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BRAAMHOEK INTEGRATION EIA

**BRAAMHOEK SUB-STATION
VISUAL IMPACT ASSESSMENT**



PREPARED FOR :

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ESKOM BRAAMHOEK SUBSTATION

VISUAL IMPACT ASSESSMENT

1 INTRODUCTION

Margen Industrial Services / PBA International (SA) as the lead consultants for the Environmental Impact Assessment have commissioned Cave Klapwijk and Associates to undertake the visual assessment investigation for the construction of the proposed Braamhoek Substation near the De Beers Pass, Kwazulu-Natal.

2 BACKGROUND AND BRIEF

The project components will consist of the substation only.

This visual assessment is a specialist study to determine the visual effects of the proposed Braamhoek Substation Project on the surrounding environment.

The purpose of this Specialist Study is to determine the impact of the proposed project on the visual and aesthetic character of the proposed alternative routes. The rationale for this Study is that the placement of the substation may fundamentally alter the landscape character and sense of place of the local environment. The primary objective of this Specialist Study is therefore to describe the potential impact of this structure on the visual character and sense of place of the area. This Specialist Study will have the following objectives:

- Determine the visual character of the areas along the proposed project routes by evaluating environmental components such as topography, current land use activities, surrounding land use activities, etc.;
- Identify elements of particular visual quality that could be affected by the proposed developments;
- Recommend mitigation measures to reduce the potential visual impacts generated by the proposed power line.

3 STUDY APPROACH

3.1 Method

In order to address the objectives of the study the following method has been used:

- A site visit to determine the setting, visual character and land uses of the areas was undertaken;
- Determine the setting, visual character and land use of the area surrounding the route, and the *Genius Loci* (sense of place);
- Discussions and meetings with the specialist consultant team and Client to identify specific aspects of the construction and development which would affect the visual quality of a setting;
- Define the extent of the affected visual environmental, the viewing distance and the critical views.

The visual impact assessment statements in this report are based on the expert opinion of the authors and attitudes that are generally accepted worldwide.

The assessment is based on the field trip and the agreed alternative routes as determined during a field inspection held on 12, 13 and 14 January 2005.

As this report is set at a scoping level with a limited budget no definitive surveys such as viewshed analysis and visual absorption capacity studies have been undertaken.

3.2 Limitations, Constraints and Assumptions

The following assumptions and limitations are applicable to this study:

- The basis for this assessment is that scenic wilderness areas form the core of eco-tourism due to the high positive aesthetic appeal;
- The assessment does not consider the ancillary project infrastructure and components such as access roads, borrow pits, spoil dumps, etc. These components will be assessed in detail during the design phase should the project be implemented;
- The assessment is based on assumed demographic data. No detailed study was done to determine accurate data on potential viewers of the project components. If necessary these studies could be undertaken during the design phase of the project;
- The location and extent of the construction and labour campsites, as well as material lay-down areas will only be determined during the design and construction phases. These are, however, of a relatively temporary nature and can effectively be controlled through the Environmental Management Plan;

- Determining a visual resource in absolute terms is not achievable. Evaluating a landscape's visual quality is both complex and problematic. Various approaches have been developed but they all have one problem in common: unlike noise or air pollution, which can be measured in a relatively simple way, for the visual landscape mainly qualitative standards apply. Therefore subjectivity cannot be excluded in the assessment procedure (Lange 1994). Individually there is a great variation in the evaluation of the visual landscape based on different experiences, social level and cultural background. Exacerbating the situation is the inherent variability in natural features. Climate, season, atmospheric conditions, region, sub-region all affect the attributes that comprise the landscape. What is considered scenic to one person may not be to another (NLA, 1997).

Localised visual perceptions of the economically depressed communities of the population have not been tested as these may be influenced rather by the economic and job opportunities that will exist rather than the direct visual perception of the project.

If the study, however, determined that the negative visual impact is of such a magnitude and significance that it will seriously influence the decision on whether or not to build, it will then be necessary to test and determine the visual perceptions of neighbouring communities. Such a study is involved, costly and time consuming.

4 DESCRIPTION OF THE BASELINE CONDITIONS

4.1 Description of the Works

The proposed project comprises the following development:

Three alternative sites have been proposed for the substation. Two of the sites are on the farm Braamhoek (Braamhoek East and West) and one is located on Zaaifontein.

The substation will be similar in size and slope to the existing Pegasus Substation near Dundee.

The size and equipment of the typical substation includes the following:

- New station, transformers, reactors, etc.
- No PCBs (Poly Chloro Biphenyl), but cooling oils will still needed for equipment
- Maximum height of infrastructure is expected at 45 m
- A footprint of approximately 320 m x 160 m
- Located close to tunnel outlet

- Connected to National Grid via 400kV Turn-in from Majub-Venus #2
- A second 400kV connection direct to Venus (Estcourt) – reliability of supply. An important aspect of the proposed Braamhoek Substation is that it will be constructed on a working platform created during the power station tunnel construction. Spoil and waste rock material will result from the tunnelling process. It is intended that some of the suitable material will be used for the surfacing of the access roads and the rest will be used for creating a terraced working platform for the power station construction. This platform will be located near the access tunnel and exploratory tunnel portals and will be used as a construction camp and storage area for the power station construction. Once this phase is complete, the substation will be constructed on this platform, thereby causing minimal additional damage to the local area.

4.2 Description of the Natural Physical Elements

- Landform

The surrounding landform consists of rolling and undulating hills and broad valleys of the Drakensberg foothills immediately below the main escarpment. This landform is located at a relatively high altitude that rises up to the high escarpment-type mountains of the Drakensberg. The Zaaifontein site is situated on the eastern slopes of a foothill terrace below a spur coming off the escarpment. Soils are shallow, highly erodable and often rocky.

- Vegetation

The vegetation is classified as North-eastern Mountain Grassland by Low and Rebelo (1996) and Highland Sourveld and Dohne Sourveld by Acocks (1988). The vegetation is predominantly grassveld with some forest relics in the steeper gorges and dongas. Black wattle is encroaching the site especially along the valley.

- Critical Views and Visibility

The surrounding mountain slopes and the De Beers Pass can be considered as major viewing points. Any physical change to the surface of the slopes would be highly visible. Views are extensive especially when viewed from the higher elevations. The Zaaifontein site is tucked away and is somewhat screened by topography from the major viewing points.

Early rehabilitation of disturbed areas during construction will limit permanent landscape scarring and reduce the visual intrusion.

- Genius Loci

The spirit of place is created by the open broad valleys and rising dramatic Drakensberg backdrop which is reinforced by the lack of visible human intrusion and the existing farm dam. It is anticipated that this sense of place will be greatly altered.

- Visual Quality and Character

The visual quality of this higher lying grassland area is considered high. This is due to the lack of human intrusion and the very diverse topography resulting in a high visual interest and the scenic quality of the existing farm dam.

These visual elements have created a quality that is vivid and one that unifies the visual landscape.

- Land Use

This section is located within a landscape utilised predominantly for stock grazing. Few other land uses occur. This area is sparsely populated with few homesteads scattered within the area. Farm labour housing lies to the west of the site.

- The Scale of the Landscape

The wide and extensive horizontal scale is reinforced by the vertical definition of the massive Drakensberg Mountains in the north. The horizontal scale of the landscape continues to the distant horizon to the east, south and west.

5 IDENTIFICATION OF RISK SOURCES

Various risk sources for the visual impact have been identified for the construction and operation phases and can be classified as both negative and positive.

5.1 Construction Phase

It is anticipated that the major risk source during construction would be:

5.1.1 *Negative Risk Sources*

- Excessive cleaning and stripping of topsoil for site offices, servitudes and temporary access road;

- The relatively random and disorganised lay down of building materials, vehicles and offices;
- Cut and fill slopes of access roads become highly visible if not re-vegetated and shaped to blend in with the existing topography;
- The extent and intensity of the security and construction lighting at night;
- Dust from construction activities;
- Open and unrehabilitated landscape scarring leading to erosion and the formation of dongas;
- Uncontrolled exploitation of borrow pits and quarries without compliance to environmental controls related to aesthetic rehabilitation;
- High seed bank of alien species such as Black Wattle (*Acacia mearnsii*) in the topsoil can lead to the uncontrolled spread of this exotic invader plant species along the edges of the transmission line servitude. This could create a treed edge that is visually contrary to the low grasslands; and
- Location and layout of construction workers camp if located in proximity of works area.

5.1.2 Positive Risk Sources

- Image of construction activity could lead to a perceived view of progress and benefit to the community.

5.2 Operational Phase

5.2.1 Negative Risk Sources

- Site engineering such as cuts and fills, could remain aesthetically incompatible with surrounding landscape. Edges may not blend in with the landscape or cut slopes may be too steep to be adequately re-vegetated;
- Areas and / or specific sites of high aesthetic value may be disfigured by the introduction of project components such as pylons and power lines associated with substations within the viewshed resulting in a permanent change to the existing visual quality of visually sensitive areas; and

- Need to keep servitudes clear of vegetation, especially in commercial plantation areas, will result in visual scarring.

5.2.2 Positive Risk Sources

- The Braamhoek Substation could be the visual affirmation of progress and prosperity for the region.

6 IMPACT DESCRIPTION AND ASSESSMENT

6.1 The Visual Analysis

This section describes the aspects which have been considered in order to determine the intensity of the visual impact on the area. The criteria includes the area from which the project can be seen (the viewshed), the viewing distance, the capacity of the landscape to visually absorb structures and forms placed upon it (the visual absorption capacity), and the appearance of the project from important or critical viewpoints.

The focus of this study is specifically on the substation and not on the ancillary infrastructure such as transmission lines and access roads.

6.1.1 The Viewshed

The viewshed is a topographically defined area which includes all possible observation sites from which the project will be visible. The boundary of the viewshed, which connects high points in the landscape, is the boundary of possible visual impact (Alonso, et al, 1986). Local variations in topography and man-made structures would cause local obstruction of views. The viewshed for the route based on the field work extends for the main part beyond a distance of five kilometres.

6.1.2 The Viewing Distance

The visual impact of an object in the landscape diminishes at an exponential rate as the distance between the observer and the object increases (Hull and Bishop, 1988).

Thus, the visual impact at 1000 metres would be approximately a quarter of the impact as viewed from 500 metres. Consequently, at 2000 metres, it would be one sixteenth of the impact at 500 metres. The view of the project components would appear so small from a distance of 5000 metres or more that the visual impact at this distance is insignificant. On the other hand the visual impact of the project components from a distance of 500 metres or less would be at its maximum.

6.1.3 The Visual Absorption Capacity

The Visual Absorption Capacity (VAC) is a measure of the landscape's ability to visually accept /accommodate or embrace a development. Areas which have a high visual absorption capacity are able to easily accept objects so that their visual impact is less noticeable. Conversely areas with low visual absorption capacity will suffer a higher visual impact from structures imposed on them. In this case the VAC has been defined as a function of three factors.

Due to budgetary constraints a full VAC determination was not possible. It was, therefore, prudent to determine the VAC based on the author's field experience.

- Slope
- Visual pattern (landscape texture) with regard to vegetation and structures
- Vegetation height

It is therefore concluded that the VAC of the substation is regarded as low to medium.

6.2 The Visual Impact

The visual impact of the project and associated structures in the landscape is a function of many factors (Table 2). Some of the factors are measurable such as viewing distance, the visual absorption capacity of the surrounding landscape and the scale of the surrounding environment and landform. Other factors are subjective viewpoints, which are extremely difficult to consistently categorise the opinion of the community. Studies in the U.S.A. have shown that professionals and environmental groups view modification of the natural landscape more negatively than other groups (McCool, et al 1986).

The critical appraisal of the visual impact of the project and associated works on the landscape is presented from the viewpoint of the informed citizen and professional. To the community surrounding the proposed project, it may well be that they do not, or will not, object to the visual intrusion in their immediate environment. It may be that they welcome it since they could perceive it as a symbol of prosperity and personal advancement opportunity.

6.2.1 The View Distance

The visual impact of the project and associated structures will reduce exponentially as the viewer moves further away from the proposed structures (Hull and Bishop, 1988).

The substation will exert a high visual impact within the 500 m and 1 000 m zone.

The viewshed analysis, based on the field experience, has indicated that the proposed substation will be intermittently visible from certain areas beyond the 5 000 m zone especially when viewed from the higher lying areas such as the De Beers Pass.

6.2.2 Critical Viewpoints

Areas with high volumes of traffic such as the De Beers Pass, areas with tourism potential and undeveloped rural areas with high scenic value were regarded as critical view zones against which the visual impact would be evaluated.

Critical views were determined during the field trip and from the 1:50 000 topographical maps. Critical views considered were those views from where the majority of people could see the site such as the De Beers Pass.

6.2.3 Extent and Spatial Scale

The visual impact for both the construction and operation phases will occur on a local scale due to the fact that the view does not generally extend to the edge of the viewshed or beyond a distance of five kilometres except intermittently from the De Beers Pass.

The visual impact extends beyond the 5 000 m zone for most of the route.

The general lack of effective screening in the form of existing landform and trees from critical viewpoints, does not fully assist in limiting the extent of the impact.

6.2.4 Duration

The duration of the impact during construction will be short term due to the relatively short construction period and the rehabilitation of the disturbed areas.

The duration of the impact during the operational phase will be long term, in other words greater than 15 years, with the impact terminating only after a possible decommissioning of the transmission line.

6.2.5 Intensity or Severity

The intensity of the visual impact during construction will be high within the 500 m.

During the operational phase the visual impact of the transmission line within the 500 m zone will be medium as the construction vehicles, camps and stockpiles will be removed and surfaces to disturbed areas will be rehabilitated.

It is not possible to screen the transmission line from the majority of the viewers or potential viewers, namely the road users of the De Beers Pass and the ecotourism in the area.

Beyond the 1 500 m zone the intensity of the impact becomes low due to the flat to rolling topography. The severity diminishes significantly from the 2 500 m zone to the 5 000 m zone where the impact can be regarded as insignificant due to the flat topography and extended viewing distance.

6.2.6 *The Probability of Occurrence*

The construction and operational impact described is probable.

6.2.7 *Magnitude and Significance*

It is considered that the significance of the impact of the construction phase is medium to high due to the fact that it is of a short, but intense, duration.

The significance of the operational phase will remain high even though the site will be rehabilitated and that it will become relatively less obtrusive in the landscape. It must be mentioned that a highway (N3 De Beers Pass) is planned to come through this area which will have a significant impact on the visual environment.

6.2.8 *Status of the Impact*

The impact status of the substation is considered medium negative for the construction and operational phases.

6.2.9 *Degree of Confidence in Predictions*

The degree of confidence that the visual impacts will occur is high.

6.2.10 *Legislation*

There are no specific legal requirements in the NEMA Act specific to the infringement of the visual attributes of the region. The National Heritage Resources Act No 25, 1999 requires that cultural sites and landscapes are protected against physical and aesthetic change.

Table 1: Impacts on the Visual Environment

Table 1.1 Braamhoek Substation		
Theme	Aesthetics	
Nature of impact	Visual Impacts	
Stage	Construction and Decommission	Operation
Extent of impact	Regional	Regional
Duration of impact	Short term	Long term
Intensity or severity	High	Medium
Probability of occurrence	Highly probable	Highly probable
Status of the impact	Negative	Negative
Legal Requirements	National Heritage Resources Act No 25, 1999	National Heritage Resources Act No 25, 1999
Accumulative Impact	Low	Medium
Level of significance	Medium to high	Medium to high
Mitigation measures	Rehabilitate all disturbed areas to minimise the visual scarring.	None
Level of significance after mitigation	Potentially medium to high	Potentially medium to high
EMP requirements	Yes – environmental rehabilitation	None
<u>Discussion:</u> The visual impact of the substation is medium to high negative even though the valley in which it is located and the backdrop of the escarpment help to screen it from the major critical viewpoints. The VAC is low to medium. The surrounding area is scenic and picturesque and would have a high ecotourism value. Mitigation measures are limited as the position of the site is fixed. However, this site (Zaaifontein) is preferred over the other two sites (Braamhoek East and West) as they are more visually exposed to the critical viewing points.		

7 RECOMMENDED GENERAL MITIGATION / MANAGEMENT MEASURES

7.1 Earthworks and Landscaping

The visual impact during construction will be moderately to highly significant and little can be done about reducing the effect since the works cannot be screened nor can they be moved to more visually suitable positions.

The mitigation measures for the substation during operation will need to focus on effective rehabilitation of the construction area. These specifications must be explicit and detailed and included in the contract documentation (Environmental Management Plan) so that the tasks can be costed and monitored for compliance and result.

The galvanising of the steelworks should be allowed to weather to a matt grey finish rather than be painted silver, as is often the case. This allows the structures to blend in with the existing environmental colours more readily than the silver which is highly reflective especially early morning and late afternoon. Should it be necessary to paint, it is recommended that a neutral matt finish be used.

Sculpturing or shaping the cut and fill slopes of platforms and access roads to angles and forms that are reflected in the adjacent landscape can reduce the visual impact. By blending the edges with the existing landforms the visual impression made, is that the project component has followed a natural route provided by the landscape, rather than been 'engineered' through the landscape.

Vegetation stripping should be done in a manner where the edges are organic (non-geometric) or curvilinear rather than straight or sharp edged as viewers tend to form positive visual impressions such as "gentleness" and "delicacy" and tend to object to negative visual impressions such as "rough", "rugged" or "violent" (Ribe, 1989). When disturbances in the landscape are viewed from a distance, those with irregular lines, rather than straight lines appear to blend in with the natural configuration and lines in the landscape (Schaefer, 1967).

It is essential that all cut and fill slopes, as well as all areas disturbed by construction activity, are suitably topsoiled and vegetated as soon as is possible after final shaping. The progressive rehabilitation measures will allow the maximum growth period before the completion of the project.

All areas affected by the construction works will need to be rehabilitated and re-vegetated. This includes the areas beyond the works area such as temporary access roads, construction campsites, workers campsites, borrow pits, laydown areas, etc.

The special conditions of contract must include for the stripping and stockpiling of topsoil from the construction areas for later re-use. Topsoil is considered to be at least the top 300 mm of the natural soil surface and includes grass, roots and organic matter. The areas to be cleared of topsoil should be all areas that will be covered by structures, roads and construction camps. The presence of degraded and disused roads and areas left over after development that are not rehabilitated, could present a high perceptual visual impact. These areas should be topsoiled and re-vegetated.

All existing large trees that fall outside the earthworks area must be retained. These will assist in softening the forms of the structures and obscure views to them.

Dust generated by construction activity and the haulage of materials and equipment will need to be suppressed by regular wetting.

The importance of suppressing the visual aspects of dust cannot be overstressed since the visibility will generate the impression of a polluting industry.

8 DISCUSSION

This study evaluated the visual impact of the Braamhoek Substation with a view to assessing its severity based on the author's experience, expert opinion and accepted techniques.

8.1 Evaluation

Table 2, Visual Assessment Criteria Ratings, rates each criteria from high, medium to low according to the specific characteristics of that criteria. Table 3 Site Evaluation, lists for each criteria the visual criteria rating and the visual impact of the component on these criteria,

The Eskom Braamhoek Substation will exert a negative influence on the visual environment. This is largely due to:

- Possible intermittent visibility of the project from elevated positions along the De Beers Pass;
- high visibility of construction and operation activity within large areas of uniform visual pattern from scenic areas such as De Beers Pass and surrounding farms;
- the low visual absorption capacity of the setting which is attributable to:
 - relatively undulating topography;
 - the low vegetation height (less than one metre); and
 - the lack of visual diversity.

The significance of the visual impact during construction is regarded as medium to high due to the construction activities. This is, however, of a short duration until the rehabilitation is complete.

The overall significance of the visual impact of the project during operation is regarded as remaining medium to high negative rather than moderate notwithstanding the implementation of the mitigation measures.

Table 2: Visual Assessment Criteria Ratings

CRITERIA	HIGH	MEDIUM	LOW
1. Visibility	Very visible from many places beyond 1000 metre zone	Visible from within the 1000 metre zone but partially obscured by intervening objects.	Only partly visible within the 1000 metre zone and beyond due to screening by intervening objects.
2. Genius Loci	A particularly definite place with an almost tangible dominant ambience or theme.	A place which projects a loosely defined theme or ambience.	A place having little or no ambience with which it can be associated.
3. Visual Quality	A very attractive setting with great variation and interest but no clutter.	A setting which has some aesthetic and visual merit.	A setting which has little aesthetic value.
4. Visible Social Structures	Housing and/or other structures as a dominant visual element.	Housing and/or other structures as a partial visual element.	Housing and/or other structures as a minor visual element.
5. Surrounding Landscape Compatibility	Cannot accommodate proposed development without it appearing totally out of place visually.	Can accommodate the proposed development without appearing totally out of place.	Ideally suits or matches the proposed development.
6. Character	The site or surrounding area exhibits a definite character.	The site or surrounding area exhibits some character.	The site or surrounding area exhibits little or no character.
7. Scale	A landscape which has horizontal and vertical elements in high contrast to the human scale.	A landscape with some horizontal and vertical elements in some contrast to the	Where vertical variation is limited and most elements are related to the human and

CRITERIA	HIGH	MEDIUM	LOW
		human scale.	horizontal scale.
8. Visual Absorption Capacity (VAC)	The ability of the landscape to easily accept visually a particular development because of its diverse landform, vegetation and texture.	The ability of the landscape to less easily accepts visually a particular development because of a less diverse landform, texture and vegetation.	The ability of the landscape not to visually accept a proposed development because of a uniform texture, flat slope and limited vegetation cover.
9. View Distance	If uninterrupted view distances to the site are > than 5 km.	If uninterrupted view distances are < 5 km but > 1 km.	If uninterrupted view distances are >500 m and < 1000 m.
10. Critical Views	Views of the project are to be seen by many people passing on main roads and from prominent areas i.e. towns / urban areas / settlements, game farms, guest farms / lodges, hiking routes.	Some views of the project from surrounding towns / urban areas / settlements, main roads and game farms / lodges.	Limited views to the project from towns / urban areas / settlements, main roads and game farms / lodges.

Table 3: Site Evaluation: Western Route

CHARACTERISTICS	VISUAL CRITERIA RATING	VISUAL IMPACT
1. Visibility	Medium	Medium
2. Genius Loci	High	High
3. Visual quality	High	High
4. Social structures	Low	Low
5. Surrounding landscape compatibility	High	High
6. Character	High	High
7. Scale	High	Medium
8. VAC	Low	Medium
9. View Distance	High to medium	Medium
10. Critical Views	Low	Medium

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