Visual Impact Assessment for Proposed ESKOM 400kV Power Transmission Line between Garona and Aries Sub-stations

Draft

Proposed ESKOM Power Transmission Line
Garona to Aries
Near Kenhardt and Groblershoop
Northern Cape

Specialist Study Report
VISUAL IMPACT ASSESSMENT

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1.0 INTRODUCTION

The Scoping Phase of the VIA is complete and has delivered the following:

- A description of the receiving and surrounding environment;
- An identification and characterization of potential visual impacts highlighting issues which are required to be evaluated in the Assessment Study.

1.1 Aim of the Impact Assessment Report

The aim of the Visual Impact Assessment Report (VIA) is to determine and rate the visual impacts associated with the project. The assessment study deals with the issues raised in the scoping phase and is a follow-on to the Scoping Report – "*Proposed ESKOM Power Transmission Line Garona to Aries Near Kenhardt and Groblershoop Northern Cape Specialist Study Report VISUAL ENVIRONMENT – SCOPING Rev 1"*, dated 19 January 2006. The VIA also compares and rates the potential visual impacts of feasible alternative routes that were identified in the Scoping Process.

1.2 Scoping Phase

The primary visual concern is of the potential impact from the physical presence of the power transmission line and associated impacts on views to residents, tourists and people passing through the study area. The following issues were raised in the Scoping Phase:

- Views to residents / farmsteads;
- Views to tourists / facilities;
- Views to people passing through the study area;
- Views at the Orange River;
- Views from the N10 (scenic route);
- View from the hills of the Quiver Tree Forest

During the scoping phase the inherent scenic value of the landscape (visual resource) was mapped (refer to Figures 2 and 3 at the back of the report) and a comprehensive description and valuation of the receiving environment given. Sensitive viewing areas were also identified and mapped (Figure 4). Alternative routes, as illustrated in Figure 1 below, were identified and are to be assessed in the VIA.

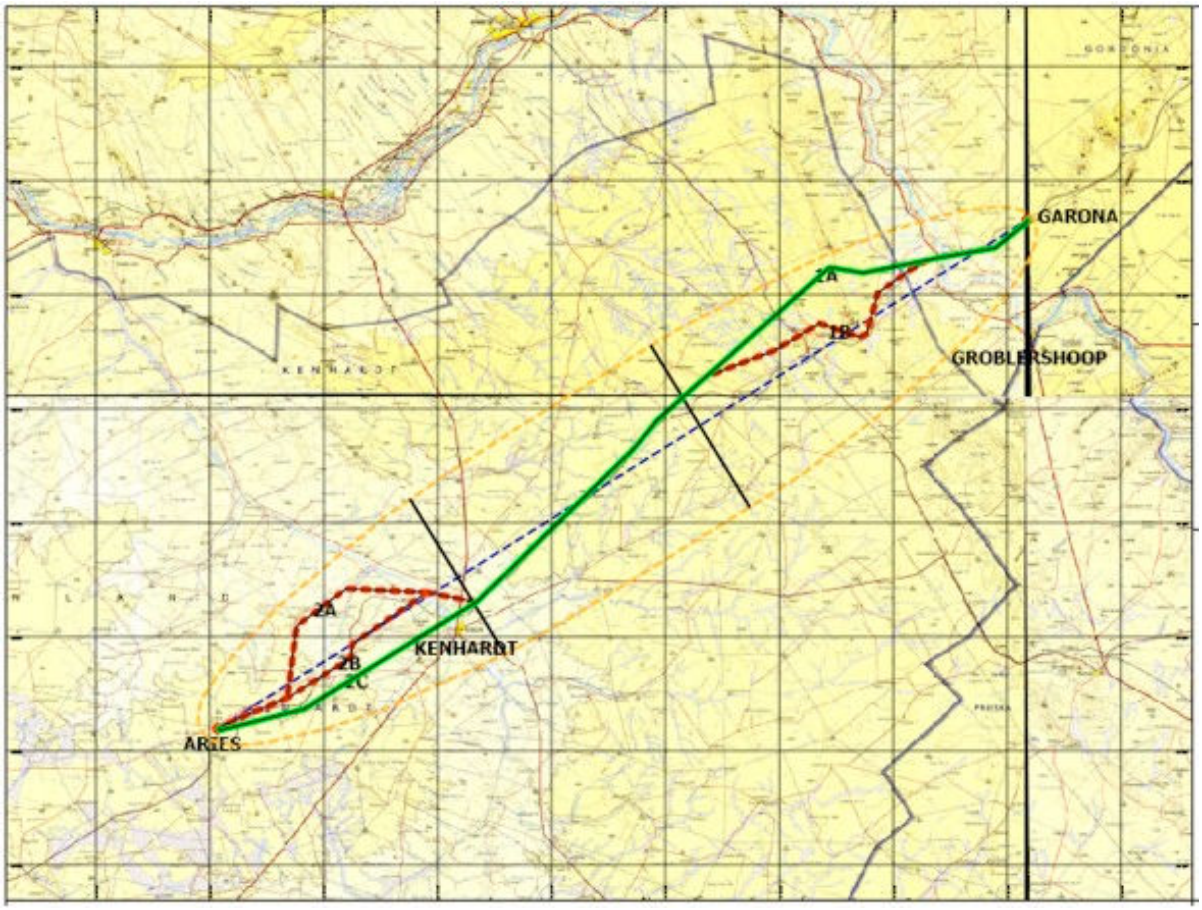


Figure 1: Route Alternatives

2.0 METHODOLOGY

To determine and evaluate the potential visual impacts of the proposed transmission lines, the following method was employed.

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effect with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (i.e. views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the scene as perceived by people visiting, working or living in the area. This approach reflects the layman's concerns, which normally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development affect views in the area and if so how?

2.1 *Magnitude* of Visual Impact

The *magnitude* of visual impact is determined using *visual intrusion*, *visibility* and *visual exposure* criteria (Hull, R.B. and Bishop, I.E. 1988), qualified by the *sensitivity* of viewers (visual receptors) towards the proposed development. The magnitude of visual impact is therefore concerned with:

- The overall impact on the visual amenity, which can range from degradation through to enhancement;
- The direct impacts of the landfill upon views of the landscape through intrusion or obstruction;
- The reactions of viewers who may be affected.

2.2 *Significance* of Visual Impact

The assessment of impacts will largely be based on DEAT's (1998) Guideline Document: EIA Regulations. The assessment will consider impacts arising from the construction and operation phases of the proposed project both before and after the implementation of appropriate mitigation measures. Once the *magnitude* of the visual impact has been determine, the *significance* of the impacts will be ranked according to extent, duration, magnitude (intensity) and probability criteria. From these criteria, a significance rating is obtained. For a detailed description of the methodologies used in this study, refer to Appendices A and B at the back of the report.

2.3 Assumptions and Limitations

The worst-case scenario is used to model and assess potential visual impacts. It has been assumed for the purpose of the simulations that Cross-rope suspension towers (36m) will be used for the straight section of the line and that Self-supporting towers (30m) will be utilized for the bends in the line.

3.0 SENSITIVE VIEWING LOCATIONS

Views from residences and tourist facilities are typically sensitive to the presence of a power transmission line as these views are frequent and of long duration. It was established in the scoping phase, that residences (along the Orange River and at Kenhardt), farmsteads (throughout the study area), tourist facilities along the Orange River, the Thuru Lodge and the Quiver Tree Forest National Monument are potential sensitive viewing areas and contain potentially sensitive receptors (viewers). The N10, a scenic route, is also considered a sensitive viewing area.

Other viewpoints, such as those from the R27 and local farm roads dispersed throughout the study area, are considered moderate sensitivity viewpoints. Refer to Figure 4 at the

back of the report, which identifies these areas.

4.0 COMPARISON OF ALTERNATIVE ROUTES

The study area is divided into three general sections (Figure 1). The northern section, comprising alternatives 1A and 1B, the central section and the southern section, which contains three alternatives, 2A, 2B and 2C.

Alternative 1A veers to the north away from the existing public road and is proposed primarily to avoid close views of the transmission lines for visitors to Thuru Lodge and the farmsteads west of the hills (Figure 3). The negative aspect of this routing is that it would compromise natural (pristine) areas, which have scenic value.

The 'southern' routing, alternative 1B, occurs along an infrastructure 'corridor' within which exist the railway line, its electricity infrastructure and a local public road. The structural contrast i.e. contrast of the new power transmission line with the existing, man altered landscape, would therefore be weaker than for alternative 1A. The negative aspect of the 1B route is the cumulative negative effect of the power transmission lines on the scenic quality of the landscape.

Alternatives 2A, 2B and 2C occur in the southern section of the study area west of Kenhardt. Alternative 2A is routed to the far north of Kenhardt and the Quiver Tree Forest National Monument and is the preferred option from a visual impact perspective as it is the farthest from sensitive viewing areas. Alternative 2B roughly follows the existing railway line. The positive aspect of this route is that the structural contrast of the proposed power line with the landscape would be less than that of Alternatives 2A and 2C due to the presence of human activity (railway, its structures and service road and a quarry). Alternative 2C is the least desirable option as it brings the power transmission line in close proximity to Kenhardt and the Quiver Tree Forest National Monument, both considered sensitive viewing areas. Refer to (Figure 2).

5.0 MAGNITUDE OF IMPACT

The *magnitude* of visual impact is determined using *visual intrusion*, *visibility* and *visual exposure* criteria, qualified by the *sensitivity* of viewers towards the proposed development.

5.1 Visibility

In the larger context of the study area, the vast flat undisturbed areas and the presence of distinctive natural landscape elements (hills and the Orange River valley) generally create a setting for expansive panoramic views, albeit from low vantage points. The only places where the public has access to elevated views, is from the Quiver Tree Forest National Monument immediately south west of Kenhardt and to a lesser degree, from the western banks of the Orange River looking in an easterly direction.

There are a number of public roads from which the power line would be visible. The line

crosses the R27 north of Kenhardt and the N10 north of Wegdraai. It is routed adjacent to a farm road east of the Aries sub-station and crosses another road immediately east of the Orange River near the Garona sub-station (Figure 4).

Views from Thuru Lodge are orientated towards the south away from the proposed power line corridor, which is visually separated from the lodge by a low ridge to its north.

Residences are spread nearly throughout the study area, although they are generally concentrated along the Orange River and in residential clusters at Wegdraai, Kenhardt and Groblershoop.

The proposed power transmission line would be the most visible and viewed by most people, in the Northern Section of the study area due to its proximity to the N10 road and the tourist attractions associated with the Orange River and Thuru Lodge.

The Central Section, is least visible in the sense that the closest public road is 8km to the south and there are few farmsteads in this rather 'isolated' section. Most are located along the public road.

The Southern Section is visible from sensitive viewing points, the R27, Kenhardt and the Quiver Tree Forest National Monument. Alternative 2C would be highly visible from these areas and would tend to focus attention from these viewing areas.

At its closest, Alternative 2B is 5km from the northern most residences of Kenhardt, at which distance the towers would begin to recede into the landscape and merge with the middle ground. Alternative 2B is 9km from the Quiver Tree Forest National Monument. Because of the elevated viewpoint from the forest, the transmission line would not break the horizon line and would therefore tend to be absorbed into the background, thus reducing their contrast with the landscape and hence their visibility.

Alternative 2A is another 8km further to the north making it 16km away from the forest and therefore less visible from this viewing point.

A summary of visibility for each section of the study area is given in Table 1 below.

Table 1: Visibility

High **for alternatives 1A and 1B in the Northern Section and 2C in the Southern Section**	**Moderate** **For alternative 2A in the Southern Section**	**Low** **For the Central Section as well as alternative 2B in the Southern Section**
The proposed power transmission line is visible by most people travelling through the study area and views from sensitive viewing areas (public roads, residences	The proposed power transmission line is visible by less people and views from some sensitive viewing areas (R27) are open but quickly recede into the middle	The proposed power transmission line is visible from the least number of people and views from sensitive viewing areas are mostly obstructed due to distance.

and/or tourist facilities) are mostly open and unobstructed.	ground.	

5.2 Visual Intrusion and Visual Exposure

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the cultural aesthetic of the landscape as a whole? Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study.

Given the linear nature of power transmission lines and the nature of the landscape, their intrusive nature (contrast with surroundings) will vary considerably along the length of the route. To help understand the nature of intrusion, three simulations have been created using computer technology. Figures 5, 6 and 7 illustrate the proposed power transmission line superimposed onto panoramas of the existing landscape from 'sensitive' viewing points, illustrating before and after scenarios.

5.2.1 Northern Section

The northern section of the study area contains the most sensitive viewing areas i.e. areas associated with tourism and the N10. Tourism is an industry based primarily on subjective perspectives of visitors to an area. In destinations where tourism is focused on outdoors or based on natural elements, the tourism value rests largely on the experience, which can be provided. Thuru Lodge occurs within this section of the study area and is arguably the most sensitive facility to the potential visual impact of the power lines. Figure 5 illustrates the proposed Alternative 1B routing of the power line near the entrance road to the lodge. It is evident from the simulation that the power lines will be clearly in view and will impact negatively on the quality of the area. However, as is illustrated in the simulation in Figure 6, approximately 3km from the entrance to the lodge, the existing telephone lines already have an impact and the power lines are mostly 'absorbed' into the background by a backdrop of hills. Nevertheless, the power lines will contribute to the cumulative negative effect on the scenic beauty of the area.

At the farm Kleinbegin, alternative 1B would impact on views from the farmstead due to orientation and proximity to the proposed power line.

Alternative 1A will not significantly impact on visitors to the Thuru lodge or the Kleinbegin farmsteads to the west of the hills.

Views from the N10 are also considered to be sensitive as it is a major public road and is used by tourist visiting or passing through the area. The power line crosses over the road near the existing train overpass and would be visible from close range. View 17 in Figure 7 illustrates the view from the road and the proximity of the power line to the existing railway line. Alternatives 1A and 1B would have an equal impact on views from these perspectives.

Another other potential area of concern is along the Orange River were there is possible for tourism associated with the vineyards. However, according to the Tourism Study the farms in this area are not currently tourism destinations. A B&B, the Headmaster's House and few other houses are located near to the railway crossing at the Orange River. Visual intrusion will be high from these vantage points. View 18 in Figure 8 is indicative of close views in this area.

To the east of the Orange River the two alternatives come together and the alignment follows the existing railway line through to the Garona sub-station. This section of the line contributes to the cumulative negative impact of infra-structure on the scenic quality of the area.

5.2.2 Central Section

The central section is the least sensitive. Here the proposed route follows the existing railway line servitude. A number of farms occur both to the north and south of the line. Most however are situated along the farm road to the south of the proposed line at distances ranging from 8km to 14km. At these distances the power line would appear in the background of most views and tend to be absorbed 'into' the landscape.

5.2.3 Southern Section

As was discussed in section 5.1 the transmission lines in this section would be visible from sensitive viewing points i.e. where the proposed route crosses the R27 north of Kenhardt, residences along the northern edge of Kenhardt and from the Quiver Tree Forest National Monument.

Alternative 2C is the most intrusive alignment as it would appear in the fore to middle ground (within 2.0km) of views from both Kenhardt and the Quiver Tree Forest.

In Alternatives 2A and 2B the power line is far enough away that it will appear in the middle and back ground of views from the Quiver Tree Forest and Kenhardt and would not be the focus of most views. The presence of the power line would therefore not distract substantially from the experience of visiting the forest or a residence along the northern side of Kenhardt.

At the western most portion of the proposed route, the three proposed alignments come together and follow an existing farm road to Aries sub-station. In this area the alignment also passes within 1,5km of the farm Olyvenhoutskolk. This section of the line, along with the additions to the Aries sub-station, would be intrusive and contribute to the cumulative

negative impact on the scenic beauty of the area.

Taking the *worst case scenario* into account Table 2 rates the visual intrusion for each section of the study area.

Table 2: Visual Intrusion and Exposure

High **For the northern section at the N10 and the Orange River, alternative 1A west of the N10 and Alternative 2C.**	**Moderate** **For the northern section east of the Orange River, alternative 1B west of the N10 and alternate 2B**	**Low** **For the entire central section and alternative 2A**	Positive No Sections of the proposed alignment
Because the proposed power transmission line: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts with the patterns or elements that define the structure of the landscape; - Contrasts with land use, settlement or enclosure patterns at the Orange River; - is cannot be 'absorbed' into the landscape from key viewing areas *Result*: Notable change in landscape characteristics over an extensive area (alternative 1A) and/or intensive change over a localized area resulting in major changes in key views (from N10 and at Orange River).	Because the proposed power transmission line: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use (utilities) patterns of the general area. - is partially 'absorbed' into the landscape from key viewing areas *Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	Because the proposed power transmission line: - Contrasts minimally with the patterns or elements that define the structure of the landscape; - is mostly compatible with land use, (utility) patterns. - is 'absorbed' into the landscape from key viewing areas *Result* Moderate change in landscape characteristics over localized area resulting in a minor change to a few key views.	The proposed power transmission line: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns. *Result* Positive change in key views.

5.3 Sensitivity of Visual Receptors

Issues raised by the public during the scoping process confirm to a degree, the sensitivity of the project. Although visual issues were raised, they did not form the focus of most peoples' concerns. Based on the criteria in Table 3 and the concerns expressed during the scoping process, the sensitivity of receptors (viewers) is rated moderate for the northern and southern sections and low for the central section.

Table 3: Sensitivity of Receptors

High	**Moderate** **Northern and Southern Section**	**Low** **Central Section**

Visual Receptors For example when viewed from residential properties, public rights of way, tourist routes/attractions and or the majority of the I&AP's are opposed to the proposed project and take major issue with the visual aspects of the project.	***Visual Receptors*** For example when viewed from sporting and recreational facilities and/or there is a split between I&AP's who either support or oppose the proposed project **and take moderate issue with the visual aspects of the project.**	*Visual Receptors* For example when viewed from, industrial or mining areas and/or most I&AP's are either supportive of the proposed project **or do not take issue with the visual aspects of the project.**

5.4 *Magnitude* of Visual Impact Rated

In synthesising the criteria used to establish the magnitude of visual impact, a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment & The Landscape Institute (1996)). The ratings for each of these criteria are indicated in Table 4 and derived from the discussion in the preceding sections. The magnitude of impact will be assessed for each section of study area as well as for the alternatives proposed in the northern and southern sections.

Table 4: Magnitude of Impact Operational Phase

	Quality of Visual Resource	Visual Intrusion and Exposure	Visibility	Sensitivity	Magnitude of Impact
Northern Section	Moderate to High				
Alternative 1A		High	High	Moderate	**High**
Alternative 1B		Moderate	High	Moderate	**Moderate**
Central Section	Moderate				
		Low	Low	Low	**Low**
Southern Section	Moderate to High in a few areas				
Alternative 2A		Low	Low	Moderate	**Low**
Alternative 2B		Moderate	Moderate	Moderate	**Moderate**
Alternative 2C		High	High	Moderate	**High**

6.0 SIGNIFICANCE OF VISUAL IMPACT

Tables 5, 6, 7, 8, 9 and 10 summarize the significance rating for each of the route alignment alternatives. The *magnitude* of impact, rated in Table 4, is further qualified with *extent*, *duration* and *probability* criteria to determine the *significance* of the visual impact. The method and formula used in these tables are summarized in Appendix B and are largely

based on DEAT's (1998) Guideline Document: EIA Regulations.

Visual resource impacts would result from the construction, operation, and maintenance of the proposed 400kV transmission line. Specifically, impacts would result from the line being seen from sensitive viewpoints and from effects to the scenic values of the landscape. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from recreation and tourist destinations, travel routes, and especially in foreground views. The significance of visual impact is predicted using the worst-case operational scenario and is summarized for each alternative route in the tables below.

Mitigation measures to reduce the visual impact of 400kv power transmission lines are not generally possible after the alignment has been determined. Screening measures from sensitive viewing areas are difficult due to the open nature of the landscape and the harsh climatic conditions that would make it difficult to grow trees, which in any event would look out of place in the semi-arid landscape. To this end no mitigation measures, other than the preferred route alignment have been proposed.

6.1 Visual Impacts: Northern Section of Study area

Table 5: Alternative 1A Northern Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission lines will cause a notable change in landscape characteristics over an extensive area (alternative 1A) and/or intensive change over a localized area resulting in major changes in key views (from N10 and at Orange River).	No	Negative	2	4	8	4	**56 Medium**
Corrective / Mitigation Measures							

Table 6: Alternative 1B Northern Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over localized area (along the public road and at Thuru Lodge) resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	No	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures							

6.2 Visual Impacts: Central Section of Study Area

Table 7: Central Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a small change in landscape characteristics over localized area resulting in a minor change to a few key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	No	Negative	2	4	4	4	**40 Medium**
Corrective / Mitigation Measures							

6.3 Visual Impacts: Southern Section of Study Area

Table 8: Alternative 2A Southern Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a small change in landscape characteristics over localized area resulting in a minor change to a few key views.	No	Negative	2	4	4	4	**40 Medium**
Corrective / Mitigation Measures							

Table 9: Alternative 2B Southern Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over an extensive area (views from the Quiver Tree Forest National Monument) resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	No	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures							

Table 9: Alternative 2C Southern Section

Issue/Impact	Corrective measures	Impact					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The power transmission lines will cause a notable change in landscape characteristics over an extensive area and/or intensive change over a localized area resulting in major changes in key views (from residences in Kenhardt and the Quiver Tree Forest National Monument).	No	Negative	2	4	10	4	**64 High**
Corrective / Mitigation Measures							

7.0 CONCLUSION

Alternative 2C is rated to have the greatest potential impact on the visual environment. Its impact is *high* i.e. where the impact must have an influence on the decision process to develop in the area. Although there are minor differences in the impact rating for the other alignments, they are all *medium* i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated.

The following route alignment is therefore proposed as it would have the least impact on the visual environment:

Northern section: Alternative 1B
Central section:
Southern section: Alternative 2A

It is *highly probable* that the proposed 400kv power transmission line, will have at least a *medium negative* impact on the *local* visual environment in the *short term* during the construction phase. During the operational phase, the significance of impact is predicted to be *medium* in the *long term* i.e. the impact will only cease after the operational life span of the project, and *high* for Alternative 2C should it be selected.

Mitigation measures are not feasible after the route has been chosen i.e. mitigation can only take place in the routing of the line to avoid conflict areas. Therefore mitigation of any significant kind is not achievable during the operational phase.

Appendix A:
Method for Determining the *Magnitude* of Landscape and Visual Impact

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Effects (impact)
Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual effects (impact)
Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the *magnitude* of visual impact four main factors are considered.

Visual Intrusion: The nature of intrusion (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use;

Visibility: The area/points from which project components will be visible;

Visual exposure: Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion;

Sensitivity: Sensitivity of visual receptors to the proposed development.

Visual Intrusion

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Generally, an object will have a greater negative impact on scenes considered to have high visual quality than on scenes of low quality because the most scenic view has the "most to lose".

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the project enhance and promote cultural continuity or does it disrupt it?

The consequence of the intrusion can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion (landscape receptor sensitivity)

High	Moderate	Low
If the physical presence of the project causes a notable change in landscape characteristics over an extensive area ranging to very intensive change over a more limited area; If the receiving landscape is of particular distinctive character susceptible to relatively small changes; Resulting in major changes in key views	If the physical presence of the project causes moderate changes in localised area; If the receiving landscape is moderately valued and is reasonable tolerant to change; Resulting in a moderate change to key views.	If the physical presence of the project causes virtually imperceptible change in any components of the landscape; If the receiving landscape is relatively unimportant, the nature of which is potentially tolerant of substantial change; Resulting in a minor change to key views.

Visual intrusion also diminishes with scenes of higher complexity, perhaps, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer=s attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

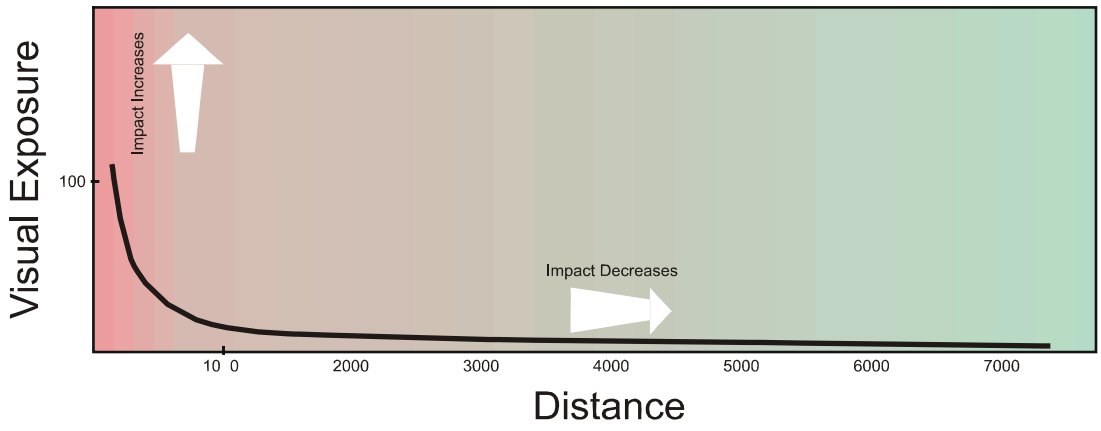
The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or the majority of viewers are affected.	*Visual Receptors* If the development is visible from less that half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the figure below.



Effect of Distance on Visual Exposure

Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the *magnitude* of the impact of the development can be determined.

High	Moderate	Low
For example viewed from residential properties, public rights of way, tourist attractions and or the majority of the I&AP's are opposed to the proposed extension to the mine	For example sporting and recreational facilities and/or there is a split between I&AP's who either support or oppose the proposed extension to the mine.	For example, industry or mining and/or most I&AP's are supportive of the proposed extension to the mine.

***Magnitude* of the Visual Impact**

The magnitude of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the magnitude of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment & The landscape Institute (1996)).

Appendix B: Method of Assessing Significant Impacts

Method of Assessing Significant Impacts

The assessment of impacts will largely be based on DEAT's (1998) Guideline Document: EIA Regulations. The assessment will consider impacts arising from the construction and operation phases of the proposed project both before and after the implementation of appropriate mitigation measures.

It is proposed that the impacts will be assessed according to the criteria outlined below. Each issue is ranked according to extent, duration, magnitude (intensity) and probability. From these criteria, a significance rating is obtained, the method and formula is described below.

Nature of Impact

The impacts are to be assessed as either having a:

- negative effect (i.e. at a `cost' to the environment),
- positive effect (i.e. a `benefit' to the environment), or
- neutral effect on the environment.

Extent of the Impact

- (**1**) Site (i.e. within the boundaries of the study area),
- (**2**) Local (i.e. the area within 10 km of the study area),
- (**3**) Municipal
- (**4**) Provincial (i.e. Northern Cape Province),
- (**5**) National (i.e. South Africa), or
- (**6**) International (i.e. Southern Africa and beyond).

Duration of the Impact

The length that the impact will last for is described as either:

- (**1**) immediate (>1 year)
- (**2**) short term (1-5 years),
- (**3**) medium term (6-15 years),
- (**4**) long term (the impact will cease after the operational life span of the project),
- (**5**) permanent (no mitigation measure of natural process will reduce the impact after construction).

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:

- (**0**) none (where the aspect will have no impact on the environment),
- (**2**) Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
- (**4**) Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
- (**6**) Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
- (**8**) High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
- (**10**) Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

Probability of Occurrence

The likelihood of the impact actually occurring is indicated as either:

- (**0**) None (the impact will not occur),
- (**1**) improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions)
- (**2**) low probability (there is a possibility that the impact will occur),
- (**3**) medium probability (the impact may occur),
- (**4**) high probability (it is most likely that the impact will occur), or
- (**5**) definite / don't know (the impact will occur regardless of the implementation of any prevention or corrective actions, or you don't know what the probability will be based on too little published information).

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance weighting (**S**). This weighting is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.

S=(E+D+M)P

The significance weightings are given below:

- (**<30**) low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- (**30-60**) medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- (**>60**) high (i.e. where the impact must have an influence on the decision process to develop in the area).

The above significance rating methodology is presented in tabular form below:

Table A: Summary of Significance Rating Methodology

Significance Rating				
Nature	Magnitude	Duration	Extent	Probability
Positive	10- Very High/ Unsure (environmental functions* permanently ceases)	5- Permanent	5- International	5- Definite/ Don't know
Negative	8- High (environmental functions temporarily ceases)	4- Long term (ceases after operation life of activity)	4- National	4- Highly probable (most likely to occur)
	6- Moderate (environmental functions altered but continue)	3- Medium term (5-15 years)	3- Regional (e.g. provincial)	3- Medium probability (distinct probability that impact will occur)
	4- Low	2- Short term (0-5 years)	2- Local (limited to site boundary and immediate surrounds)	2- Low probability (unlikely to occur)
	2- Minor	1- Immediate	1- Site only	1- Improbable (probability very low due to design or experience)
	0- None			0- None

Combining the consequence (magnitude, duration, and extent) with the probability of occurrence provides an overall significance rating (i.e. (magnitude+duration+extent) multiplied by probability = significance). Based on the overall significance rating the impact is assigned as having a low, medium or high significance. The criteria for the significance categories are as follows: <30 points = low significance; > 30 and <60 points = medium significance; and >60 = high significance.

The significance ratings applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best route alignment for the proposed development.

*** NLA ***

REFERENCES:

Australian Heritage Commission (1999), *Protecting Local Heritage Places*, Australian Heritage Commission, Canberra.

Crawford, D., (1994), Using remotely sensed data in landscape visual quality assessment, *Landscape and Urban Planning.* 30: 71-81.

Hull, R.B. and Bishop, I.E. (1988), Scenic Impacts of Electricity Transmission Mine: The Influence of Landscape Type and Observer Distance. *Journal of Environmental Management.* 1988 (27) 99-108.

The Landscape Institute with the Institute of Environmental Management and Assessment (2002), *Guidelines for Landscape and Visual Impact Assessment Second Edition,* Spon Press, London

Institute of Environmental Assessment & The landscape Institute (1996), *Guidelines for Landscape and Visual Impact Assessment,* E & FN Spon, London

Ittelson, W.H., Proshansky, H.M., Rivlin, L.g. and Winkel, G.H. (1974). *An Introduction to Environmental Psychology.* Holt, Rinehart and Winston, New York.

Lange, E. (1994), Integration of computerized visual simulation and visual assessment in environmental planning. *Landscape and Environmental Planning.* 30: p 99-112.

Lynch, K. (1992). *Good City Form*, The MIT Press, London. p131

Ramsay, J. (October 1993). Identification and assessment of aesthetic values in two Victorian forest regions. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

Schapper, J. (October 1993). The importance of aesthetic value in the assessment of landscape heritage. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

The Bureau Of Land Management (BLM), *The Visual Resource Management System,* Department Of The Interior of the USA Government.

Warnock, S. & Brown, N., Putting Landscape First. *Landscape Design.* No. 268 March 1998. p 44-46.