GLOCKNER-ETNA TRANSMISSION LINE
VISUAL IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

Naledzi Environmental Consultants was appointed by Eskom Holdings Limited Transmission Division, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for a proposed 400kV transmission line between the Etna and Glockner substations in the Midvaal Local Municipality.

Strategic Environmental Focus (Pty) Ltd (SEF) was appointed by Naledzi Environmental Consultants 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 transmission line on the receiving environment.

Three Alternative alignments have been proposed to connect to the two substations. The alternatives stretch over approximately 30km.

The study area contains the extent of all the three alternative alignments and includes an approximate 10 km buffer area around the alternatives.

PROJECT DESCRIPTION

The following consequential effects of the proposed 400kV transmission line will impact on the Landscape character:

- Clearing of servitudes to accommodate new transmission lines;
- Construction of foundations and erection of transmission lines;
- Installation of overhead lines;
- Construction of camps, lay-down yards and other construction equipment;
- Construction of access roads to inaccessible points; and
- Construction of service roads

A distinction is 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 the landscape character while the latter are impacts on the viewers themselves and the views they experience. Both the landscape character and the viewers are receptors that form part of the affected environment.

The findings of impact on the Landscape character is summarised in the table below.

SUMMARY OF IMPACTS ON THE LANDSCAPE

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 landscape types due to the presence of foreign elements and alteration to sensitive landscape types over alignment's length.	Low	Permanent if not mitigated	Medium	Probable	Low	Low	Medium
Alternative 2		Low		Medium	Probable	Low	Low	Medium
Alternative 3		Medium		Medium	Probable	Medium	Medium	Medium
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the intrusion of or obstruction by transmission line.	Regional	Permanent	Medium	Definite	Medium	Low	Medium
Alternative 2				Medium	Definite	Medium	Low	Medium
Alternative 3				Medium	Definite	Medium	Medium	Medium

The following consequential effects of the proposed 400kV transmission line will impact on the visual character:

- Presence of construction camps and equipment in the construction period to viewers;
- Presence of new permanent structure of the transmission line in the operational phase to viewers;
- The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- The overall impact on visual amenity, due to the degradation of a visual amenity; and
- The reaction of viewers who may be affected.

The findings of impact on the visual character are summarised in the tables below.

SUMMARY OF 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	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Medium	Medium	Medium
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	Medium	Highly Probable	Low	Low	Medium
Alternative 2				Medium	Highly Probable	Low	Low	Medium
Alternative 3				Medium	Highly Probable	Medium	Medium	Medium

SUMMARY OF 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 – Intruding on existing views of the landscape.	At a number of point locations	Short period	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Low	Low	Medium
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Low	Low	Medium

SUMMARY OF 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	Very-Low	Medium
Alternative 2				Low	Probable	Low	Very - Low	Medium
Alternative 3				Low	Probable	Low	Very- Low	Medium
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Low	Probable	Low	No significance	Medium
Alternative 2				Low	Probable	Low	No significance	Medium
Alternative 3				Low	Probable	Low	No significance	Medium

RECOMMENDED MITIGATION MEASURES

The aim of mitigation is to reduce or alleviate the anticipated impacts that are a consequence of the proposed project's components and activities. Mitigation should be implemented as an iterative process, accompanying the design phase to mitigate predictable impacts before construction commences. This approach generates preventative measures that will influence design decisions instead of relying on cosmetic landscape remediation of a completed project.

Mitigation is proposed for the various phases of the project. It addresses issues from the design phase through to the operational phase.

CONCLUSION

The three proposed 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.

Landscape impacts: Alternative 3 will have the greatest landscape impact in the construction phase on sensitive landscape types, the extent for alternative 3 is rated *Medium* and *Low* for alternative 1 and 2 with mitigation.

The operational phase is characterised by a *medium* landscape impact on a regional scale on all alignments.

Impacts on residents: Alternatives 1 and 2's severity can be reduced in both the construction and operational phases through mitigation measures. In the case of alternative 3, mitigation will ineffective in reducing in the visual impact's severity.

Impacts on tourists: Both the construction and operational phases are characterised with a *low* visual impact with mitigation.

Impacts on motorist: *Low* impacts on motorists are expected in both the construction and operational phases.

Impact on landscape amenities: Alternatives 2 and 3's alignment traverses over a number of landscape amenities within the north-east section of the site. These landscape amenities will be negatively impacted on. See (4.2.2).

The alternatives are rated according to preference by using a three-point rating system in see table below, three (3) being the most preferred, to one (1) being the least preferred. The preference rating is informed by the impact assessment discussions in Table 9 and the overall performance of each alternative with regards to the impact on the Landscape character and the identified viewers.

Alternative 1 is the most preferred alternative.

EVALUATION OF ALTERNATIVE ALIGNMENTS

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

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1. INTRODUCTION

Naledzi Environmental Consultants was appointed by Eskom Holdings Limited Transmission Division, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for a proposed 400kV transmission line between the Etna and Glockner substations in the Midvaal Local Municipality.

Strategic Environmental Focus (Pty) Ltd (SEF) was appointed by Naledzi Environmental Consultants 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 transmission line on the receiving environment.

Three Alternative alignments have been proposed to connect to the two substations. The alternatives stretch over approximately 30km.

The study area contains the extent of all the three alternative alignments and includes an approximate 10 km buffer area around the alternatives.

1.1. BACKGROUND AND BRIEF

This VIA will conform to the requirements of a level four 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; and
- A photographic simulation of the proposed transmission line.

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 SEFGIS (2007) respectively;
- Observations made and photographs taken during site visits;
- Technical information received from Eskom Transmission;
- Socio-Economic Analysis report (2001) done for the Midvaal Local Municipality;
- 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 it is estimated to be 15 months. 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 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 routes. There is not enough project information to determine the exact type of towers to be used in this project. The following three types of towers are used under normal situations; Compact cross-rope tower, Self-supporting strain tower and Cross-rope tower. (See Table 2)

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 8).

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 2).

This visual impact assessment is rated with a general confidence level of 4. This rating indicates that the author's general confidence in the accuracy of the findings is *moderate* (Table 15). 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 study area is 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.

2.5. LOCATION OF STUDY AREA

The study area includes the entire area covered by the three proposed alignments. The study area is located in the southern end of Gauteng Municipality and approximately 35 kilometres south of Johannesburg. All three alignments fall within the Midvaal Local Municipality. The three proposed alignments stretch from the existing Etna substation situated near Ennerdale in the north of the study area to Glockner substation near Rothdane residential area in the south of the study area.

3. PROJECT DESCRIPTION

3.1. OVERVIEW OF DEVELOPMENT

The project involves the construction of a 400 kV transmission line from the Etna to Glockner substations within the Midvaal Local Municipality, which is located south of Gauteng. The direct linear distance between the start and the end of the line is approximately 30 km (refer to Figure 1).

The proposed project includes the following components

- Clearing of servitudes to accommodate new transmission lines;
- Construction of foundations and erection of transmission lines;
- Installation of overhead lines;
- Construction of camps, lay-down yards and other construction equipment;
- Construction of access roads to inaccessible points and;
- Construction of service roads

Table 1: Description of Alternative alignments

ALTERNATIVES	DESCRIPTION (Refer to Figure 1)
Alternative 1	Alternative 1 runs from Glockner substation parallel with a portion of an existing transmission line servitude where after it runs close to the western side of the R82 and finally connects to the Etna substation in the northern portion of the study area.
Alternative 2	Alternative 2 follows a similar route to alternative 1 in the south, it splits from Alternative 1 at the northern corner of the Doornkuil farm, it continues straight up in a northern direction over Elandsfontein ridges before making a sharp turn to the west to connect with the Etna substation.
Alternative 3	Alternative 3 from Glockner runs parallel to the eastern side of the R82 highway. It branches off to the west at the Hartzenbergfontein ridge before cutting across the R82 to connect to the Etna substation.

3.2. PROJECT COMPONENTS AND ACTIVITIES

Each project component and activity will affect the receiving environment differently and is therefore discussed separately. The following construction activities are expected to cause the greatest visual influence and will potentially cause impacts on the landscape character or on visual receptors in the study area:

3.2.1. TRANSMISSION LINE

The completed transmission line will connect the Etna substation to the Glockner substation. The direct linear distance between the Etna and Glockner substations is approximately 30 km (Figure 1).

3.2.2. 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).

3.2.3. CONSTRUCTION CAMPS AND LAY-DOWN YARDS

The construction phase is expected to continue for 15 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.

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. In extreme cases, a helicopter may be used where the transmission line transects inaccessible terrain (Figure 3).

Three types of towers will be used depending on the terrain being crossed. The towers will consist of a lattice steel framework reaching a maximum height of 38 m with electrical cables suspended between them. The average spacing between the towers will be approximately 450 m (Figure 4). The self-supporting strain tower will only be used where the alignment changes direction.

Table 2: Types and typical characteristics of proposed towers

Type	Compact cross-rope tower	Self-supporting strain 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
Stays	2	None	4

Figure 1: Locality Plan

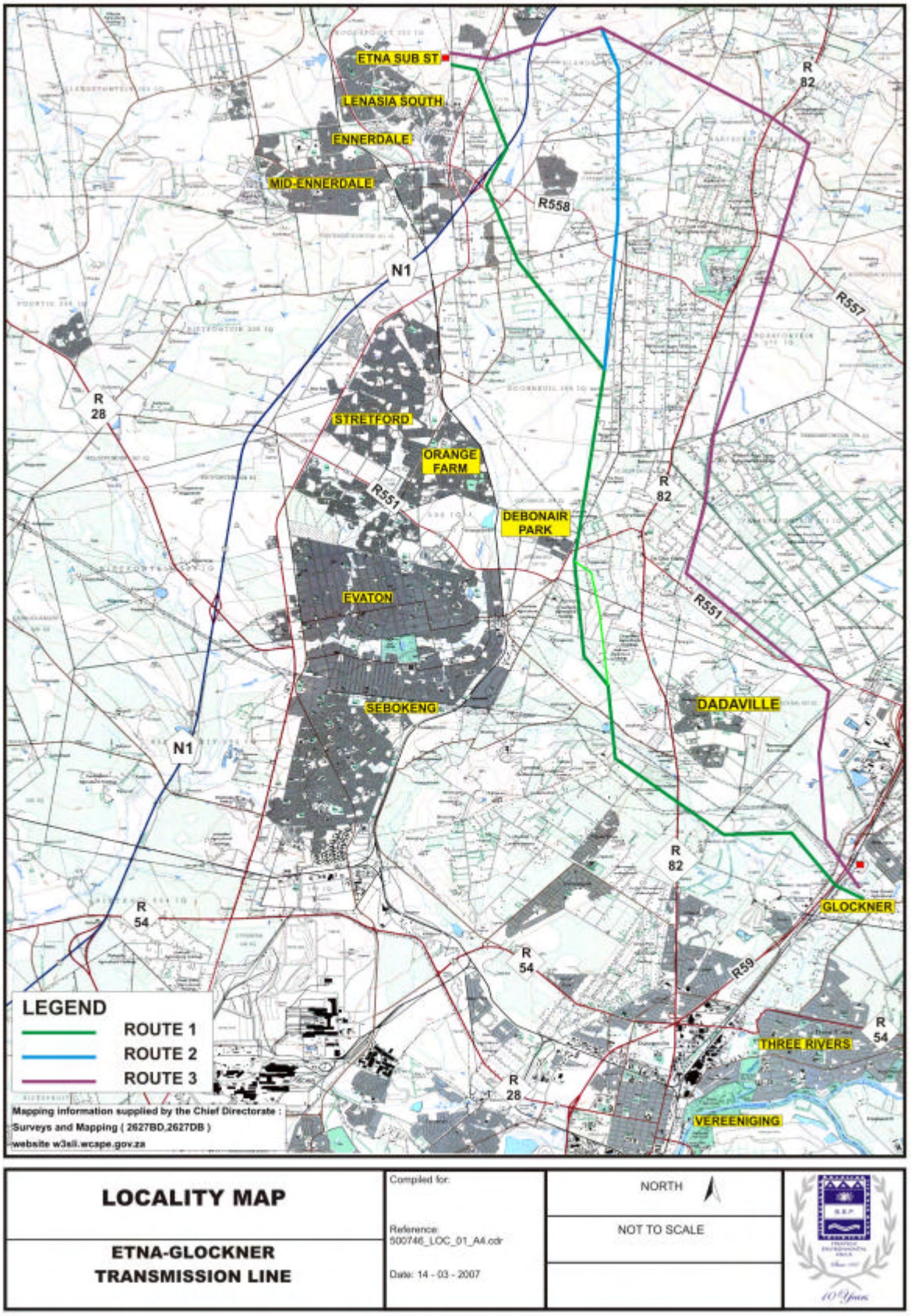


Figure 2: Example of construction camps

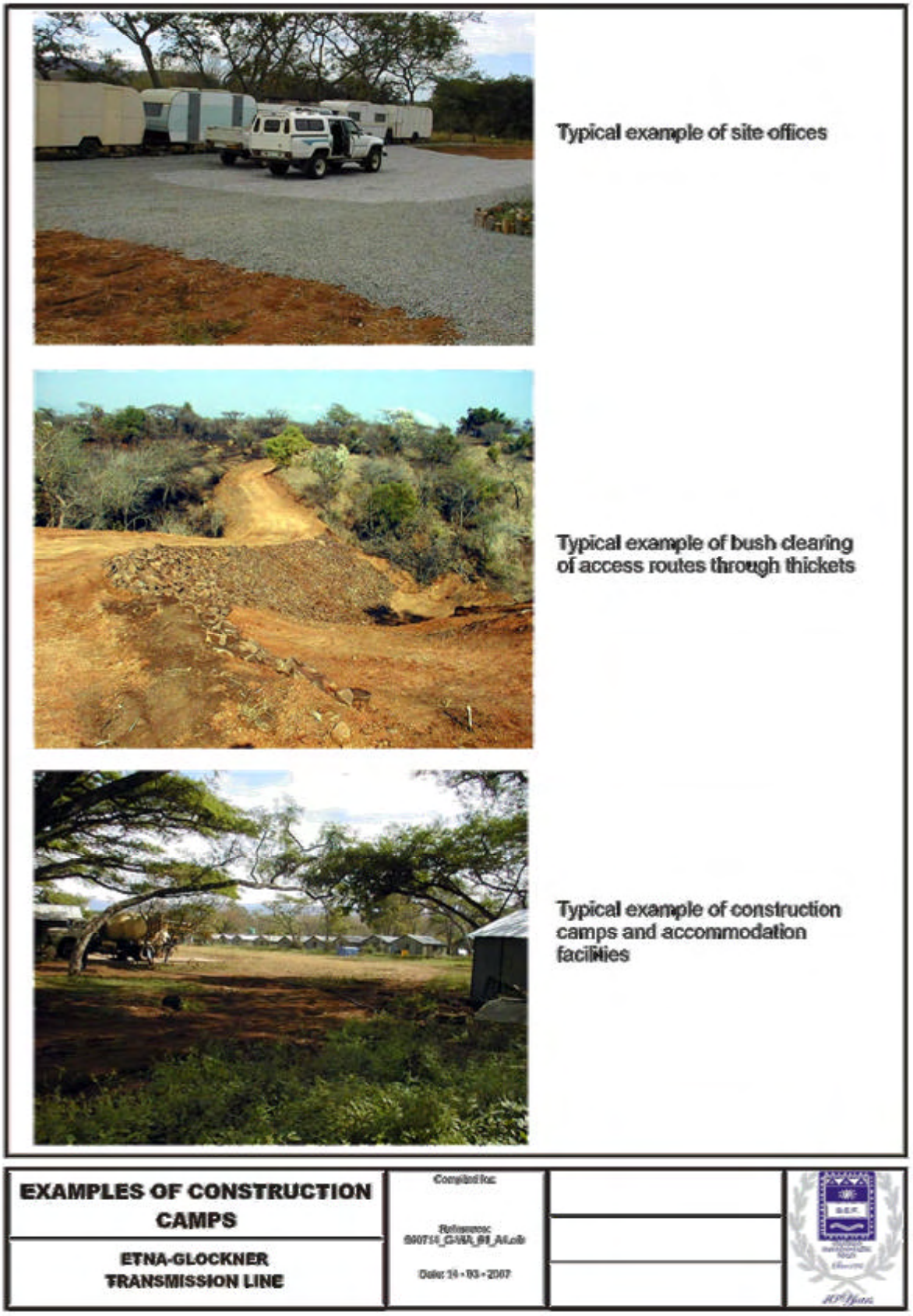


Figure 3: Typical construction equipment

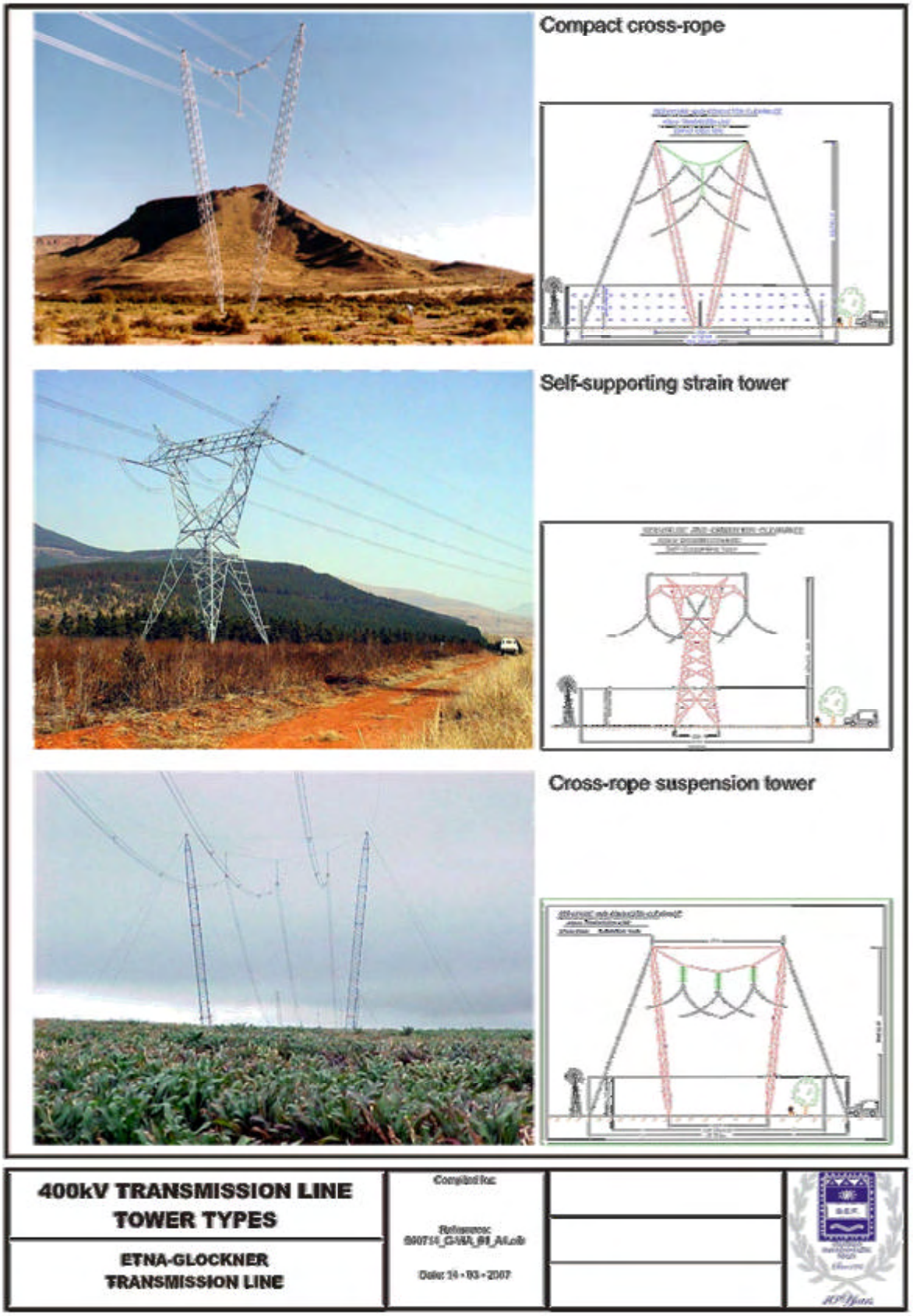
CRANE

HELICOPTER

TENSIONER STATION

TYPICAL CONSTRUCTION EQUIPMENT **ETNA-GLOCKNER TRANSMISSION LINE**	Compiled by: Reference: Date: 14-03-2007		

Figure 4: 400 kV transmission line tower types



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. BRIEF HISTORY AND BACKGROUND

It is clear from the land use survey and areas occupied by agriculture, smallholdings and other land uses that the Midvaal area is known as a rural area and is predominantly characterized by open spaces and farming activities.

Air pollution is a major concern as a result of Midvaal's locality in southern Gauteng. It is situated south of the mining belt in Johannesburg, which results in dust being blown over the area from these surrounding mining activities. Further causes of air pollution are the industries situated in Johannesburg, the East Rand and within the Sedibeng District.

4.2. 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. Similar landscapes are identified and assessed against the impact of the project upon them.

4.2.1. DEFINING LANDSCAPE TYPES

Generally the study area is composed of areas of grassveld, agricultural lands, rural -urban residential, retail centres and industrial areas. The greater vegetation cover is indigenous grasses, bushes and isolated clumps of exotic species. Exotic vegetation is mainly located along the roads and around farm boundaries.

The landscape character changes gradually 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.

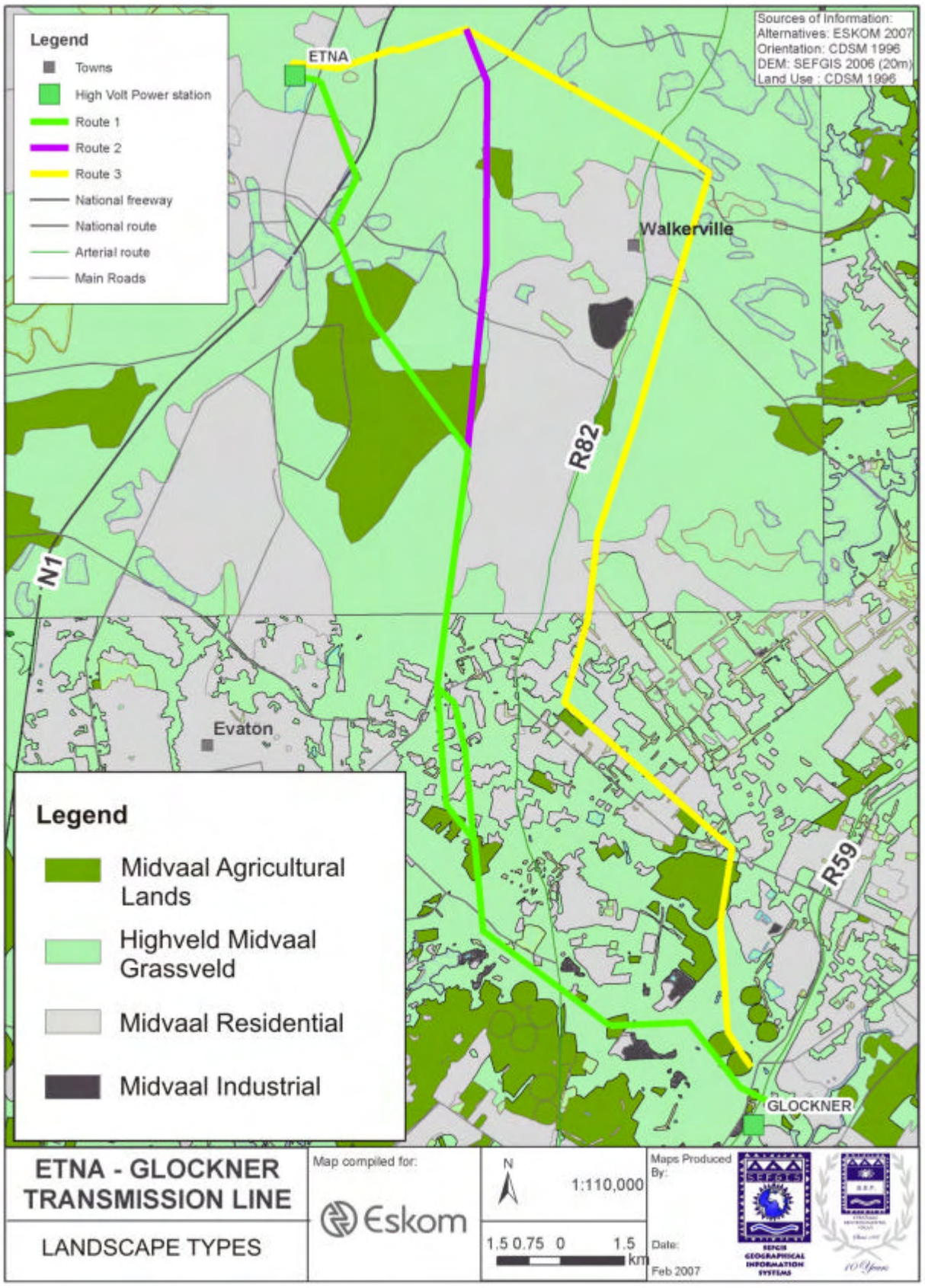
The assessment of the landscape types in the study area is undertaken at a macro-scale and discusses the predominant landscape conditions and visual characteristics found in a particular landscape type. Each landscape type is given a descriptive name which relates to the vegetation type, topography and/or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

The following broad scale landscape types have been delineated in the study area (Figure 5).

4.2.1.1 LANDSCAPE TYPES

- Midvaal Agricultural
- Midvaal Residential
- Highveld Midvaal Grassveld
- Midvaal Industrial

Figure 5: Landscape types in the study area



Midvaal Agricultural

A gentle sloping landscape, presence of clay soils and good rainfall conditions prevailing in this area contributes positively towards the increase of its agricultural and tourism potential. Lands are cultivated for the production of sunflower, maize meal and fruit farm plantations.

Rural residential land use occurs in the form of labours' farmhouses and farmsteads on agricultural holdings. The agricultural holdings are typically occupied by a main dwelling unit and subsidiary dwelling units where domestic workers and other labourers stay. Agricultural holdings in the area are used for small, intensive agricultural purposes, secondary industries and residential purposes. This is a poorly developed area and most residents in this area do not have access to electricity or water. Informal residential settlements occur in this area due to eviction of farm labourers from farms within the locality. The density in this area is generally high. (Socio-Economic Analysis report, 2006)

The Midvaal Residential

These are the formal townships in the area and they include Meyerton, Roseville, De Deur, Walkerville, Vaal Marina, Henley-on-Klip, Ohinimuri, Witkop, Klipwater, Klipriviersdorp, Highbury, Riversdal and Rothdane. Most of these residential areas are privately owned plots; their owners reside in them or rent them out. The structures conform to the building standards and the buildings and are made from conventional material such as brick and plaster. These houses have municipal supplied water and electricity, waterborne sanitation and weekly refuse removal. Densities vary between low (single residential) to medium (security complex developments). (Socio-Economic Analysis report, 2006)

Highveld Midvaal Grassveld

Most of the study area sits on shale resulting in the hilly formations in this area. The topography is gently sloping. Areas located on the Vryheid formation consist of sandstone and shale that erodes into clay creating potential arable soil. The region falls within the Grassland Biome, which covers the high central plateau of South Africa. Trees and shrubs occur in patches within the landscape and naturally along drainage lines. It is believed that a third of mammal species occur within this biome. (Socio-Economic Analysis report, 2006)

Midvaal Industrial

Midvaal industrial is composed of mining, processing and retail industries. Industries associated with the extraction and processing of raw materials employ a number of the local residents. Heavy industries and mines are characterised by dust, smoke clouds, noisy industrial machinery and large mounds of extracted stockpiles. Such industries include Nampak, Corobrick, MITTAL and Everite. Most of them are situated next to the main transportation routes especially rail routes for easy transportation of bulky materials. MITTAL steel covers a large proportion in the south of the study area. The Glen Douglas mine is situated near Randvaal and it extracts dolomite. Retail and manufacturing industries have less dominating structures, manifesting themselves in small buildings or at times limited to temporary shade structures. Car retail outlets are more popular in this area. The landscape and air quality in this area is poor due to the dust and smoke emitted from these industries. Air quality is a major concern in this area. (Socio-Economic Analysis report, 2006)

4.2.2. 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 study area presents vast areas of grassveld. Trees and bushes are common along rocky hills and ridges. Most of the remaining undeveloped areas offer panoramic landscapes such as the Pedeberg koppie located in the north-east part of the study area (see photo above). The Lapeng Hotel and Conference Centre are slightly visible on the lower slopes of the koppie. This is a well known area and is considered a unique feature in the landscape. Other landscape amenities in the area include; Ohinimuri Golf course at north of the R82 and R558 intersection; Walkerville rural retreat in the Spioenkop koppie locality west Ohinimuri Golf course; Duncanville industrial in the south of the study area; and MITTAL steel also in the south end of the study area.

4.2.2.1 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, and 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.

There are many factors contributing to the visual value of the study area. Each contributes to a different degree and is valued on a different scale by different people, but ultimately shape the current character of the study in a positive or negative manner.

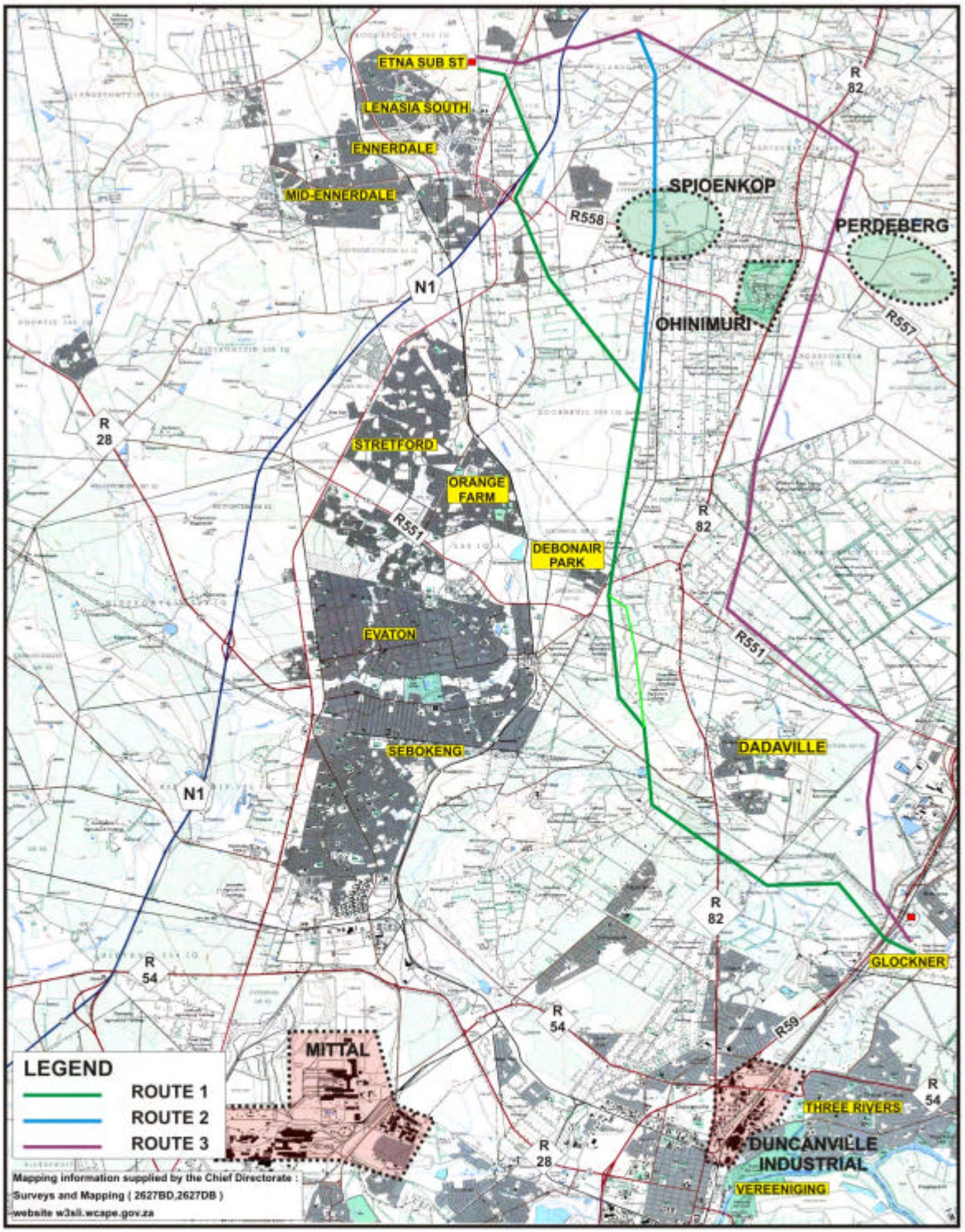
The following are elements believed to shape the visual value:

- Pedeberg Koppie in the north-east of the area;
- Ohinimuri Golf course at north of the R82 and R558 intersection;
- Walkerville rural retreat in the Spioenkop koppie locality west Ohinimuri Golf course;
- Duncanville industrial in the south of the study area; and
- MITTAL steel also in the south end of the study area.

See Figure 6 below.

The Pedeberg Koppie, Ohinimuri and Walkerville rural retreat have a positive influence on the landscape character of the area, indicated in a green shading whilst Duncanville industrial and MITTAL have a negative influence indicated in a red shading.

Figure 6: Landscape amenities map



4.2.2.2 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 landscape

LANDSCAPE TYPE	VIVIDNESS	INTACTNESS	UNITY	VISUAL QUALITY
Midvaal Agricultural Lands	3	3	3	Low
The Midvaal Residential	2	2	3	Low
Highveld Midvaal Grassveld	5	3	5	Moderate
Midvaal Industrial	1	3	3	Low

The two most dominant landscape types in the study area are the Highveld Midvaal Grassveld and the Midvaal Residential area. Individually these two landscape types are rated moderate to low in terms of the prevailing visual quality.

The Midvaal Residential Townscape is considered to provide no positive contribution to the visual quality of the study area. A large proportion of the built up area is considered to have a poor townscape character.

The Midvaal Industrial landscape type has a negative impact on the prevailing visual quality of the study area. Reference is made to the poor air quality in the landscape around these industries. The impact on the visual quality is however localised and limited to the industrial areas.

4.2.3. 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 has 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 (4.3). A landscape sensitivity rating was adapted from GOSW (2006) (Table 6) and applied in the classification of the study area into different sensitivity zones.

Table 5: 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 sens itivity	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.

Table 6: Landscape character sensitivity rating

LANDSCAPE TYPE (LT)	PREVAILING LANDSCAPE CHARACTER SENSITIVITY	AREA OF DISTURBANCE IN LT	LOCALISED REDUCTION OF SENSITIVITY
Midvaal Agricultural Lands	Low	At the point where alternatives 1 and 2 meet.	Low
The Midvaal Residential	Low	At the point where alternative 3 crosses the R551 up until it approaches the R82.	Low
Highveld Midvaal Grassveld	Moderate	The point where alternative 3 crosses the R82 on the eastern side of the highway.	Moderate
Midvaal Industrial	Low	The area in the south before alternative 1 crosses the R82 highway.	Low

The Midvaal Agricultural, Midvaal Residential and Midvaal industrial have typically a *low* landscape character sensitivity due to the extensive development resulting in reduced natural characteristics in these landscape units.

The Highveld Midvaal Grassveld has notable amenities with a *moderate* landscape character sensitivity. This is attributed to the reduced level of urban development in this area, for example the Pedeberg Koppie, Ohinimuri Golf course and Walkerville rural retreat, in the north-eastern side of the study area.

4.2.4. VISUAL ABSORPTION CAPACITY (VAC)

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 7). 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 7: Visual Absorption Capacity evaluation

LANDSCAPE TYPE	VISUAL SCREENING	TERRAIN VARIABILITY	LAND COVER	VAC
Midvaal Agricultural Lands	2	1	2	Medium
The Midvaal Residential	2	1	3	Medium
Highveld Midvaal Grassveld	1	1	2	Low
Midvaal Industrial	3	2	1	Medium

4.3. VISUAL RECEPTOR ASSESSMENT

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 in the study area are classified under the following broad groups: Residents, Tourists; and Motorists.

To determine visual receptor sensitivity a commonly used rating system is utilised (Table 8). 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.

Table 8: 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

4.3.1. 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.

All residential areas within the study are fall within the high visibility zone:

- Evaton;
- De Deur Estates;
- Sebokeng;
- Duncanville;
- Ennerdale;
- Meyerton;
- Golfpark;
- Orangefarm;
- Meyerton small farms; and
- Ohinimuri.

(See Figure 13, Figure 14 and Figure 15)

4.3.2. TOURISTS

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

There are no recorded tourist attraction areas within the study area. Therefore tourists on the road routes will be considered. Tourists will probably visit the near-by Suikerbosrand Nature Reserve and will make use of any of the local roads. The R557 is a possible route to the Suikerbosrand Nature Reserve.

4.3.3. MOTORISTS

Motorists are generally classified as visual receptors of *low* sensitivity due to their momentary view and experience of a potential visual impact. 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.

For this report only motorists using the main routes will be considered as there are many countless smaller roads within the study area. The major motorist routes in the study area are the N1 connecting the towns of Johannesburg and Evaton, the R82 connects Eldorado Park and Vereeniging. Highway R557 leads to Daleside in the south-eastern side of the study area. The R551 runs across the study area connecting Orange farm area in the west to Meyerton in the east

5. IMPACTS ASSOCIATED WITH THE PROJECT

5.1. 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 or 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.

The following are consequential effects of the proposed 400kV transmission line project on the landscape character:

- Clearing of servitudes to accommodate new transmission lines;
- Construction of foundations and erection of transmission lines;
- Installation of overhead lines;
- Construction of camps, lay-down yards and other construction equipment;
- Construction of access roads to inaccessible points and;
- Construction of service roads

The severity of these components is determined by the size or footprint of their disturbance. In this case the construction camps and service roads will cause the greatest landscape impacts. The severity of all these components is considered for two scenarios, which are construction and operational phases. The cumulative impact of the project components and activities are rated *medium*.

5.2. 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.

The following consequential effects of the proposed 400kV transmission line will impact on the visual character:

- Presence of construction camps and equipment in the construction period to viewers;
- Presence of new permanent structure of the transmission line in the operational phase to viewers;
- The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- The overall impact on visual amenity, due to the degradation of a visual amenity; and
- The reaction of viewers who may be affected.

The sensitivity of visual recipients depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions. See (Table 8).

Figure 7: Elevation map of study area

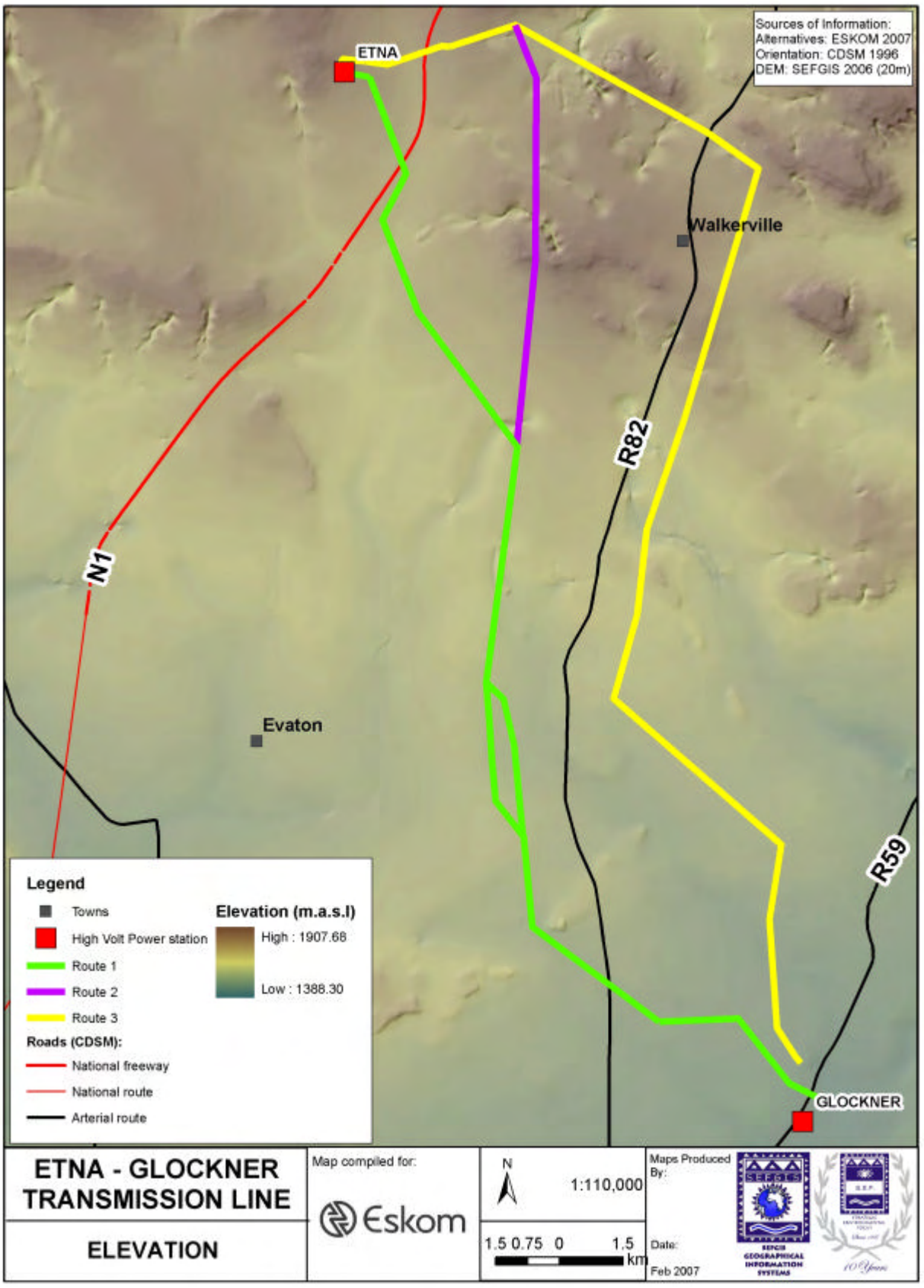


Figure 8: Land cover map of study area

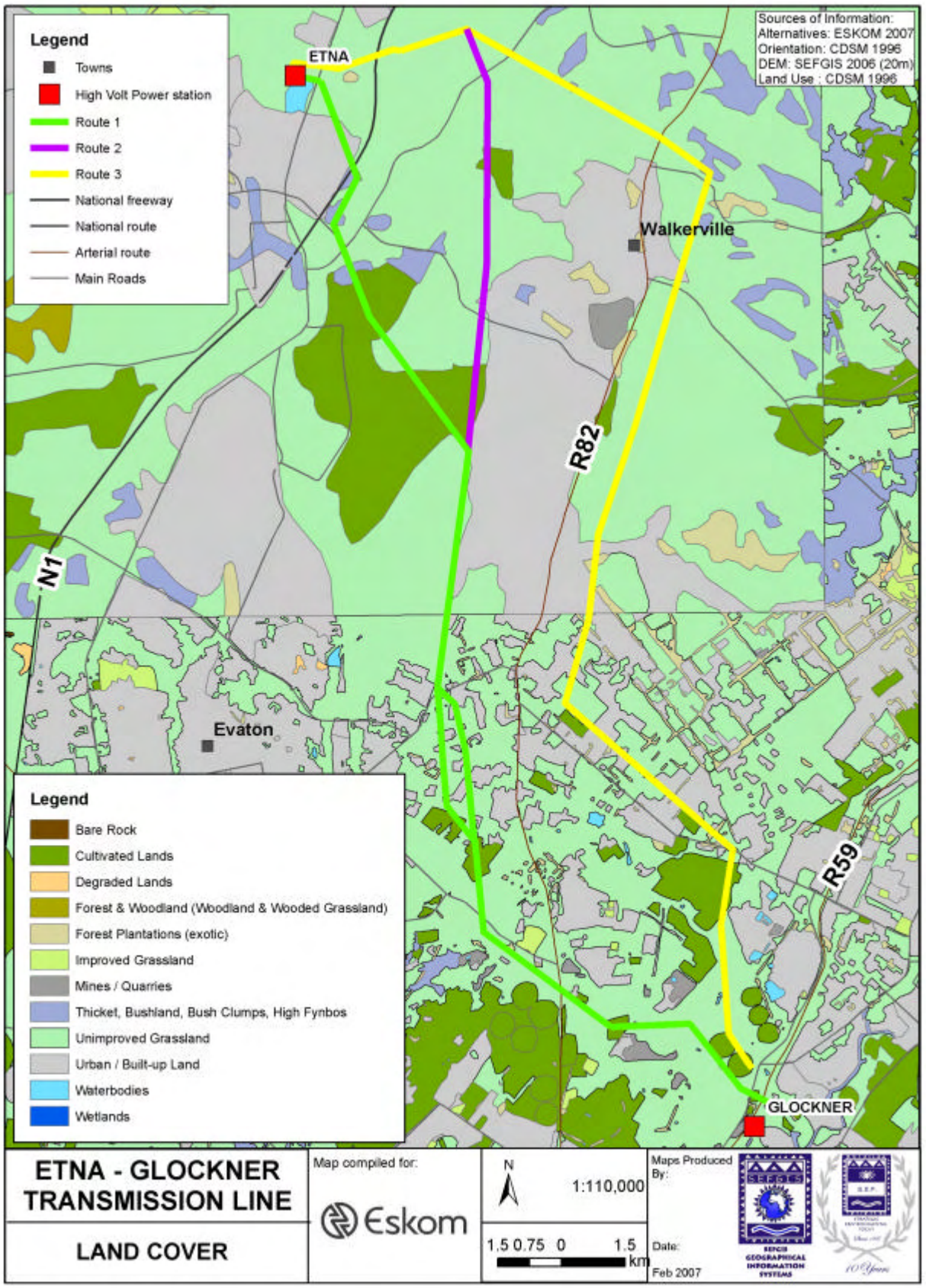


Figure 9: Etna Substation

Figure 10: Site photographs of Landscape Types

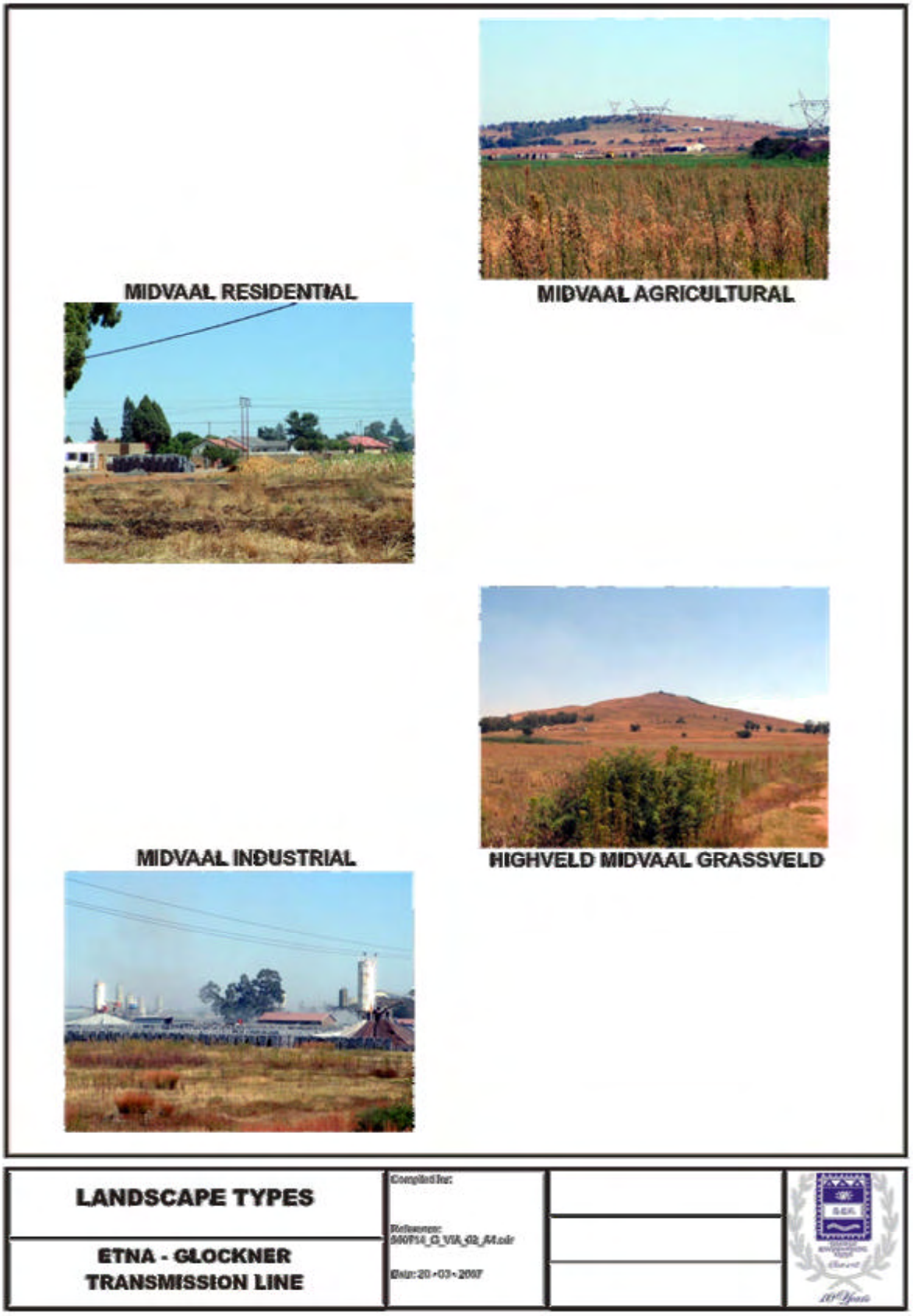


Figure 11: Glockner Substation

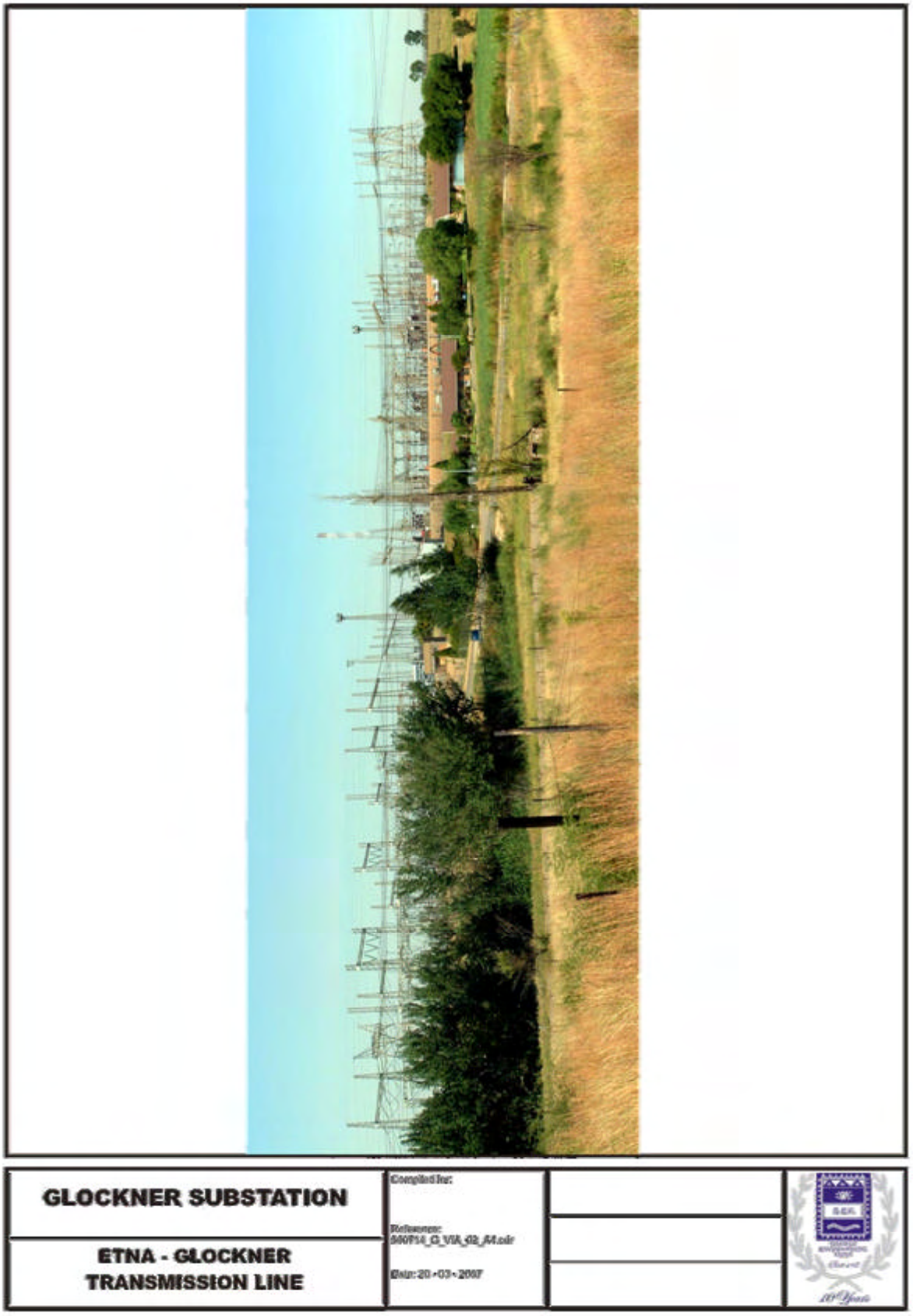
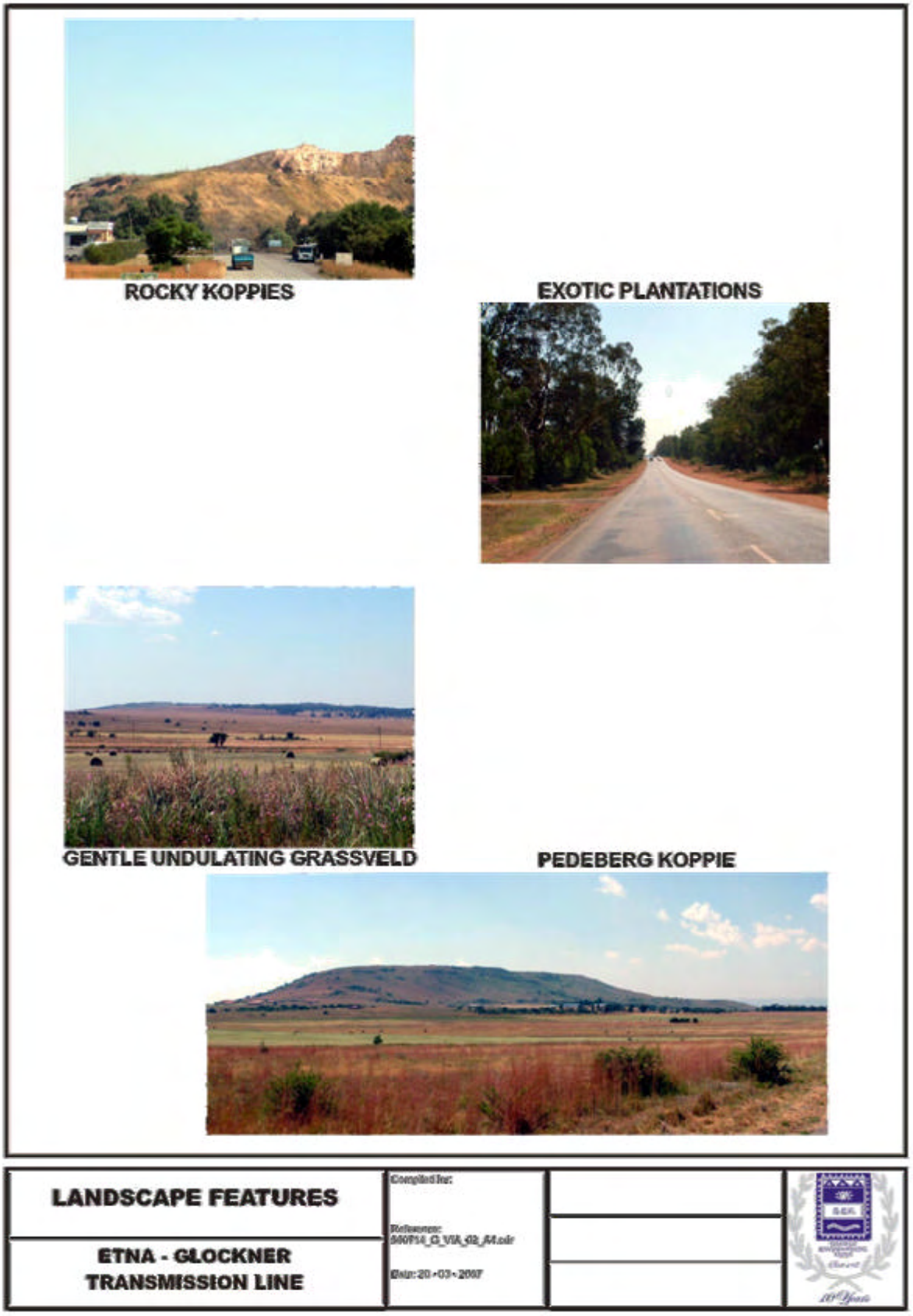


Figure 12: Landscape features in study area



6. 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 9)

Table 9: Significance of impacts

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

6.1. SIGNIFICANCE OF LANDSCAPE IMPACTS

Table 10: Potential Landscape Impacts

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 landscape types due to the presence of foreign elements and alteration to sensitive landscape types over alignment's length.	Low	Permanent if not mitigated	Medium	Probable	Low	Low	Medium
Alternative 2		Low		Medium	Probable	Low	Low	Medium
Alternative 3		Medium		Medium	Probable	Medium	Medium	Medium
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the intrusion of or obstruction by transmission line.	Regional	Permanent	Medium	Definite	Medium	Low	Medium
Alternative 2				Medium	Definite	Medium	Low	Medium
Alternative 3				Medium	Definite	Medium	Medium	Medium

During the construction and operational phases, certain project components or activities will affect the visual value of the landscape, ultimately resulting in an impact on the landscape character.

The following are consequential effects of the proposed 400kV transmission line project on the landscape character:

- Clearing of servitudes to accommodate new transmission lines;
- Construction of foundations and erection of transmission lines;
- Installation of overhead lines;
- Construction of camps, lay-down yards and other construction equipment;
- Construction of access roads to inaccessible points and;
- Construction of service roads

6.1.1. Landscape Impacts in the Construction phase

Activities listed above are expected to cause landscape impacts in the construction phase. 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 be determined from the footprint area.

Clearing of servitudes will be associated with undisturbed areas with only grass or low growing vegetation. Only in cases were dense vegetation occurs along the servitude path will vegetation be cleared to reduce the fire hazard. Taller and denser vegetation clumps mostly occur in drainage lines, in isolated patches on the hills and boundaries of properties in undeveloped areas. The presence of the project components in the landscape will have a localised reduction in the character of the landscape.

During construction, the area around the individual towers will be disturbed, cleared for foundation footings. The number of concrete footings will depend on the type of pylon. See (Figure 4) for different types of pylons.

Overhead lines/ cables are installed with a tension station. A helicopter and cranes are used to lift the pylon structures into place. This activity complexity will depend on the type of tower being erected and terrain.

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 degree of severity of the landscape impact. Due to a lack of programme and planning 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 pristine 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 due to the direct relationship between size of a town and its ability to absorb physical changes.

Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. In other cases these roads will become service roads.

The severity of landscape impact during the construction stage is expected to be *low* for alternatives 1 and 2 and *medium* for alternative 3. 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 traverses landscape types of varying (VAC) and sensitivity. Surface disturbances are also minimised through, for example, utilising existing roads and already disturbed land. Severity of the landscape impact is already low, however to avoid more significant impacts at a local level sensitive placement of the construction camp sites, limited surface disturbance and prompt rehabilitation are recommended.

6.1.2. Landscape Impacts in the 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 in the landscape.

The industrial character and the near monumental vertical scale of the towers will easily blend with the prevailing conditions in the Midvaal Agricultural, Midvaal Residential and Midvaal Industrial as there already a significant number of structures in these landscape types. Due to vegetation along road sides, structures and buildings, some form of screening will be provided to reduce inter-visibility between landscape units[1]. The VAC for the Midvaal Agricultural, Midvaal Residential and Midvaal Industrial is rated *medium,* while the Highveld Midvaal Grassveld is rated *low.* See (Table 7).

The Highveld Midvaal Grassland has a low VAC and therefore will not readily absorb the project components without compromising the character of this landscape type. The relative remoteness, the associated openness and value of; the Pedeberg Koppie in the north-east of the study area, Ohinimuri Golf course at north of the R82 and R558 intersection, Walkerville rural retreat in the Spioenkop koppie located west of Ohinimuri Golf course are considered as landscape amenities (Section 4.2.2) that contribute to the study area's character. The quality of this landscape will be negatively affected by the presence of a transmission line of this scale and extent.

6.1.3. Conclusion (Landscape Impacts)

Most of the construction will occur along the proposed alternative routes. Landscape impacts will negatively influence the visual value of the landscape on a localised scale.

The cumulative impact of the activities and components of the proposed 400kV transmission line project on the landscape character will be *medium* on a regional scale.

The Midvaal industrial, Midvaal Agricultural and Midvaal Residential land types have a *low* sensitivity. The severity with mitigation will be *Low* for alternative 1and 2 and *medium* for alternative 3 (Table 9).

The sensitivity of the Highveld Midvaal Grassveld is rated *moderate.* The cumulative impact of the project is *moderate* and the resultant severity is therefore *medium* for the Highveld Midvaal Grassveld. The increase in sensitivity is due to the fact that the Highveld Midvaal Grassveld is less developed, and has a low VAC rating mostly attributed to the low growing vegetation cover in this region.

The Ohinimuri, Spioenkop and Pedeberg areas sit within the Highveld Midvaal Grassveld landscape type, adding to the sensitivity of this landscape type. The extent of alteration to sensitive landscapes is *low* for alternative 1 and 2 and *medium* for alternative 3.

Due to the presence in landscape amenities in the north-east preference is for alternatives 1. Alternative one's alignment avoids the amenities in the study area.

6.2. SIGNIFICANCE OF VISUAL IMPACTS

Severity of visual impact refers to the magnitude of change to specific visual receptor's views 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 degree of visibility of the proposed project (ZVI);
- Number of affected viewers; and
- Duration of views to development experienced by affected viewers.

[1] 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.

Degree of **visual intrusion** created by the project.

During the construction and operational phases, certain project components or activities will intrude on specific visual receptor's views, ultimately resulting in a visual impact.

The following consequential effects of the proposed 400kV transmission line will impact on the visual character:

- Presence of construction camps and equipment in the construction period to viewers;
- Presence of new permanent structure of the transmission line in the operational phase to viewers;
- The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- The overall impact on visual amenity, due to the degradation of a visual amenity; and
- The reaction of viewers who may be affected.

The findings of impact on the visual character are summarised in the tables below.

Table 11: 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	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Medium	Medium	Medium
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	Medium	Highly Probable	Low	Low	Medium
Alternative 2				Medium	Highly Probable	Low	Low	Medium
Alternative 3				Medium	Highly Probable	Medium	Medium	Medium

6.2.1. VISIBILITY OF PROJECT COMPONENTS AND ACTIVITIES

Before the consequential effects of the proposed phase 2 expansion project is assessed as visual impacts, it is important to understand the concept of visibility. For an object or activity to cause a visual impact, it is necessary to be visible from a particular vantage point. A vantage point is representative of the view of a specific visual receptor which is for instance from the house of a resident.

Empirical research indicates that the visibility of an object and hence the severity of visual impact, decreases as the distance between the observer and the object increases. The vividness of an object in a viewer's visual field is dependent on several aspects of which distance from an object and contrast between the object and its background, is most influential[2].

[2] To explain this concept the following example can be used: A black object displayed against a white background from a particular distance will be much more visible than a red object displayed against a

To expand, it is necessary to apply this concept of visibility to the context of the study area. This is because:

The further an observer is located from an object, the smaller that object becomes in the field of vision and the more difficult it is to detect and recognise detail such as texture, colour and perspective.

6.2.1.1 Visibility mapping

The extent and degree of visibility is generally a good indicator of the anticipated visual impact that may be associated with a specific project. In reality, a project that is not visible is believed to have no impact on viewers. To determine visibility, a technique referred to as visibility mapping is utilised to establish a first order impression of a project's extent and degree of visibility.

The results of the visibility analyses are included in APPENDIX 1 (Figure 13, Figure 14 and Figure 15).

6.2.2. Visual Impacts on Residents in the Construction phase

The presence of construction equipment and activities during the construction phase will cause a visual intrusion on residents living in the study area. All residents will be affected by the introduction of the transmission lines as indicated from the visibility maps.

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 *medium* level of confidence in the assessment of the visual impact. The duration of the potential visual impact will be temporary which will result in a *medium* severity of visual impacts on residents.

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.

Alternative 3 crosses through Mayerton Park, De Deur and Sebokeng residential areas. These residents will have a severe impact due to their proximity to the project components associated with construction. For alternative 3 a *medium* severity of visual intrusion is expected even after mitigation due to proximity to this route.

Alternatives 1 and 2 pass on the fringes of residential areas. The visual impact severity can be mitigated to a low severity.

Preference is for alternatives 1 and 2 in this case.

6.2.3. Visual Impacts on Residents in the Operational phase

The operational phase will be characterised with the permanent structures within the landscape that will intrude on their views. The residents to the west side of the R82 will experience a *low* degree of visual intrusion due to increased distance between residents and proposed alternatives. Such areas include Sebokeng, Evaton and Orange farm residents. Severity of the visual impact is considered to be *medium* for all residents.

maroon background at the same distance. This is because the contrast in colour between a black object and white background is greater and therefore easily distinguished.

For alternative 3, due to the proximity and the high level of visibility of the transmission towers residents will experience a severe visual impacts for the residents mentioned above, mitigation will be less effective for them due to either obstruction to other views or intrusion of the transmission towers.

Possible degradation to visual amenities in the north-east areas is high for alternative 2 and 3.

Alternatives 1 and 2 pass on the fringes of Dadeville, Debonair Park and Cyferfontein areas. The visual impact for these residents can be mitigated successfully.

Preference again is for alternative 1 and 2.

Table 12: 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 – Intruding on existing views of the landscape.	At a number of point locations	Short period	Medium	Medium	Low	Low	Medium
Alternative 2				Medium	Medium	Low	Low	Medium
Alternative 3				Medium	Medium	Low	Low	Medium
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Medium	Medium	Low	Low	Medium
Alternative 2				Medium	Medium	Low	Low	Medium
Alternative 3				Medium	Medium	Low	Low	Medium

6.2.4. Visual Impacts on Tourists in the Construction phase

Only main routes leading to a particular tourist attraction area will be considered, in this case the R557 is a possible route to the Suikerbosrand Nature Reserve.

Although there is no information relating to tourist attraction spots in this area, the nearest tourist attraction is the Suikerbosrand Nature Reserve. Most visitors to this area would make use of the R557 to visit the Suikerbosrand Nature Reserve. Alternative 3 crosses over the R557 and only at this point will a *medium* visual impact be experienced by tourists in this phase.

Due to their limited exposure to the project activities associated with construction, mitigation can be implemented successfully. The potential visual impact on tourists during the construction phase of the project can be mitigated with relative ease to a *low* severity.

The construction camps may however cause a higher visual intrusion on tourists. Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised due to the fact that they are travelling along the route and not visiting this particular area.

Alternatives 1 and 2 do not have any visual impact to the tourist travelling along the R557.

Preference is for alternatives 1 and 2 in this case.

6.2.5. Visual Impacts on Tourists in the operational phase

The only visual impacts that tourist are likely to be exposed to will be the transmission line crossing the R557 at the foot of Pedeberg Koppie. Due to their limited exposure to the transmission line the severity will be reduced to a low impact. Mitigation of the visual impact at this point will not be effective due to the proximity of the transmission line to tourists along the R557.

Alternatives 1 and 2 do not have any visual impact to the tourist travelling along the R557.

Again preference is for alternatives 1 and 2 in this case.

Table 13: 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	Low	Low	Very-Low	Medium
Alternative 2				Low	Low	Low	Very - Low	Medium
Alternative 3				Low	Low	Low	Very- Low	Medium
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Low	Low	Low	No significance	Medium
Alternative 2				Low	Low	Low	No significance	Medium
Alternative 3				Low	Low	Low	No significance	Medium

6.2.6. Visual Impacts on Motorists in the Construction phase

The positioning of construction camps near roads can be motivated from an accessibility point of view. The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure is brief and the severity of visual impact is therefore *low* with effective mitigation the severity will have *no significance*.

Cumulative impact is anticipated at the point where other existing lines already cross the R59 from the Glockner substation in the south. The severity of visual impact at this point will be further increased by the additional alignment; this applies to all alternatives as they all cross at this point before branching off taking different routes.

6.2.7. Visual Impacts on Motorists in the Operational phase

This assessment will be limited to motorists utilising the main routes, as there are countless smaller roads that can be considered. The major motorist routes in the study area are the N1 connecting the towns of Johannesburg and Evaton, the R82 connects Eldorado Park and Vereeniging. Highway R557 leads to Daleside in the south-eastern side of the study area. The R551 runs across the study area connecting Orange farm area in the west to Meyerton in the east. Motorists travelling along the major routes R82 and R557 are likely to experience some visually intrusion. With mitigation severity of exposure to motorists will be very low and have no significance to motorists.

All alternatives will have a *low* severity on motorists.

6.2.8. Conclusion (Visual Impacts)

Residents:

Residents within 5 kilometres buffer around the transmission line will be exposed to the highest visual impact severity. The severity to these residents will be difficult to mitigate effectively due to the nature and scale of transmission lines.

Most of the construction will occur along the proposed alternative routes. Landscape impacts will negatively influence the visual value of the landscape on a localised scale. Residents are going to be visually impacted on during construction and operational phase. More severity in the operational phase is anticipated due to the permanency of the transmission lines. Residents are regarded as very sensitive receptors compared to tourist and motorists.

Tourists:

Due to the fact that there are no recorded tourist attraction spots in the study area, tourists are limited to travelling tourist instead of visiting tourists. Only main routes leading to a particular tourist attraction area will be considered, in this case the R557 is a possible route to the Suikerbosrand Nature Reserve. Travelling tourists could be considered less sensitive. Tourists will be exposed to a *medium* visual severity. The assessment only refers to alternative 3; this is the only alignment that crosses the R557.

Motorists:

Only major routes are considered as there are many other numerous smaller roads to consider in the area. Main routes will accommodate a higher number of motorist receptors. These are the least sensitive receptors. Their views are limited to what they see along the road. Severity of the impact to motorists is rated *low.* The construction and operational phase are anticipated to have the same severity.

7. 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.

7.1. GENERAL

1. Proceed with construction of the transmission line during the off peak tourism season;
2. 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;

7.2. TRANSMISSION TOWERS

1. Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value;
2. The preferred type of tower is the compact cross-rope or the cross-rope suspension tower. These two tower types are the most visually permeable and create an extremely low degree of visual obstruction;
3. Avoid changing the alignment's direction too often in order to minimise the use of the self-supporting strain tower. This tower type is the most visually intrusive as the steel lattice structure is more dense than the other two tower types, hence creating more visual obstruction;
4. Where practically possible, provide a minimum of 1 km buffer area between the transmission line and sensitive visual receptors such as residential areas and tourism facilities; and
5. Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.

7.3. ACCESS ALTERNATIVES

1. Make use of existing access roads where possible;
2. 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;
3. Locate access alternatives so as to limit modification to the topography and to avoid the removal of established vegetation;
4. Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value;
5. Maintain no or minimum cleared road verges;
6. Access alternatives should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and
7. 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.

7.4. CLEARED SERVITUDES

1. Locate the alignment and the associated cleared servitude so as to avoid the removal of established vegetation; and
2. 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.

7.5. CONSTRUCTION CAMPS AND LAY DOWN YARDS

1. If practically possible, locate construction camps in areas that are already disturbed or where it isn't necessary to remove established vegetation for example, areas with less dense vegetation;
2. 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;
3. Keep the construction sites and camps neat, clean and organised in order to portray a tidy appearance; and
4. 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.

8. CONCLUSION

The three proposed 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.

Landscape impacts: Alternative 3 will have the greatest landscape impact in the construction phase on sensitive landscape types, the extent for alternative 3 is rated *Medium* and *Low* for alternative 1 and 2.

The operational phase is characterised by a *medium* landscape impact on a regional scale on all alignments.

Impacts on residents: Alternatives 1 and 2's severity can be reduced in both the construction and operational phases through mitigation measures. In the case of alternative 3, mitigation will ineffective in reducing in the visual impact's severity.

Impacts on tourists: Both the construction and operational phases are characterised with a *low* visual impact with mitigation.

Impacts on motorist: *Low* impacts on motorists are expected in both the construction and operational phases.

Impact on landscape amenities: Alternatives 2 and 3's alignment traverses over a number of landscape amenities within the north-east section of the site. These landscape amenities will be negatively impacted on. See (4.2.2).

The alternatives are rated according to preference by using a three-point rating system in see table below, three (3) being the most preferred, to one (1) being the least preferred. The preference rating is informed by the impact assessment discussions in Table 9 and the overall performance of each alternative with regards to the impact on the Landscape character and the identified viewers.

Alternative 1 is the most preferred alternative.

Table 14: Evaluation of Alternative alignments

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

9. APPENDIX 1

Figures 13, 14 and 15 reflect the results of a visibility assessment, carried out using GIS software. Additional to a conventional visibility assessment, a land cover map was integrated in the findings. The results provide a clear interpretation of the extent of the visual influence per alternative 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 result in higher impacts.

Figure 13: Alternative 1

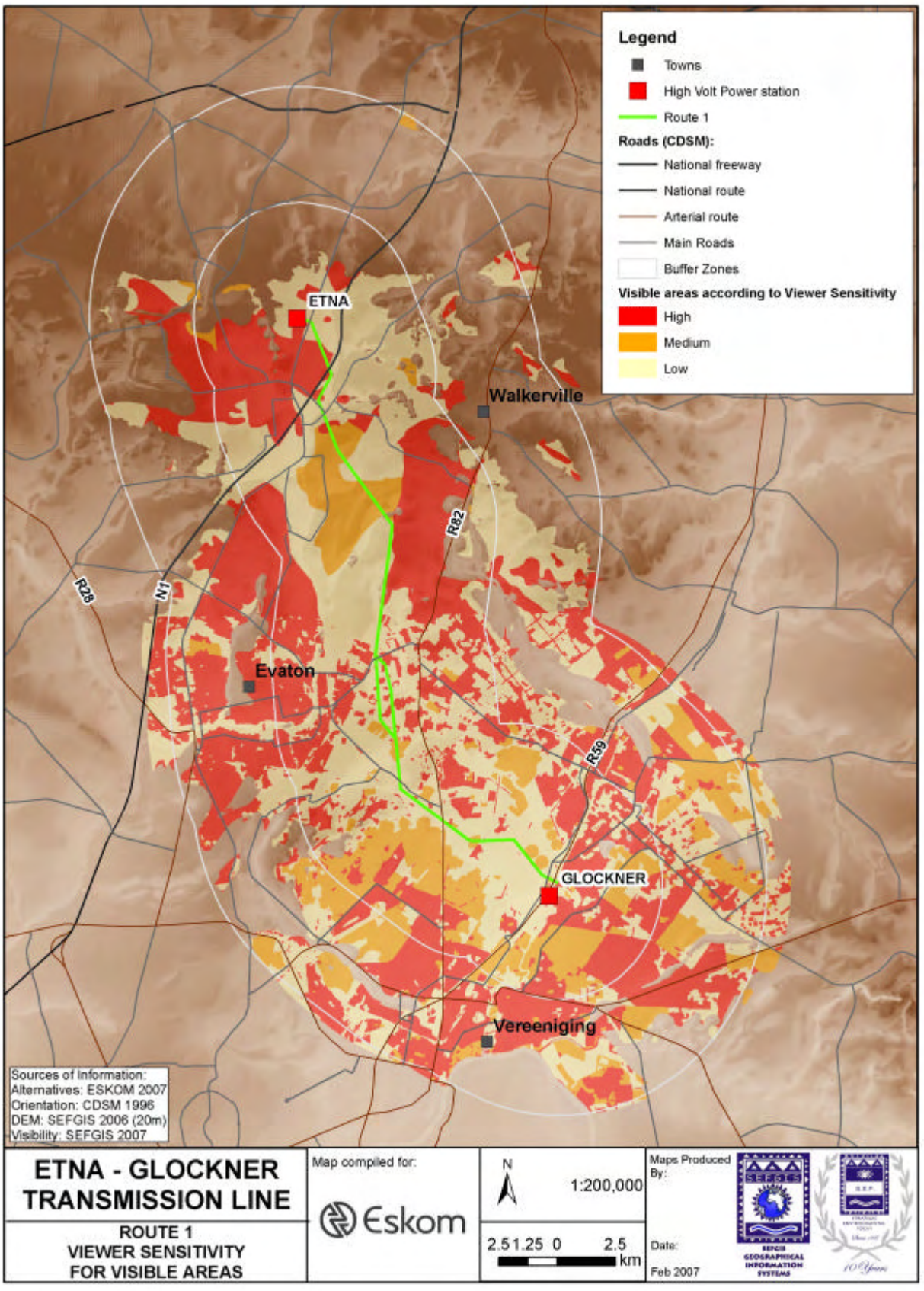


Figure 14: Alternative 2

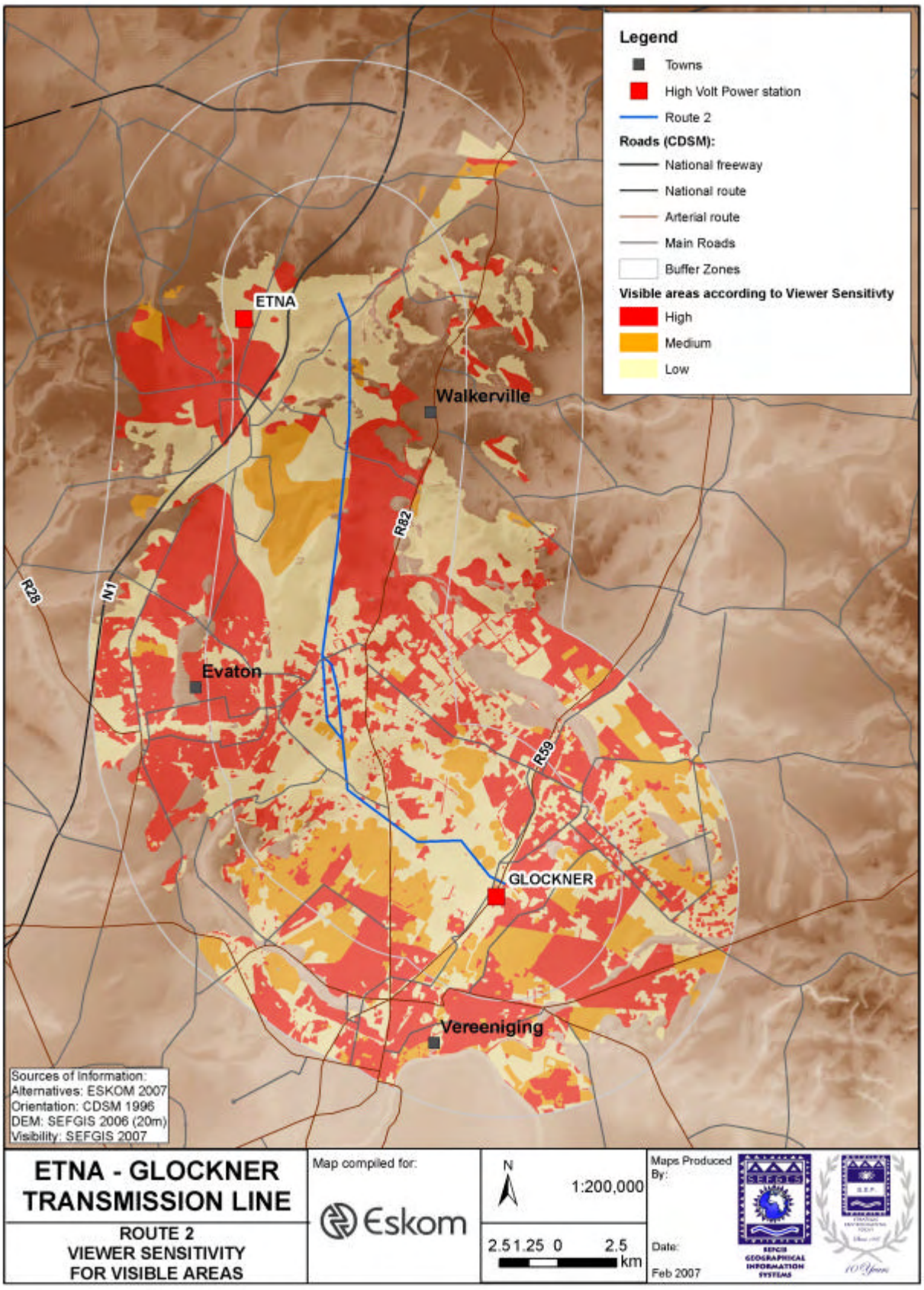


Figure 15: Alternative 3

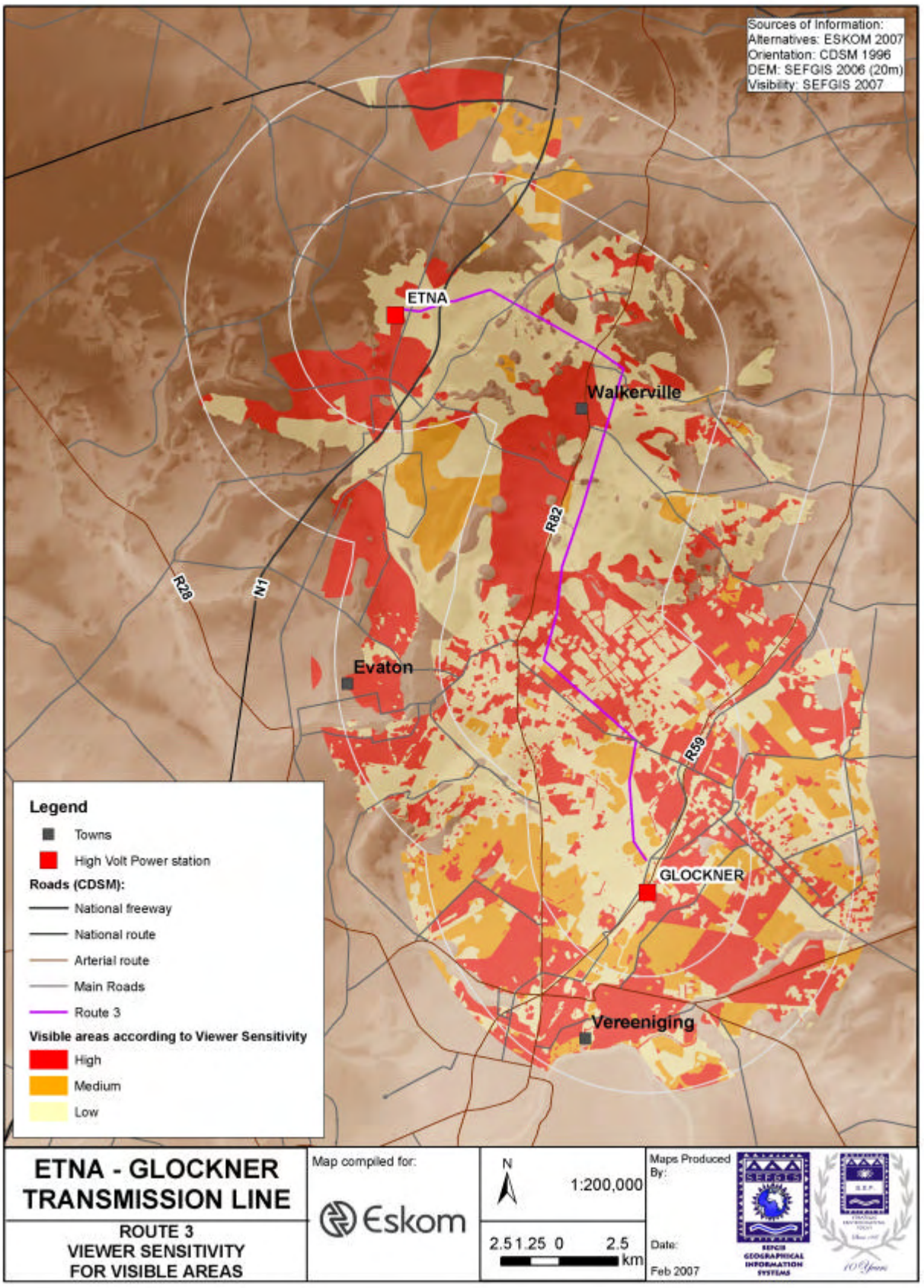


Figure 16: Simulation 1

10. SIMULATION COMMENTS

The simulation shows the effect of the introducing a transmission line in the Midvaal Highveld Grassland landscape. Alternative 1 is the preferred alternative; the alignment will traverse longer over this landscape type.

The Self-supporting strain tower is used in the simulation because it is a more visible tower compared to the Compact cross-rope tower and Cross-rope tower (Figure 4) and it causes more landscape impact as it requires the construction of four concrete footings compared to the other two types of pylons.

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)[i].
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.
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 viewshed experienced by visual receptors and intrusion of foreign elements into the viewshed 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 magnitude Product of the vertical and horizontal angles of an object to describe quantitatively the visual dimension of an object. (Iverson, 1985). The visual magnitude is best described in terms of visual arcs with a one minute arc usually considered as being the minimum resolution detectable by the human eye (equivalent to observing a 29mm ball at a distance of one hundred metres).

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 15: 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)

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.
ZVI	Zone of Visual Influence.

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