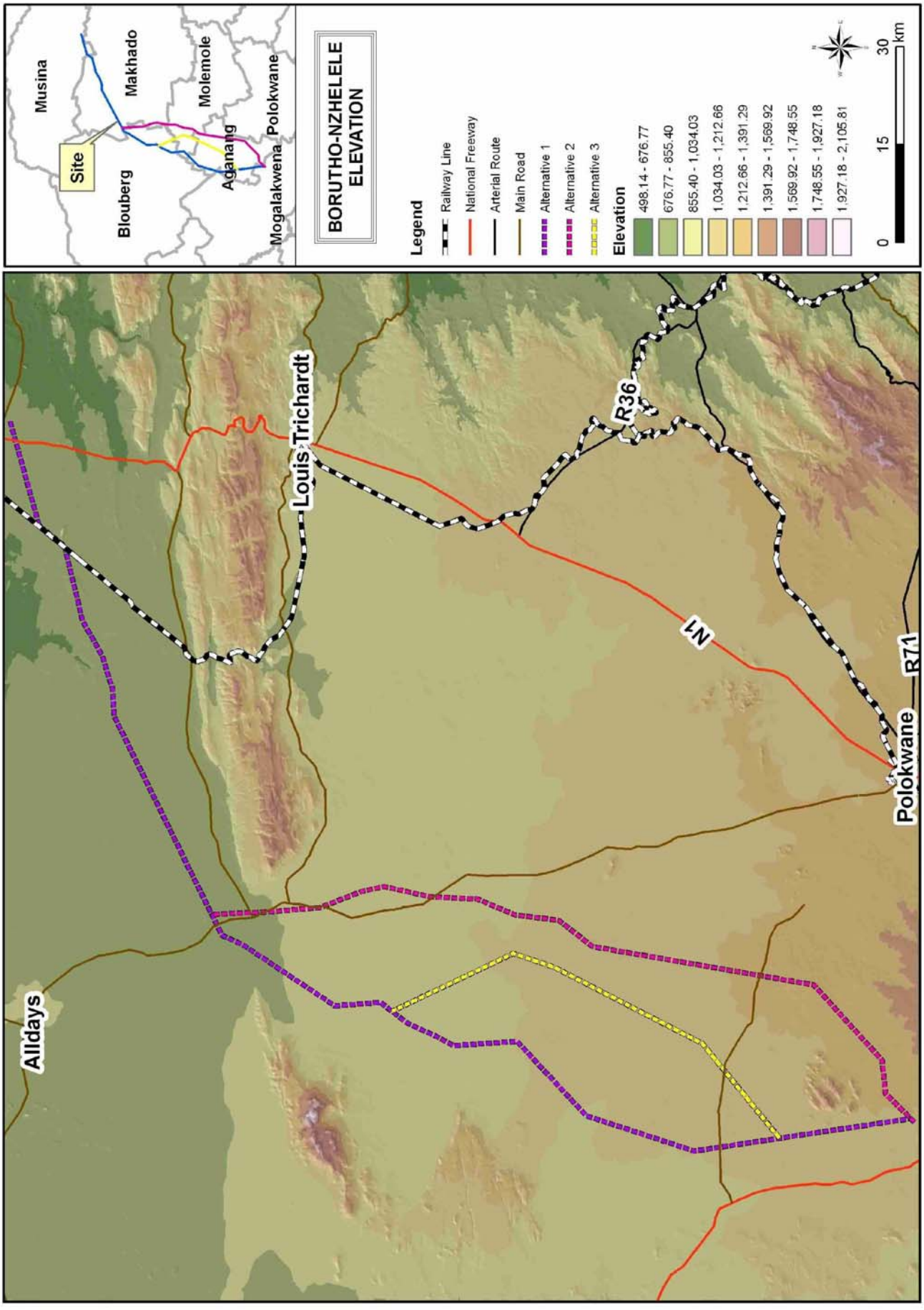


Figure 5: Land cover map of study area

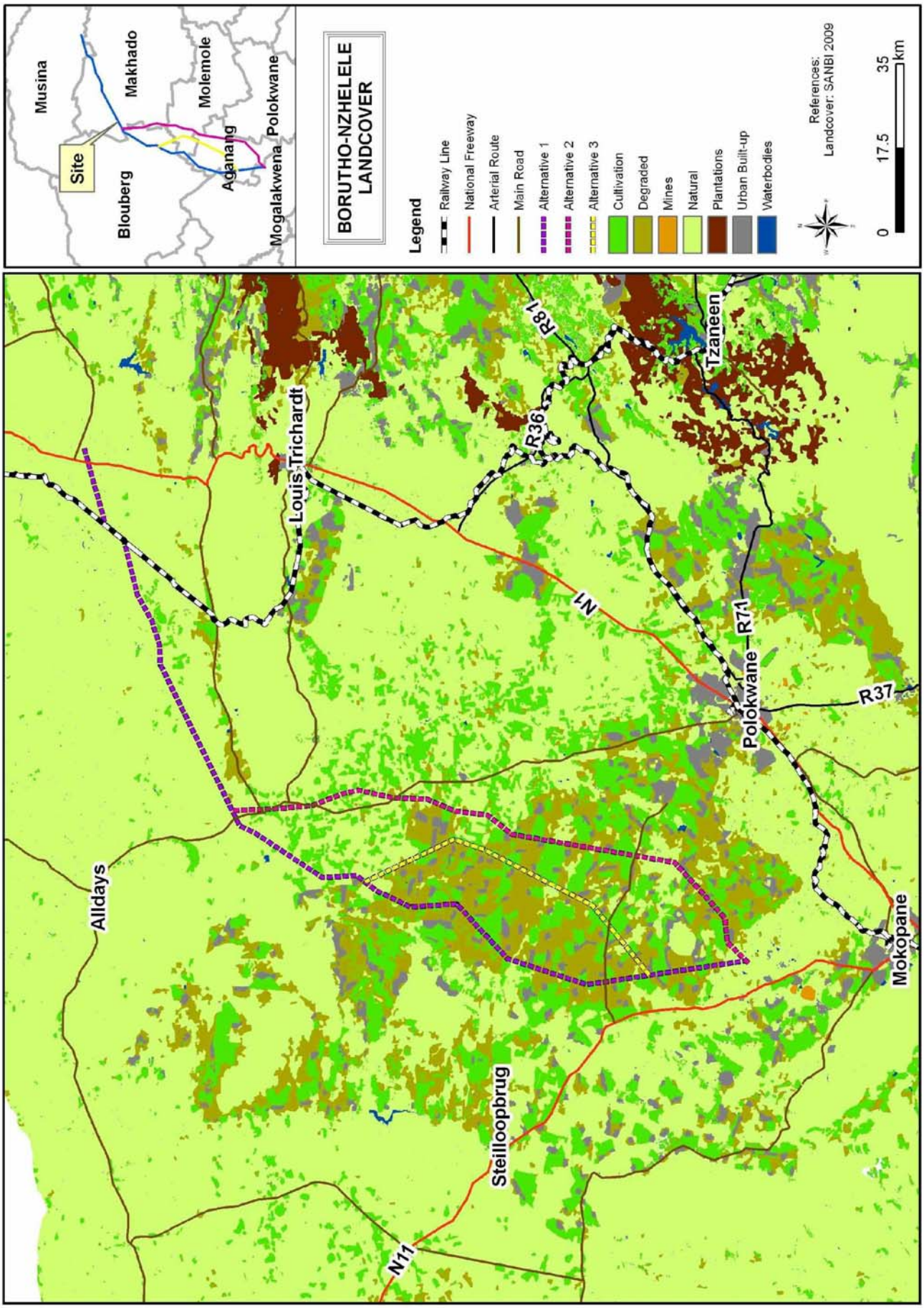
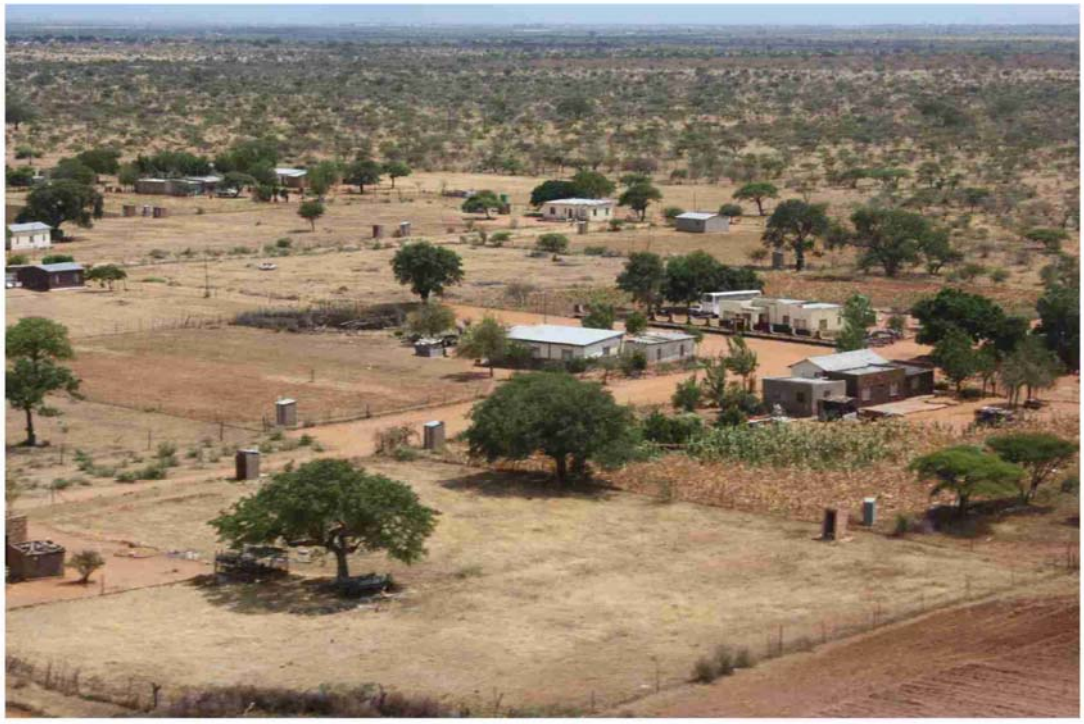


Figure 6: Landscape types of study area

CAPRICORN AGRICULTURAL



CAPRICORN RURAL SETTLEMENTS

LANDSCAPE CHARACTER PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

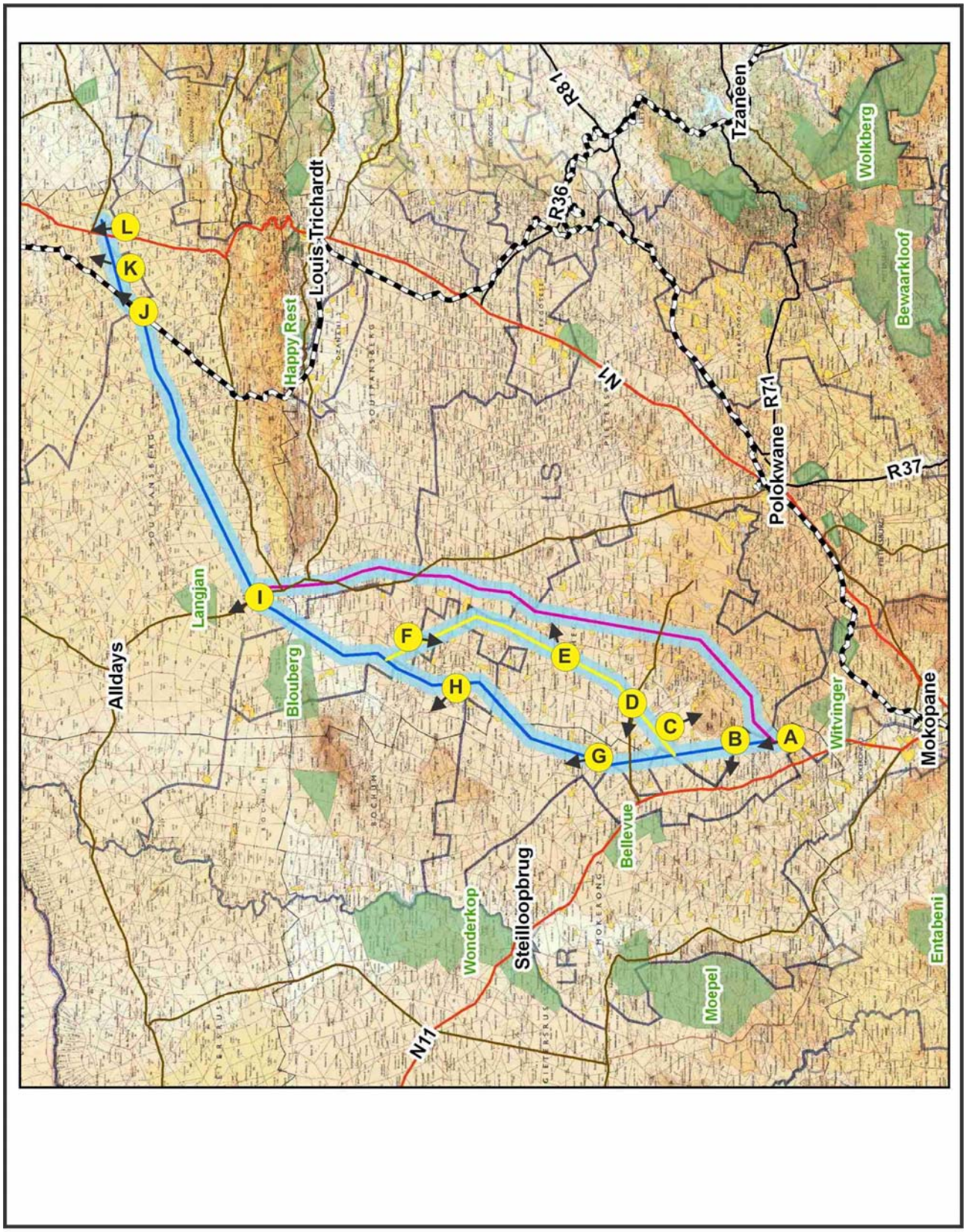
Figure 7: Landscape types of the study area

CAPRICORN BUSHVELD

CAPRICORN GAMEFARMS

LANDSCAPE CHARACTER PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 8: Photo Reference Map



SITE CONTEXT PHOTO'S REFERENCE MAP PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 9: Photo plate 1

VIEW A: VIEW TOWARDS THE PROPOSED BORUTHO SUBSTATION

VIEW B: VIEW TOWARDS A LOCAL ROAD

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 10: Photo plate 2

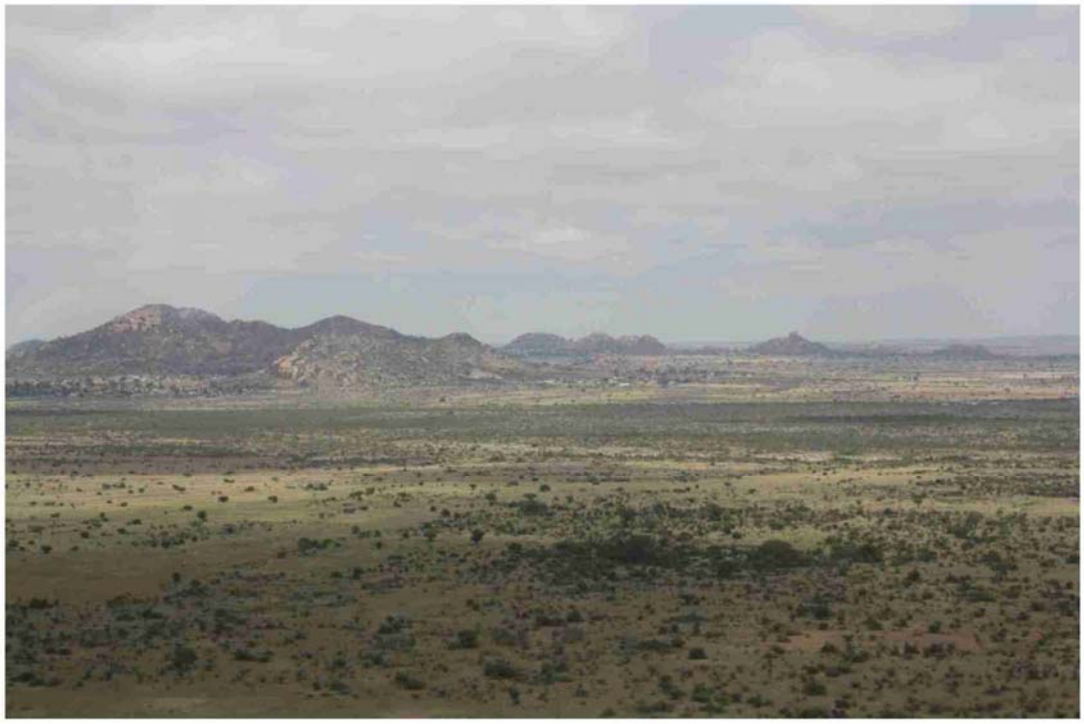
VIEW C: VIEW TOWARDS A RURAL SETTLEMENT

VIEW D: VIEW TOWARDS A LOCAL ROAD

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 11: Photo plate 3

VIEW E: VIEW TOWARDS A RURAL SETTLEMENT



VIEW F: VIEW TOWARDS ALTERNATIVE 3

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 12: Photo plate 4

VIEW G: VIEW TOWARDS A RURAL SETTLEMENT

VIEW H: VIEW OF THE CAPRICORN BUSHVELD

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 13: Photo plate 5

VIEW I: VIEW TOWARDS THE R37

VIEW J: VIEW TOWARDS THE RAILWAY LINE

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

Figure 14: Photo plate 6

VIEW K: VIEW TOWARDS A GAME FARM

VIEW L: VIEW TOWARDS THE N1

SITE CONTEXT PHOTO'S PROPOSED BORUTHO - NZHELELE 400 KV POWERLINE	Compiled for: Nzumbululo Heritage Solutions Reference:BOR2011- LANDS TYPES-A4.cdr Date: 2012-04-16	AXIS LANDSCAPE ARCHITECTURE

5. IMPACT ASSESSMENT

The significance of impacts is a comparative function relating to the severity of the identified impacts on the respective receptors. The significance of an impact is considered *high* should a *highly* sensitive receptor be exposed to a *highly* severe impact (Table 6).

Table 6: Significance of impacts

RECEPTOR SENSITIVITY	IMPACT SEVERITY		
	LOW	MEDIUM	HIGH
LOW	No significance	Low	Low
MEDIUM	Low	Medium	Medium
HIGH	Low	Medium	High

5.1. SIGNIFICANCE OF LANDSCAPE IMPACT

5.1.1. LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of " the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002). A landscape with a *high* sensitivity would be one that is greatly valued for its aesthetic attractiveness and/or have ecological, cultural or social importance through which it contributes to the inherent character of the visual resource.

The assessment of the sensitivity of the different landscape types is substantiated through professional judgement and informed reasoning which is based on the landscape character assessment in Section 4. A landscape sensitivity rating was adapted from GOSW (2006) (Table 7) and applied in the classification of the study area into different sensitivity zones.

Table 7: Landscape character sensitivity rating (Adapted from GOSW, 2006)

	DESCRIPTION
Low sensitivity	These landscapes are likely to: ° Have distinct and well-defined landforms; ° Have a strong sense of enclosure; ° Provide a high degree of screening; ° Have been affected by extensive development or man-made features; ° Have reduced tranquillity; ° Are likely to have little inter-visibility with adjacent landscapes; and ° Exhibit no or a low density of sensitive landscape features that bare visual value.
Moderately sensitivity	These landscapes are likely to: ° Have a moderately elevated topography with reasonably distinct landforms that provides some sense of enclosure; ° Have been affected by several man-made features; ° Have limited inter-visibility with adjacent landscapes; and ° Exhibit a moderate density of sensitive landscape features that bare visual value.
Highly sensitivity	These landscapes are likely to: ° Consist mainly of undulating plains and poorly defined landforms; ° Be open or exposed with a remote character and an absence of man-made features; ° Are often highly visible from adjacent landscapes; and ° Exhibit a high density of sensitive landscape features that bare visual value.

The majority of the study area is considered to have a *moderate* landscape character sensitivity due to the relative undeveloped condition of the landscape, the generally high visual quality and the related tourism value that is placed on the visual resource. Low terrain variability mainly occurs in the southern part of the study area where a low to moderate VAC can be expected. Generally the vegetation cover is limited to medium to low shrubs and trees covers which will provide limited visual screening for the proposed transmission line.

The landscape character of the different landscape types is considered moderately susceptible to change, whether it is a low intensity change over an extensive area or an acute change over a limited area. Generally, the vegetation occurring in the study area is not resilient and recovers very slowly from surface disturbances. This often results in long periods of exposed soil and a reduction in visual quality.

Previous human induced activities and interventions have negatively impacted the original landscape character of the different landscape types. In this case, the agricultural farms that are scattered through the study area, the informal settlements with their subsistence farming and existing infrastructure, including transmission lines, roads, etc., can be classified as landscape disturbances and elements that cause a reduction in the condition of the affected landscape type and detrimentally affect the quality of the visual resource.

The reduced sensitivities of the different landscape characters are localised and do not account for the entire landscape type. The impact of existing development on the different landscape types is discussed in Table 8.

Table 8: Landscape character sensitivity

LANDSCAPE TYPE (LT)	PREVAILING LANDSCAPE CHARACTER SENSITIVITY	AREA OF DISTURBANCE IN LT	LOCALISED REDUCTION OF SENSITIVITY
Capricorn Agricultural	Low	• The areas around agricultural farms • The fallow lands of subsistence farming	Moderate
Capricorn Rural Settlements	Low	Degraded areas around these settlements	Moderate
Capricorn Bushveld	High	• The agricultural fields • Informal Settlements • The R36 and N1 routes	Low

5.1.2. SEVERITY OF POTENTIAL LANDSCAPE IMPACTS

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types it traverses. The magnitude/severity of this intrusion is measured against the scale of the project, the permanence of the intrusion and the loss in visual quality, -value and/or VAC.

Table 9: Landscape impact – Altering the landscape character

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due to the presence of foreign elements and a loss of vegetation cover.	Localised impacts over an extensive area	Permanent if not mitigated	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the presence of a transmission line.	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Construction phase

The activities that are expected to cause landscape impacts and that are associated with the construction phase, are the establishment of the construction camp, construction of access roads and the clearance of the servitude. These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The extent of the disturbances will generally affect a relative small footprint area. Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. During construction, the area around the individual towers will be disturbed. Vegetation will be trampled and may take years to recover.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the severity of the landscape impact. Due to a lack of technical information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in a

undeveloped landscape will cause a temporary and localised alteration to the landscape character. A construction camp located in or adjacent to an existing town or settlement will be easily associated with the town and therefore the presence of the town, mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is.

Servitudes will generally be cleared of higher growing and dense vegetation to reduce biomass that may cause a fire hazard if ignited. The complete removal of high growing vegetation and scrubs will result in disturbed areas of exposed soil and difference in texture.

The exposed soil and change in texture will contrast severely with the intact vegetation around the disturbance footprint and servitudes.

The presence of the roads and existing power lines has caused a localised reduction in the visual quality of the landscape types. Areas along these routes are occupied by active or fallow cropland, which further reduces the quality of the landscape. The VAC between Borutho and Bokmakierie is also considered moderate due to the varied topography. These factors limit the *severity of landscape impact* to a *low* degree.

Considering the moderate to low VAC throughout most of the study area, the undeveloped condition of great parts of the landscape and the slow recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be *moderate* for all the Alternatives. The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it transects landscape types of varying VAC. Surface disturbances are also minimised through, for example, utilising existing roads.

Operational phase

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers. The industrial character and the near monumental vertical scale of the towers will severely contrast with the uniform landscape character that prevails through most of the study area.

All the Alternatives is aligned along the existing linear infrastructure such as the existing transmission line servitude and existing transmission lines as well as various routes. The co-existence of transport routes and transmission lines is a common sight in South Africa. These two man-made features are often associated with each other and are considered compatible land uses. A localised reduction of landscape character sensitivity occurs along the existing servitudes and N1 routes which will result in a *moderately low* significance of landscape impact.

5.2. SIGNIFICANCE OF VISUAL IMPACTS

5.2.1. VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys.

5.2.1.1 Residents

Residents of the affected environment are classified as visual receptors of *high* sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment.

5.2.1.2 Tourists

Tourists are regarded as visual receptors of exceptional *high* sensitivity. Their attention is focused towards the landscape which they essentially utilise for enjoyment purposes and appreciation of the quality of the landscape.

5.2.1.3 Motorists

Motorists are generally classified as visual receptors of *low* sensitivity due to their momentary view and experience of the proposed development. As a motorist's speed increases, the sharpness of lateral vision declines and the motorist tends to focus on the line of travel (USDOT, 1981). This adds weight to the assumption that under normal conditions, motorists will show *low* levels of sensitivity as their attention is focused on the road and their exposure to roadside objects is brief.

Motorists on the scenic routes in the study area will present a higher sensitivity. Their reason for being in the landscape is similar to that of the tourists and they will therefore be categorised as part of the tourist viewer group.

5.2.2. SEVERITY OF POTENTIAL VISUAL IMPACTS

Severity of visual impact refers to the magnitude of change to specific visual receptor's views and/or experience of the landscape. Severity of visual impact is influenced by the following factors:

- The **viewer's exposure** to the project:
  - Distance of observers from the proposed project;
  - The visibility of the proposed project (ZVI);
  - Number of affected viewers; and
  - Duration of views to development experienced by affected viewers.
- Degree of **visual intrusion** created by the project.

Empirical research indicates that the visibility of a transmission tower and hence the severity of visual impact, decreases as the distance between the observer and the tower increases. The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The Zone of Visual Influence (ZVI) is determined through a Geographical Information System (GIS). The result reflects a shaded pattern which identifies the areas that are expected to experience views of the proposed alignments. The ZVI is limited to 10 km from the proposed alignments.

A visibility analysis has been completed for each of the three alternative alignments (APPENDIX 1). According to Bishop *et al* (1988), visual receptors within 1 km from the alignment are most likely to experience the highest degree of visual intrusion, hence contributing to the severity of the visual impact. This is considered as the zone of highest visibility after which the degree of visual intrusion decreases rapidly at distances further away.

The visibility analysis considers the worst-case scenario, using line-of-sight based on topography alone. This assists the process of identifying possible affected viewers and the extent of the affected environment.

5.2.2.1 Potential visual impacts on residents

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yards may cause unsightly views.	Local	Temporary	Moderate	Probable	Moderate	Low	High
Alternative 2				Moderate	Probable	Moderate	Low	High
Alternative 3				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape.	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Generally, the study area is moderately populated, especially the informal settlements and farming communities in the south. These communities are normally situated along main transportation routes, near agricultural areas or adjacent rivers or water resources.

Numerous other farm residents will experience an intrusion on their views due to the presence of the proposed transmission line. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

Considering the transmission of residents across the study area, it can be concluded that the entire study area has a moderate density of residents with the exception of higher concentrations of residents in the towns and rural settlements.

Construction phase

During the construction phase, unsightly views may be created by the presence of the construction camp and the lay-down yards. The uncertainty pertaining to the number, location and size of the construction camps, relates to a low level of confidence in the assessment of the visual impact. The duration of the potential visual impact will be temporary which will result in an anticipated *moderate* significance of visual impact for all the alternatives.

Operational phase

The residents of the rural settlements and farming communities along the existing servitudes and power lines may experience a moderate degree of visual intrusion due to their proximity to all the Alternatives. These residents are within 5 km and in some instances within 1 km from the proposed alignments. This is considered the zone of highest visibility in which the highest degree of visual intrusion can be expected. All the Alternatives southern alignment will affect the largest number of residents compared to the northern alignment. Visual exposure is considered high due to the proximity of the alignment to the informal settlements and the high level of visibility that can be expected.

The VAC of the different landscape types plays a major role in the visibility of the proposed transmission line. As discussed in Section 5.2.2, a diverse land cover and topographically varied terrain does have the ability to decrease the severity of visual impact (Bishop *et al,* 1985) by creating a backdrop. The steel frame of the towers presents a high degree of visual permeability, and hence a low degree of visual obstruction. This characteristic of the towers allows it to readily blend with the background colours and patterns of the landscape. This results in a reduced ZVI because the visibility of the individual towers is limited to a smaller distance.

The presence of a transmission line in the visual field of the residents in this part of the study area will spoil the uncluttered panoramic views they currently experience. The silhouette of a transmission line on the horizon will be visible from a great distance and thus increase the ZVI considerably, potentially impacting on more residents.

5.2.2.2 Potential visual impacts on tourists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yards may cause unsightly views and spoil the undisturbed views over the landscape.	At a number of point locations	Temporary	Moderate	Probable	Moderate	Low	High
Alternative 2				High	Highly Probable	High	Moderate	High
Alternative 3				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape	Local	Permanent	Low	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Low	Definite	Low	Low	High

The study area is renowned for its biodiversity and Bushveld landscapes. These characteristics provide the basis for the tourism industry which plays a major role in the economy of the Limpopo Province. The entire study area is considered to have a high tourism potential.

The type of tourist that visits the Bushveld is expected to travel considerably through the study area by vehicle. This implies that they will experience a large part of the study area in a relative short time span.

Construction phase

The temporary duration of the construction phase is not expected to cause major visual impacts. The location, number and size of the construction camps and lay-down yards will be crucial in regulating the impact. Detail information is not available and it is anticipated that the visual impact will occur localised and that a small number of tourists will be adversely affected by these project components during construction.

The construction camps may however cause a higher visual intrusion on tourists visiting the mostly vacant, eastern areas of the study area where the possibility of integrating it with existing settlements/towns, is low. This could potentially be the case during the construction of all the alternatives. Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised.

The potential visual impact on tourists during the construction phase of the proposed project can be mitigated with relative ease. The greatest factor to consider is the location of the construction camp out of potential views that may be experienced from scenic routes or tourist hotspots.

Operational phase

Considering the short length of the proposed alternatives, a limited number of tourists will be affected during their visit to the Capricorn Tourism Region. Although it is difficult to pinpoint particular locations in the study area that are of specific tourist value, since the entire study area bares value, the most obvious concentration of tourists can be expected in the Northern part of the study area. For these tourists, all the alternatives will create alterations to their views. The landscape is very photogenic and is the majority of many tourists' photographic memorabilia.

It can be concluded that alternatives 2 will cause visual intrusion for tourists travelling through the study area. The southern part of the study area generally has a low VAC which will cause a greater ZVI (Reference is made to the discussion in Section 5.2.2.1). The severity of the visual impact will be *moderately* severe, causing a *moderately* significant visual impact.

5.2.2.3 Potential visual impacts on motorists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	At a number of point locations	Short period	Low	Probable	Low	Low	High
Alternative 2				Moderate	Highly Probable	Moderate	Low	High
Alternative 3				Low	Probable	Low	Low	High
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Intermittent	Low	Definite	Low	Low	High
Alternative 2			Intermittent	Medium	Definite	Moderate	Low	High
Alternative 3			Intermittent	Low	Definite	Low	Low	High

The major routes in the study area are the N1, N11 and R37 connecting the towns and informal settlements. Secondary and tertiary routes form a loose network of gravel roads in the remote areas, linking smaller settlements. This assessment will be limited to motorists utilising the main routes, as the countless smaller roads are considered as scenic routes, mostly utilised by tourists (Discussed in Section 5.2.1.2).

Construction phase

The potential visual impact that may be experienced by motorists during the construction phase is considered to be minimal. Limited information is available and the number, location and size of the construction camps and lay-down yards are essential for accurately assessing the visual impact. It is anticipated that views of the construction camps and lay-down yards of Alternative 2 may be visible from the N1. The likeliness of a construction camp at this location is high and can be motivated from an accessibility point of view, due to the proximity to a major route.

The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure to the impact will be brief and the severity of visual impact will be *low*. The significance of potential visual impact is expected to be *low*.

Operational phase

Of these routes, the N1, N11 and R37 is the most prominent, carrying the highest volume of traffic. Alternative 2 will be the most visible from the N1. The severity and significance of visual impact for the proposed alternative 1 and 3 on motorists will be *low*. The speed at which motorists travel also has a moderating effect on the severity of the visual impact and further reduces visual exposure. The severity and significance of visual impact for the proposed alternative 3 on motorists will be *moderate*.

6. RECOMMENDED MITIGATION MEASURES

The aim of mitigation is to reduce or alleviate the intrusive contrast between the proposed project components and activities, and the receiving landscape to a point where it is acceptable to visual and landscape receptors.

6.1. GENERAL

- Proceed with construction of the transmission line during the off peak tourism season;
- Where areas are going to be disturbed through the destruction of vegetation, for example the establishment of the construction camp, the vegetation occurring in the area to be disturbed must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation;

6.2. TRANSMISSION TOWERS

- Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover;
- Where practically possible, provide a minimum of 1 km buffer area between the transmission line and sensitive visual receptors; and
- Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.

6.3. ACCESS ROUTES

- Make use of existing access roads where possible;
- Where new access roads are required, the disturbance area should be kept as small as possible. A two-track dirt road will be the most preferred option;
- Locate access routes so as to limit modification to the topography and to avoid the removal of established vegetation;
- Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover;
- Maintain no or minimum cleared road verges;
- Access routes should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and
- If it is necessary to clear vegetation for a road, avoid doing so in a continuous straight line. Alternatively, curve the road in order to reduce the visible extent of the cleared corridor.

6.4. CLEARED SERVITUDES

- Locate the alignment and the associated cleared servitude so as to avoid the removal of established vegetation; and
- Avoid a continuous linear path of cleared vegetation that would strongly contrast with the surrounding landscape character. Feather the edges of the cleared corridor to avoid a clearly defined line through the landscape.

6.5. CONSTRUCTION CAMPS AND LAY DOWN YARDS

- If practically possible, locate construction camps in areas that are already disturbed or where it isn't necessary to remove established vegetation like for example, naturally bare areas;
- Utilise existing screening features such as dense vegetation stands or topographical features to place the construction camps and lay-down yards out of the view of sensitivity visual receptors;

- Keep the construction sites and camps neat, clean and organised in order to portray a tidy appearance; and
- Screen the construction camp and lay-down yards by enclosing the entire area with a dark green or black shade cloth of no less than 2 m height.

7. CONCLUSION

The three alternative alignments have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternatives are rated according to preference by using a three-point rating system in Table 10, one (1) being the most preferred, to three (3) being the least preferred. The preference rating is informed by the impact assessment discussions in Section 0 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Table 10: Evaluation of alternative alignments

ALTERNATIVES	PREFERENCE RATING
Alternative 1	1
Alternative 2	3
Alternative 3	2

Alternative 1 is regarded as the most preferred alternative. Its alignment along the existing transmission line and transmission servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The impact of Alternative 1 on visual receptors varies between residents, tourists and motorists. Alternative 1's great advantage lies in the less significant visual impact on tourists as compared to the other alternatives. The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable.

APPENDIX 1

Figure 15 to Figure 17 reflects the results of a visibility assessment, carried out using GIS software. Additional to a conventional visibility assessment, a land cover map (Figure 5) was integrated in the findings. The results provide a clear interpretation of the extent of the visual influence and also provide an indication of the land use that can be expected in the affected areas. Through the integration of different GIS datasets it is possible to identify areas along the alternative alignments that may cause higher impacts.

Figure 15: Alternative 1

Figure 16: Alternative 2

Figure 17: Alternative 3

GLOSSARY OF TERMS

Aesthetics	The science or philosophy concerned with the quality of sensory experience. (ULI, 1980)
Horizon contour	A line that encircles a development site and that follows ridgelines where the sky forms the backdrop and no landform is visible as a background. This is essentially the skyline that when followed through the full 360-degree arc as viewed from a representative point on the site defines the visual envelope of the development. This defines the boundary outside which the development would not be visible.
Landscape characterisation/ character	This covers the gathering of information during the desktop study and field survey work relating to the existing elements, features, and extent of the landscape (character). It includes the analysis and evaluation of the above and the supporting illustration and documentary evidence.
Landscape condition	Refers to the state of the landscape of the area making up the site and that of the study area in general. Factors affecting the condition of the landscape can include the level maintenance and management of individual landscape elements such as buildings, woodlands etc and the degree of disturbance of landscape elements by non-characteristics elements such as invasive tree species in a grassland or car wrecks in a field.
Landscape impact	Changes to the physical landscape resulting from the development that include; the removal of existing landscape elements and features, the addition of new elements associated with the development and altering of existing landscape elements or features in such as way as to have a detrimental affect on the value of the landscape.
Landscape unit	A landscape unit can be interpreted as an “outdoor room” which are enclosed by clearly defined landforms or vegetation. Views within a landscape unit are contained and face inward.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. A more emotive sense of place is that of local identity and attachment for a place “*which begins as undifferentiated space* [and] *becomes place as we get to know it better and endow it with value*” (Tuan 1977)[1].
Viewer exposure	The extent to which viewers are exposed to views of the landscape in which the proposed development will be located. Viewer exposure considers the visibility of the site, the viewing conditions, the viewing distance, the number of viewers affected, the activity of the viewers (tourists or workers) and the duration of the views.
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Visual absorption capacity (VAC)	The inherent ability of a landscape to accept change or modification to the landscape character and/or visual character without diminishment of the visual quality or value, or the loss of visual amenity. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.

[1] Cited in Climate Change and Our 'Sense of Place', http://www.ucsusa.org/greatlakes/glimpactplace.html

Visual amenity The notable features such as hills or mountains or distinctive vegetation cover such as forests and fields of colour that can be identified in the landscape and described. Also included are recognised views and viewpoints, vistas, areas of scenic beauty and areas that are protected in part for their visual value.

Visual character This addresses the viewer response to the landscape elements and the relationship between these elements that can be interpreted in terms of aesthetic characteristics such as pattern, scale, diversity, continuity and dominance.

Visual contour The outer perimeter of the visual envelope determined from the site of the development. The two dimensional representation on plan of the horizon contour.

Visual contrast The degree to which the physical characteristics of the proposed development differ from that of the landscape elements and the visual character. The characteristics affected typically include:

- Volumetric aspects such as size, form, outline and perceived density;
- Characteristics associated with balance and proportion such scale, diversity, dominance, continuity;
- Surface characteristics such as colour, texture, reflectivity; and
- Luminescence or lighting.

Visual envelope The approximate extent within which the development can be seen. The extent is often limited to a distance from the development within which views of the development are expected to be of concern.

Visual impact Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the view shed experienced by visual receptors and intrusion of foreign elements into the view shed of landscape features thereby detracting from the visual amenity of the area.

Visual impact assessment A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.

Visual quality An assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.

Visual receptors Includes viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible. The existing visual amenity enjoyed by the viewers can be considered a visual receptor such that changes to the visual amenity would affect the viewers.

Zone of visual influence The extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest (see visual envelope).

LEVEL OF CONFIDENCE

Table 11: Confidence level chart and description

CONFIDENCE LEVEL CHART				
	Information, knowledge and experience of the **project**			
Information, and knowledge of the **study area**		3b	2b	1b
	3a	9	6	3
	2a	6	4	2
	1a	3	2	1

3a – A *high* level of information is available of the **study area** in the form of recent aerial photographs, GIS data, documented background information and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.

2a – A *moderate* level of information is available of the **study area** in the form of aerial photographs GIS data and documented background information and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.

1a – *Limited* information is available of the **study area** and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

3b – A *high* level of information and knowledge is available of the **project** in the form of up-to-date and detailed engineering/architectural drawings, site layout plans etc. and the visual impact assessor is well experienced in this type of project and level of assessment.

2b – A *moderate* level of information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.

1b – *Limited* information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor has a low experience level in this type of project and level of assessment. (Adapted from Oberholzer. B, 2005)

VISUAL RECEPTOR SENSITIVITY

Table 12: Visual receptor sensitivity

VISUAL RECEPTOR SENSITIVITY	DEFINITION (BASED ON THE GLVIA 2ND ED PP90-91)
Exceptional	Views from major tourist or recreational attractions or viewpoints promoted for or related to appreciation of the landscape, or from important landscape features.
High	Users of all outdoor recreational facilities including public and local roads or tourist routes whose attention or interest may be focussed on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Residents with views affected by the development.
Moderate	People engaged in outdoor sport or recreation (other than appreciation of the landscape);
Low	People at their place of work or focussed on other work or activity; Views from urbanised areas, commercial buildings or industrial zones; People travelling through or passing the affected landscape on transport routes.
Negligible (Uncommon)	Views from heavily industrialised or blighted areas

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