Visual Impact Assessment for Proposed De Wittekrans Open Cast Mine, Hendrina, Mpumalanga

Draft 0

PROPOSED DE WITTEKRANS OPEN CAST MINE, HENDRINA, MPUMALANGA

Specialist Study Report
VISUAL IMPACT ASSESSMENT

Submitted to:

GCS (Pty) Ltd

63 Wessel Road Woodmead

PO Box 2597 Rivonia 2128

South Africa

Tel: +27 (0)11 803 5726

Fax: +27 (0)11 803 5745

jhb@gcs-sa.biz

Prepared by:

Newtown Landscape Architects

PO Box 36

Fourways

2055

www.newla.co.za

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Prepared By:	Yonanda Martin
Reviewed By:	Liana Muller PrLArch
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GLOSSARY OF TERMS

Aesthetic Value

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Cumulative effects

The summation of effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseeable actions.

Landscape Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings and roads. They are generally quantifiable and can be easily described.

Landscape Impact

Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The landscape Institute 1996).

Sense of Place *(genius loci)*

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *Genius loci* literally means 'spirit of the place'.

Sensitive Receptors

Sensitivity of visual receptors (viewers) to a proposed development.

Viewshed analysis

The two dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.

Visibility

The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance.

Visual Exposure

Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.

Visual 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 Intrusion

The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.

Worst-case scenario

Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.

Zone of potential visual influence

By determining the zone of potential visual influence it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius about an object beyond which the visual impact of its most visible features will be insignificant due primarily due to distance.

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1.0 INTRODUCTION

1.1 Project Overview

Mashala Hendrina Coal (Pty) Ltd ("Mashala") has applied for a mining right in respect of coal reserves on Portions 5, 7, 10, 11, the remaining extents of Portions 1 and 2 of the farm De Wittekrans 218 IS, as well as the farms Groblershoop 192 IS, Israel 207 IS, Tweefontein 203 IS and the remaining extent of the farm Groblershoek 191 IS, in the Ermelo District, Mpumalanga . The total size of the proposed De Wittekrans operation is estimated at 3 193 ha in size. It is the intention of Mashala to develop both an opencast and underground coal mine on the above mentioned properties.

In terms of Section 39 (1) of the Mineral and Petroleum Resource Development Act (Act 28 of 2002) (MPRDA), Mashala is required to conduct an Environmental Impact Assessment (EIA) and submit an EIA Report and an Environmental Management Programme (EMP) to the Department of Minerals and Energy (DME), in respect of the development and operations of the proposed opencast and underground mine.

Newtown Landscape Architects (NLA) was appointed by *GCS (Pty) Ltd* to undertake a specialist study on the impact of the proposed De Wittekrans Open Cast Mine on the visual environment.

1.2 Proposed Area

The site is located on Portion 11(extent of Portion 10), Portion 5 & 7 and the Re of Portions 1 & 2 of the farm De Wittekrans 218 IS, the farm Tweefontein 203 IS, Re of the farm Groblershoek 191 IS, Re of the farm Israel 207 IS and the farm Groblershoop 192 IS, Hendrina, Mpumalanga. De Wittekrans forms part of Mashala Resources. The area of investigation for this study is located adjacent to the N11 national road and is approximately 10km southeast of the town of Hendrina. Refer to Figure 1: Locality. The proposed locality for the plant is currently not fixed and there are two alternatives. Both alternatives are situated on the farm Groblershoek with Alternative 1 to the east of Klein-Olifants River and Alternative 4 to the west of the river.

1.3 Aim of the Study

The aim of the Visual Impact Assessment Report (VIA) is to determine the aesthetic value of the visual resource (receiving environment) and to rate the visual impacts associated with the project on the visual environment. The report will also compare the two alternative sites for the proposed plant from a visual point of view.

1.4 Terms and Reference

A specialist study is required to assess the visual impacts arising from the proposed De Wittekrans Mining Project. Based on the general requirements for a comprehensive Visual Impact Assessment (VIA), the following terms of reference have been established:

- Visual Impact Assessment for the proposed De Wittekrans Mining Project.
- Description of the nature of the development and identification of the aspects associated with the project activities, which could have a visual impact;
- Assess visual issues associated with the physical presence of the De Wittekrans open cast mine, plant and discard;
- Assess the visual quality and the effect on the "sense of place" (determine the visual resource);
- Assess the visual impact of the proposed development;
- Assess site landscaping, restoration and rehabilitation that will be required;
- Recommendations for the management of the aspects to reduce their potential to cause visual impacts;
- Assess the impact of the aspects associated with the project activities on the assumption that the recommended aspect management will be implemented;
- Recommendations for mitigation of impacts, those that cannot be prevented by management aspects.

1.5 Concerns

The primary visual concern of the potential impact from the physical presence of the proposed project and related impacts on views to residents, tourists and people passing through the study area.

1.6 Assumptions

Due to uncertainties regarding the final layout and site location for the plant and discard, the following assumptions were made:

- In order to construct the simulations, it was assumed that the plant and discard are located on the small hill. This assumption was made to illustrate what the plant and discard will look like from the main farm road.
- It was also assumed that the layout was as per the illustration on the simulations.
- As the layout and exact location of the plant is not known, the viewshed were done by selecting the middle point of the proposed site for the plant.

2.0 APPROACH AND METHODOLOGY

2.1 Approach

The assessment of likely effects on a landscape resource and on visual amenity is 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)). When assessing visual impact the worst-case scenario is taken into account. Landscape and visual assessments are separate, although linked, procedures.

The landscape, its analysis and the assessment of impacts on the landscape all contribute to the baseline for visual impact assessment studies. The assessment of the potential impact on the landscape is carried out as an impact on an environmental resource, i.e. the physical landscape. Visual impacts, on the other hand, are assessed as one of the interrelated effects on people (i.e. the viewers and the impact of an introduced object into a particular view or scene).

2.1.1 The Visual Resource

Landscape character, landscape quality (Warnock, S. & Brown, N. 1998) and "sense of place" (Lynch, K. 1992) are used to evaluate the visual resource i.e. the receiving environment. A qualitative evaluation of the landscape is essentially a subjective matter. In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology. The criteria given in Appendix A are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

2.1.2 Landscape Impact

The landscape impact of a new development is measured as the change to the fabric, character and quality of the landscape caused by the physical presence of the new development. Identifying and describing the nature and intensity of change in the landscape brought about by the proposed new mine is based on the professional opinion of the author supported by photographic simulations. It is imperative to depict the change to the landscape in as realistic a manner as possible (Van Dortmont in Lange 1994). To do this, photographic panoramas were taken from key viewpoints and altered using computer simulation techniques to illustrate the physical nature of the proposed project in its final form within the context of the landscape setting. The resultant change to the landscape can then be observed and an assessment of visual intrusion made.

2.1.3 Visual Impact

Visual impacts are a subset of landscape impacts. 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?

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur in the absence of visual impacts, for instance where a development is wholly screened from available public views, but nonetheless results in a loss of landscape elements and landscape character within a localized area (the site and its immediate surrounds).

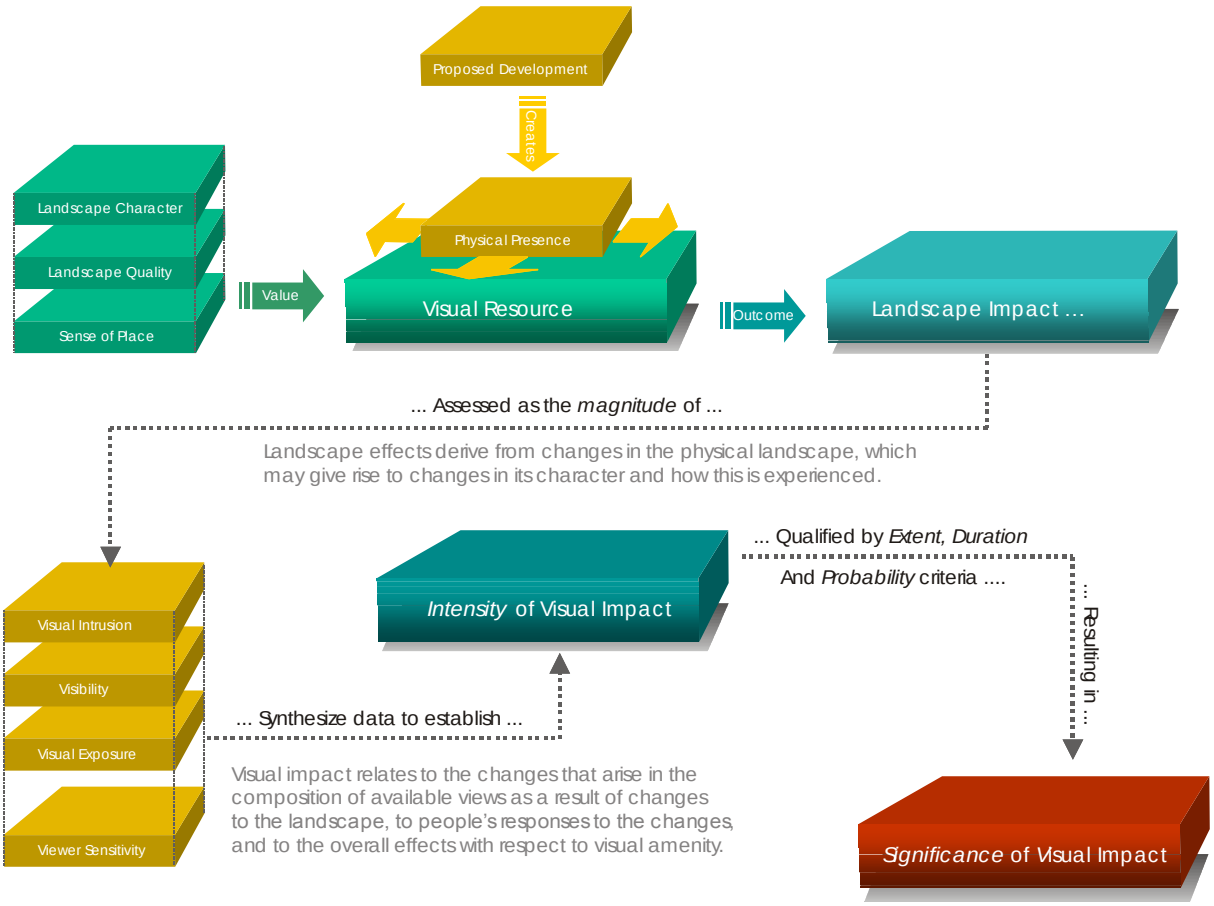
2.1.4 Intensity of Visual Impact

The intensity 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 intensity 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 mine upon views of the landscape through intrusion or obstruction;
- The reactions of viewers who may be affected.

For a detailed description of the methodology used in this study, refer to Appendices A. Image 1 graphically illustrates the visual impact process:

Image 1: Visual Impact Process



2.1.5 Significance of Visual Impact

The significance of impact was determined using a ranking scale, based on terminology from the Department of Environmental Affairs and Tourism's (DEAT) guideline document on EIA Regulations, April 1998. The following criteria are used:

Occurrence, based on

- Probability of occurrence (how likely is it that the impact may occur?), and
- Duration of occurrence (how long may it last).

Severity, based on

- Intensity of impact (will the impact be of High, Moderate or Low intensity?) and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?)

2.2 Methodology

To evaluate the impacts of the proposed development, the inherent scenic value of the landscape (visual resource) first needs to be determined. Data collected during a site visit (October 2008) allowed for a comprehensive description and valuation of the receiving environment. The full visual impact process is indicated in Image 1 above and will be employed in the full Visual Impact Assessment phase. The following method was used for the Scoping phase of the project:

- Site visit - one field survey was undertaken and the study area scrutinized to the extent that the receiving environment could be documented and adequately described;
- Project components - the physical characteristics of the project components were described and illustrated;
- General landscape characterization – Visual Resource (i.e. receiving environment) - was mapped using field survey and GIS mapping technology. The description of the landscape focused on the nature of the land rather than the response of a viewer (refer to Appendix 1);
- Describe and map the **landscape character** of the study area. The description of the landscape focussed on the nature and character of the landscape rather than the response of a viewer;
- Describe the **quality of the landscape**. Aesthetic appeal is described using recognized contemporary research in perceptual psychology as the basis;
- Describe the **sense of place** of the study area as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historic/current use of the land;
- Illustrate, in very basic **simulations**, the proposed project overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points to give the reviewer an idea of the scale and location of the proposed project within their landscape context;
- Determine precise visual intrusion (contrast) of the proposed project by simulating its physical appearance from sensitive viewing areas;
- Determine the visibility of the proposed project by conducting detailed viewshed analyses;
- **Rate the impact** on the visual environment and sense of place of the proposed mine based on a professional opinion and the method described below; and
- Suggest measures that could **mitigate** the negative impacts of the proposed mining project

3.0 DESCRIPTION OF THE PROJECT

Mashala Hendrina Coal (Pty) Ltd ("Mashala") has applied for a mining right in respect of coal reserves on Portions 5, 7, 10, 11, the remaining extents of Portions 1 and 2 of the farm De Wittekrans 218 IS, as well as the farms Groblershoop 192 IS, Israel 207 IS, Tweefontein 203 IS and the remaining extent of the farm Groblershoek 191 IS, in the Ermelo District, Mpumalanga . The total size of the proposed De Wittekrans operation is estimated at 3 193 ha in size. It is the intention of Mashala to develop both an opencast and underground coal mine on the above mentioned properties.

The life of mine for this resource at the planned mining rate is in excess of 30 years. The annual production rate is based on an average of approximately 320 000 tonnes per month.

The proposed De Wittekrans Mining Project will consist of the following components; refer to Figure 2, Visual Resource:

- Under Ground Mining Area
- Open Cast Mining Area
- Plant
- Discard
- Offices

4.0 THE ENVIRONMENTAL SETTING

4.1 The Site

The proposed site is located approximately 10km to the southeast of Hendrina, on both sides of the N11 national road towards Ermelo. The topography of the site is characterised by rolling grass plains and most of the adjacent properties as well as the proposed site are characterised by agricultural activities (crops and grazing fields) and can be characterised as a rural/ pastoral environment. The site to the north of the N11 will be open cast and underground mining. To the south of the N11 will be a combination of open cast and underground mining as well as the plant, discard and offices. Refer to Figure 4 - 15.

4.2 Surrounding Land Use

Refer to Figures 2, 4 - 15.

4.2.1 Residential

As mentioned previously, the proposed site is characterised by a rural / pastoral environment and the site is surrounded by farms to the north, east, south and west of the site. The farmsteads are scattered throughout the area. The closest residential area is the town of Hendrina, which is located approximately 10 km to the northwest of the site. There are two farmsteads located to the north of the alternative 1 & 4 sites as well as two farmsteads to the south of these sites.

4.2.2 Tourism

The N11 national road is one of the tourist routes travelled towards Swaziland, Mozambique and the northern coast of Kwa Zulu-Natal. During the site visit no tourist facilities were spotted in the area surrounding the site.

4.2.3 Business

Most businesses are located in the CBD of Hendrina. There are no other mining activities in the vicinity of the proposed site. The closest mine is approximately 12km to the northeast of the site.

4.2.4 Transportation systems

The N11 divides the proposed site in two sections and is currently the main access to the site. Other roads in the vicinity are the local farm roads, the R517 and R38. There is also a railway to the south of the De Wittekrans site.

4.3 Landscape character

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 maps, aerial photographs and information gathered on the site visit. Dominant landform/land use features (e.g., hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics, typically define landscape character types. Refer to the images on Figures 2, 4 – 15.

The proposed study site is characterised by rolling grass plains with some low hills and depressions with streams / rivers. The site mainly consists of three dominant natural landscape types: low hills, the Klein – Olifants River, and grassland areas. Three other types, mainly derived from man-made intervention, also occur within the study area. They are the agricultural areas, built-up areas (residences) and infrastructure (such as the N11, R517, the R38 and other farm roads). Figure 2: Visual Resources, illustrates the spatial distribution of the various landscape character types.

The proposed site is situated in a slight depression that extends from a hill north of the N11 to the hills south of the N11. The Klein-Olifants River runs through the proposed site. The open cast mining activities are located to the centre of the site and are located on both sides of the Klein-Olifants River. The underground mining is located towards the edges of the site (hills). The two proposed sites for the plant and discard are located to the south of the opencast area on two small hills, with the Klein-Olifants River running between the sites.

Most of the adjacent properties are farms with expansive grasslands and farmsteads scattered throughout these areas. There are two farmsteads located to the north and two located to the south of the proposed plants. The closest town is Hendrina. Other towns in the area include Breyton which is located 22km to the east of the site and Ermelo which is located approximately 40 km southeast of the site.

The vegetation of the proposed site is mostly Eastern Highveld Grassland with small patches of Soweto Highveld Grassland to the south of the site. The Eastern Highveld Grassland is characterized by slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grassland grass composition.

The Soweto Highveld Grassland has gently to moderately undulating landscapes on the Highveld plateau supporting short to medium-high, dense tufted grassland dominated almost entirely by *Themeda triandra*.

5.0 VISUAL RESOURCE

5.1 Criteria to value a visual resource

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response is usually to both visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value is more than the combined factors of the seen view, visual quality or scenery. It includes atmosphere, landscape character and sense of place (Schapper 1993). Refer also to Appendix A for further elaboration.

Studies for perceptual psychology have shown human preference for landscapes with higher visual complexity, for instance scenes with water or topographic interest. On the basis of contemporary research, landscape quality increases where:

- Topographic ruggedness and relative relief increase;
- Water forms are present;
- Diverse patterns of grassland and trees occur;
- Natural landscape increases and man-made landscape decreases;
- Where land use compatibility increases. (Crawford 1994)

Aesthetic appeal (value) is therefore considered **high** when the following are present (Ramsay 1993):

- Abstract qualities: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- Evocative responses: the ability of the landscape to evoke particularly strong responses in community members or visitors;
- Meanings: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- Landmark quality: a particular feature that stands out and is recognised by the broader community.

And conversely, it would be **low** where:

- Limited patterns of grasslands and trees occur;
- Natural landscape decreases and man-made landscape increases;
- And where land use compatibility decreases (after Crawford 1994).

5.2 Visual Resource Value / Scenic Quality

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

The landscape as described in Section 4.3 can be divided into basic landscape character types, each with its own set of physical, visual and aesthetic characteristics. The spatial distribution of these landscape types is illustrated in Figure 2: Visual Resources, and is a graphic illustration of the various elements contributing to the value of the visual resource. The diagram indicates the aesthetic quality and resultant landscape resource sensitivity.

Scenic quality ratings (using the scenic quality rating criteria described in Appendix A) were assigned to each of the landscape units defined in Figure 2. The *highest* value is assigned to the rolling grassland plains with its low hills and depressions. The Klein-Olifants River and associated streams are also rated high. The combination of these natural features, which is characteristic of these areas, and the farmsteads create a more natural and rural environment with a strong sense of place.

The landscape types with the lowest scenic quality rating are the infrastructure, the N11, R517 and the R38. The town of Hendrina also has a low scenic quality.

Based on the discussion in this section, the specialist experience of the author and the criteria in Appendix A, scenic quality values for the various landscape types within the study area ***high to moderate.*** This is due to the fact that landscape types with a high scenic quality (hills, grassland and river) are mixed with those with a lower quality (roads, residential areas) around the site and within the study area. This is tabulated in Table 1 below.

Table 1: Value of the Visual Resource - Scenic Quality
(after The Landscape Institute with the Institute of Environmental Management and Assessment (2002)

High Rolling grassland plains, rivers and streams	**Moderate** Farmsteads scattered throughout the site as well as the agricultural fields	**Low** Infrastructure. Hendrina
This landscape type is considered to have a *high* value because it is a: Distinct landscape that exhibits a very **positive character with valued features that combine to give the experience of unity, richness and harmony**. It is a landscape that may be considered to be of particular importance to conserve and which has a strong sense of place. It may be sensitive to change in general and may be detrimentally affected if change is inappropriately dealt with.	This landscape type is considered to have a *moderate* value because it is a: Common landscape that exhibits **some positive character but which has evidence of alteration /degradation/erosion of features** resulting in areas of more mixed character. It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with but change may not require special or particular attention to detail.	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features. Scope for positive enhancement could occur.

Sections that are placed in bold are applicable to the proposed mine.

5.3 Sensitivity of Visual Resource

The sensitivity of a landscape or visual resource is the degree to which a particular landscape type or area can accommodate change arising from a particular development, without detrimental effects on its character. Its determination is based upon an evaluation of each key element or characteristic of the landscape likely to be affected. The evaluation will reflect such factors such as its quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted (Institute of Environmental Assessment & The Landscape Institute, 1996:87).

Figure 2: Visuals Resources indicates all landscape elements evident within the study area. These landscape elements have been described in Section 5.2. The diagram is an attempt to rate the value of this visual resource, with rolling grasslands, rivers and streams constituting the highest value and infrastructural elements such as roads the lowest value. Subsequently, these landscape types present the highest sensitivity to change.

5.4 Sense of Place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. According to Lynch (1992), sense of place, “is the extent to

which a person can recognize or recall a place as being distinct from other places – as having a vivid, unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Because the sense of place of the study area is derived from the emotional, aesthetic and visual response to the environment, it cannot be experienced in isolation. The landscape context must be considered. With this in mind, the rolling grassland plains, rivers, streams, agricultural activities, roads, and residential activities contribute to the sense of place for the study area. It is these land-uses, which define the area and establish its identity.

The combination of the rolling grasslands, hills, rivers, streams, agricultural fields and the farmsteads scattered throughout the grasslands creates a more natural and rural environment which evoke a 'pastoral' sense of place.

6.0 VISUAL RECEPTORS

6.1 Views

As previously mentioned the proposed site has a roiling topography which plays a major role in the views towards the site. The hills to the east and southwest of the study area screen views from beyond them to the east and southwest. When driving along the N11 towards Ermelo, these hills also act as a screen for the proposed site. The hills towards the east of the site screen most of the views from the farmsteads, while the hills towards the southwest screen only a small percentage of the mining area. Due to the topography and the slight hills towards the north of the site, views from Hendrina are also screened. Although the topography screens some of the views from farmsteads, the western parts of the mining area features specific farmsteads that will have a clear views of the mining activities. This specifically refers to the farmsteads that area located around the proposed Alternative 1 and Alternative 4 Plant Sites. This is also relevant to the views from the farmstead located directly west of the Open Cast Site Offices.

When considering the views towards the two alternative plant sites it should be noted that although the two sites don't have the same viewers, both the sites can be seen from highly sensitive viewers. When selecting the proposed site it should be kept in mind that the proposed Alternative 4 Plant Site will have clear vies from the main farm road. The proposed Alternative 1 Plant Site is situated behind a hill and there are no clear views from the main farm road.

The N11 cuts through the proposed site, resulting in most of the potential views being directed towards the site. The views from the N11 only occur intermittently as the rolling topography of the area acts as a screen of the proposed site. Some of the local farm roads are incorporated into the mining area and views from these roads will be clear. Some of the surrounding farm roads are located on an elevated position, which has potential to offer clear views towards the proposed mining site.

6.2 Sensitive viewer locations

The sensitivity of visual receptors and views are dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;

- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);
- People travelling through or past the affected landscape in cars or other transport routes;
- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in their views (Institute of Environmental Assessment & The Landscape Institute (1996)).

Views from residences and tourist facilities / routes are typically more sensitive, since views from a residence or a tourist facility are considered to be frequent and of long duration.

Therefore, using these criteria, residences, especially the surrounding farmsteads, are regarded as highly sensitive viewpoints. The residences that are located close to the mining activities will be the most sensitive viewers. Other viewpoints, such as those from the N11 and the local roads dispersed throughout the study area, are considered moderately sensitive viewpoints.

6.3 Non sensitive visual receptors

Non sensitive visual receptors would typically be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in their views. At this stage there are no views that could be considered as non sensitive, as most of the views are from farmsteads and local farm roads. It should also be kept in mind that the proposed mine is the only one in this particular area and therefore intrusive to the proposed area. It is for this reason that most of the views towards the mine will be highly sensitive.

Table 2: Potential Sensitivity of Visual Receptors

High Views from farmsteads located close to the proposed plant areas and the open cast mining sites	**Moderate** Views from roads such as the N11 and local farm roads	**Low**
Users of all outdoor recreational facilities including public rights of way (tourist routes), whose intention or interest may be focused on the landscape; **Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;** **Occupiers of residential properties with views affected by the development.**	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value); **People travelling through or past the affected landscape in cars, on trains or other transport routes;**	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through urban and industrial areas

7.0 LANDSCAPE and VISUAL IMPACT

7.1 Landscape Impact

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of a development) of the proposed De Wittekrans Mining Project will be ***high*** as the physical impact of the construction and operation of the opencast mining, plant and discard will disturb a large percentage of the proposed study site. The main disturbance would be during the construction and operational phase, where clearance of the site and mining operations would take place.

However, as stated in the approach, the physical change to the landscape at the project site must be understood in visibility and aesthetic terms of the study area. The following sections discuss the effect that the proposed project will have on the visual and aesthetic environment.

7.2 Magnitude of Visual Impact

The magnitude of visual impact is determined using visibility, visual intrusion, visual exposure and viewer sensitivity criteria. When the intensity of impact is qualified with spatial, duration and probability criteria the significance of the impact can be predicted (refer to Appendix A).

7.2.1 Visual Intrusion

The landscape impact of the project is measured as the change to the fabric, character and quality of the landscape (visual resource) caused by the physical presence of the proposed new development. Visual intrusion is measured as the intensity of intrusion that the project will have on available views, specifically those from within sensitive or critical viewing areas.

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? As discussed in Section 4.3, the study area is characterised by the rolling grasslands and hills accompanied by rivers, streams and agricultural activities (crops and grazing fields). Farmsteads are scattered throughout this area. To the northwest of the site is the town of Hendrina.

The vegetation of the area is characterised by expansive grasslands, which is mainly used for grazing. Agricultural activities such as irrigated fields are also found within the study area. There are also groups of trees located around existing farmsteads. The rolling grasslands with the rivers and agricultural activities give the site a very rural and pastoral sense of place. The only manmade structures in this area are the roads and the power lines. It should also be kept in mind that the proposed mine is the only one in this particular area and therefore intrusive to the proposed area. It is

for this reason that most of the views towards the mine will be highly sensitive.

For the reasons mentioned above, the proposed mining project will have a ***high*** visual intrusion for the proposed area.

Taking the *worst case scenario* into account Table 3 rates and summarises the visual intrusion for the study area.

Table 3: Visual Intrusion

High	**Moderate**	**Low**	Positive
Because the proposed development: **- Has a substantial negative effect on the visual quality of the landscape;** **- Contrasts dramatically with the patterns or elements that define the structure of the immediate landscape;** - **Contrasts with land use, settlement or enclosure patterns of the immediate environment;** **- Cannot be 'absorbed' into the landscape from key viewing areas** *Result*: Notable change in landscape characteristics over an extensive area and**/or intensive change over a localized area resulting in major changes in key views (surrounding farmsteads).**	Because the proposed development: **-** Has a moderate negative effect on the visual quality of the landscape; - Contrasts 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 development: - 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 development: - 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.

Sections that are placed in bold are applicable to the proposed mine.

7.2.2 Visibility

In determining the visibility of the project, the worst-case scenario i.e. visibility of the project's features at a variety of heights and locations, was used. To do this, vantage points were assigned at offsets equivalent to the height above ground level of the proposed project. The 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was established at 7.5km. Over 7.5km the impact of the proposed open cast mine, plant and discard is insignificant due to the diminishing effect of distance and atmospheric conditions (haze) on visibility.

A viewshed analysis was undertaken from various vantage points around the proposed De Wittekrans mining area. The spatial pattern generated by the viewshed analysis is illustrated in Figure 21-25 and indicates areas from which the project potentially can be seen.

This analysis for the proposed Plant Site Alternative 4 indicates that the project will be highly visible from farmsteads directly next to the proposed site as well as from farmsteads that fall in the De Wittekrans site area. It will be potentially visible from approximately 45% of the 'zone of potential influence' as indicated in Figure 21. The project will not be visible from the far western and eastern parts as well as from low lying areas. This is due to the influence of the rolling topography that results in screened views from these areas. The proposed Alternative 4 Site will be visible from sections of the main farm road that runs along the western boundary of the site. If the proposed site is located exactly on the top of the hill it increases the visibility from the main farm road as well as adjacent farms. It is thus suggested that the plant be located on the lower parts of the eastern slope of the hill.

The analysis for the proposed Plant Site Alternative 1 indicates that the project will be highly visible from farmsteads directly next to the proposed site as well as from farmsteads that fall in the De Wittekrans site area. It will be potentially visible from approximately 40% of the 'zone of potential influence' as indicated in Figure 22. The proposed Alternative 1 Site will only be visible from small sections along the main farm road as the site is located on the other side of the Klein –Olifants River. The proposed Alternative 1 Site will be only be visible from parts of the surrounding areas as it is located in a valley or lower lying area. It is suggested that the plant be located in this area as the visibility from surrounding areas is significantly less than that of Plant Site Alternative 4. It should be kept in mind that if the plant is located on the hill it will be visible from more areas surrounding the site.

The analysis for the proposed discard dumps at both Alternatives sites indicates that the project will be highly visible from farmsteads directly next to the proposed sites. The visibility will be moderately to low for the rest of the farmsteads within the De Wittekrans mining areas and surrounding areas. The discards will be potentially visible from approximately 30% - 35 % of the 'zone of potential influence' as indicated in Figures 23 and 24. The proposed discard for Plant Site Alternative 4 will be less visible than that of Plant Site Alternative 1. This is mainly due to the topography of the area.

For the viewshed analysis for the proposed open cast areas the worst case scenario was used, whereby the rehabilitation is not necessarily implemented directly and more than one phase of the open cast mining will be visible. This is just to illustrate what the impact will be if no mitigation measures are implemented. As illustrated in Figure 25 the entire open cast area was used as part of the viewshed and vantage points were placed on the areas marked as dumps. From the analysis it is clear that the open cast mine will be highly visible from adjacent farmsteads and the N11. The open cast mine will be potentially visible from 60% of the 'zone of potential influence' as indicated by Figure

25. The open cast mining activities will not be visible from farmsteads located to the northeast to east and southwest of the site.

The potential visual impact of the development after sunset will be significant, for viewers that are located directly next to the proposed development (farmsteads) and for people travelling along the N11 and local farm roads. Light sources at night, particularly poorly directed security flood lighting, can influence the visual impact of a development. Unobstructed light sources can cause a general glow in the area and will be visible from significantly longer distances than any structural features during daylight hours.

Using the criteria in Table 3, visibility of the plants from the surrounding areas during the construction and operational phases will be ***moderate*** and visibility during the closure phase will become ***moderate to low*** after mitigation measures have been correctly adhered to according to this report.

Table 4: Visibility of the Plant
(This is for both Alternative 1 and Alternative 4)

High	Moderate	Low
If the proposed development is visible from over half the zone of potential influence, and/or views are mostly unobstructed.	**If the proposed development is visible from less than half the zone of potential influence within 1km, and/or views are partially obstructed.**	If the proposed development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed.
The proposed development is visible by most people travelling through the study area and views from sensitive viewing areas (public roads, residences and/or tourist facilities) are mostly open and unobstructed.	**The proposed development is visible by people travelling through the study area and a reduced number of views from sensitive viewing areas (public roads, residences and/or tourist facilities) are open and unobstructed.**	The proposed development is visible from the least number of people and views from sensitive viewing areas are mostly obstructed due to distance.

As indicated in the viewshed (Figure 23 & 24) visibility of the discards from the surrounding areas during the construction and operational phases will be ***low to moderate*** and visibility during the closure phase will become ***low*** after mitigation measures have been correctly adhered to according to this report. Refer to Table 5 below.

Table 5: Visibility of the Discard
(This is for both Alternative 1 and Alternative 4)

High	Moderate	Low
If the proposed development is visible from over half the zone of potential influence, and/or views are mostly	**If the proposed development is visible from less than half the zone of potential influence within 1km,**	If the proposed development is visible from less than a quarter of the zone of potential influence, and/**or views are mostly**

unobstructed. The proposed development is visible by most people travelling through the study area and views from sensitive viewing areas (public roads, residences and/or tourist facilities) are mostly open and unobstructed.	**and/or views are partially obstructed.** **The proposed development is visible by people travelling through the study area and a reduced number of views from sensitive viewing areas (public roads, residences and/or tourist facilities) are open and unobstructed.**	**obstructed**. **The proposed development is visible from the least number of people and views from sensitive viewing areas are mostly obstructed due to distance.**

Visibility of the open cast from the surrounding areas during the construction and operational phases will be ***high*** and visibility during the closure phase will become ***moderate to low*** after mitigation measures have been correctly adhered to according to this report. Refer to Table 6 below.

Table 6: Visibility of the Open cast mining area

High	Moderate	Low
If the proposed development is visible from over half the zone of potential influence, and/or views are mostly unobstructed.	If the proposed development is visible from less than half the zone of potential influence within 1km, and/or views are partially obstructed.	If the proposed development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed.
The proposed development is visible by most people travelling through the study area and views from sensitive viewing areas (public roads, residences and/or tourist facilities) are mostly open and unobstructed.	The proposed development is visible by people travelling through the study area and a reduced number of views from sensitive viewing areas (public roads, residences and/or tourist facilities) are open and unobstructed.	The proposed development is visible from the least number of people and views from sensitive viewing areas are mostly obstructed due to distance.

7.2.3 Visual Exposure

Visual exposure is rated using four increments of severity, each with their respective qualification and contribution to visual impact. The visual exposure curve in Figure 21-25 graphically illustrates these increments.

Table 7: Visual Exposure Ratings for the plant and discard
Effect specific to the project is given in **bold**

	High Exposure (significant contribution to visual impact)	**Moderate Exposure (moderate contribution to visual impact)**	Low Exposure (minimal influence on visual impact)	Insignificant Exposure (negligible influence on visual impact)
Surrounding Farmsteads and local farm roads	**0 – 1.5 km**	**1.5 – 4 km**	4 – 7.5 km	Over 7.5 km
Motorists on the N11	0 – 1.5 km	1.5 – 4 km	**4 – 7.5 km**	**Over 7.5 km**

In terms of visual exposure, when studying the viewshed analyses (Figure 21-24), it is clear that some of the sensitive viewer locations toward the plant and discard site are located less than 1.5 kilometres from the site. The rest of the sensitive viewers are located further than 1.5 kilometres from the plant and discard site. It should be noted that only a small percentage of the farmsteads are located within 1.5 kilometres of the site and the rest of the farmsteads are located further than 1.5 kilometres. Therefore, the proposed project would be in the immediate foreground for the farmsteads directly next to the site and from parts of the main farm road. This results in a ***moderate to high*** visual exposure for the plant and discards from farmsteads directly next to the site and a ***moderate to low*** visual exposure for the rest of the farmsteads.

Table 8: Visual Exposure Ratings for the open cast mining area
Effect specific to the project is given in **bold**

	High Exposure (significant contribution to visual impact)	**Moderate Exposure (moderate contribution to visual impact)**	Low Exposure (minimal influence on visual impact)	Insignificant Exposure (negligible influence on visual impact)
Surrounding Farmsteads and local farm roads	**0 – 1.5 km**	**1.5 – 4 km**	4 – 7.5 km	Over 7.5 km
Motorists on the N11	**0 – 1.5 km**	**1.5 – 4 km**	4 – 7.5 km	Over 7.5 km

In terms of visual exposure, when studying the viewshed analyses (Figure 25), it is clear that most of the sensitive viewer locations toward the open cast mine site are located less than 4 kilometres from the site and that most of the non sensitive viewer locations are located further than 4 kilometres from the site. Therefore, the proposed project would be in the immediate foreground for the farmsteads and viewers travelling along the main farm road and the N11. This results in a ***high to moderate*** visual exposure for the opencast mine from these viewing points.

7.2.4 Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity (visual receptors) criteria the significance of the visual impact of the proposed project can be determined. The sensitive visual receptors would include the residents from farms immediately adjacent to the proposed development, surrounding farm roads as well as other farmsteads in the area. For this reason sensitivity is rated **high**.

Table 9: Sensitivity of Receptors

High	Moderate	Low
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.

Given the criteria in Table 5, the sensitivity of viewers to change in the visual environment brought on by the physical presence of the project is ***high.***

7.2.5 Intensity of Visual Impact

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 6 and derived from the discussion in the preceding sections. These results are based on *worst-case scenarios* when the impact of all aspects is taken together.

According to the results tabulated below in Table 8 the *magnitude* of visual impact during the construction phase and operational phases for the plant and discard will be ***moderate to high*****,** while during the closure phase the visual impact will be ***low to moderate*** assuming that mitigation measures are successful.

The *magnitude* of visual impact during the construction phase and operational phases for the open cast will be ***moderate to high*****,** while during the closure phase the visual impact will be ***low to moderate*** assuming that mitigation measures are successful.

Table 10: Intensity of Impact for the Plant and Discard

	Quality of Visual Resource	Visual Intrusion	Visibility	Visual Exposure	Sensitivity	Visual Impact (Significance)
Prior to construction	***Moderate to High***					
Construction Phase & Operational Phase (Assuming mitigation is successful)		*High*	*Moderate*	*Moderate - High*	*High*	***Moderate to High***

Closure Phase (Assuming mitigation is successful)		*Moderate*	*Low - Moderate*	*Low - Moderate*	*Moderate*	***Low - Moderate***

According to the results tabulated in Table 9 below, the *magnitude* of visual impact during the construction phase and operational phases for the open cast will be ***moderate to high*****,** while during the closure phase the visual impact will be ***low to moderate*** assuming that mitigation measures are successful.

Table 11: Intensity of Impact for the Open Cast Mine

	Quality of Visual Resource	**Visual Intrusion**	**Visibility**	**Visual Exposure**	**Sensitivity**	**Visual Impact (Significance)**
Prior to construction	***Moderate to High***					
Construction Phase & Operational Phase (Assuming mitigation is successful)		*High*	*Moderate*	*Moderate - High*	*High*	***Moderate to High***
Closure Phase (Assuming mitigation is successful)		*Moderate*	*Low - Moderate*	*Low - Moderate*	*Moderate*	***Low - Moderate***

8.0 SIGNIFICANCE OF VISUAL IMPACT

The *magnitude* of impact, rated in Table 12 and Table 13, 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.

Table 12: Summary Table for Impact Assessment- De Wittekrans Plant and Discard

	Management	Extent	Duration	Probability	Intensity	Significance	Status	Confidence
Construction & Operational Phase	Without Mitigation	2	5	3	2	**12 Moderate to High**	Negative	High
	With Mitigation	1	5	1	1	**8 Moderate**	Negative	High
Closure Phase	Without Mitigation	2	3	3	2	**10 Moderate**	Negative	High
	With Mitigation	1	3	1	1	**6 Low to Moderate**	Positive	High

Note: * This prediction assumes all mitigating measures implemented and are effectively managed at all times.

Table 13: Summary Table for Impact Assessment- De Wittekrans Open Cast Mining

	Management	Extent	Duration	Probability	Intensity	Significance	Status	Confidence
Construction & Operational Phase	Without Mitigation	2	5	3	2	**12 Moderate to High**	Negative	High
	With Mitigation	1	3	1	1	**6 Low to Moderate**	Negative	High
Closure Phase	Without Mitigation	2	3	3	2	**10 Moderate**	Negative	High
	With Mitigation	1	2	1	1	**5 Low to Moderate**	Positive	High

Note: * This prediction assumes all mitigating measures implemented and are effectively managed at all times.

9.0 MITIGATING MEASURES

In considering mitigating measures there are three rules that were considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been considered:

- Mitigation measures should be designed to suite the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

Mitigation measures would be feasible and effective in reducing the visual impact on some residential views from adjacent farmsteads and local farm roads. It is proposed that the following actions be implemented:

9.1 Site Development

- The minimum amount of existing vegetation and topsoil should be removed. Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the site rehabilitation.

9.2 Earthworks

- Dust suppression techniques should be in place at all times during the construction and operational phases.
- Only the footprint and a small 'construction buffer zone' around the proposed development should be exposed. In all other areas, the natural vegetation, more importantly the indigenous vegetation should be retained.
- All topsoil and subsoil should be placed along the northern, eastern and western edges of the property to act as visual screens. The bulk of the sub– and topsoil should therefore be distributed amongst these structures and not concentrated in a singular structure. These berms are to be landscaped as described in Section 9.3 below.

9.3 Landscaping

- Natural vegetation should be retained wherever possible and any removal of vegetation should be conducted as described in 9.1.

- The north, east and western edges of the property should be extensively landscaped around and on the berms as proposed in Section 9.2 to create a visual buffer. The vegetation could be used to screen nearby views toward the open cast mine, plant and discard.

- An ecological approach to rehabilitation and vegetative screening measures, as opposed a horticultural approach to landscaping should be adopted. For example communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. This ecological approach to landscaping costs significantly less to maintain than conventional landscaping methods and is more sustainable. A registered landscape architect should be consulted for this purpose.

9.4 Access Roads

- During construction of the development, access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface.

9.5 Lighting

Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances. Security and aesthetic flood lighting should only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas. Wherever possible, lights should be directed downwards so as to avoid illuminating the sky.

The negative impact night lighting, glare and spotlight effects, can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the complex – this is especially relevant where the edge of the complex is exposed to residential properties.

- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement at illegal entry to the site.

- Use security lighting at the periphery of the site that is activated by movement and are not permanently kept on.

10.0 CONCLUSION

Visual impacts would result from the construction, operation and closure phase of the proposed De Wittekrans Mining Project. Specifically, impacts would result from the open cast mining and associated dumps together with the plant and discard being seen from sensitive viewpoints (I.e. impacts of views from residences) and the negative effects (relating primarily to visibility and intrusion) on the scenic quality and sense of place of the landscape of the proposed site.

Impacts to some sensitive sites are rated high because these views are from the farmsteads directly adjacent to the open cast mining areas, the plant, discard and from local farm roads. From the viewsheds (Figure 21-25) it is clear that the proposed open cast mining area will be highly visible from adjacent farmsteads and people travelling along the N11. The high visibility could however be reduced by implementing the correct mitigation measures. The visual impact of the open cast mining area will also be reduced if the mine rehabilitates areas that have already been mined.

The impact of the plant and discard at the two Plant Site Alternatives will be moderate to high. Farmsteads located directly next to the proposed sites will have relatively clear views. The plant and discard will also be visible from sections of the main farm road. The topography of the area does however play a major role in screening the plant and discard. This is clear when viewing the viewshed (Figures 21-24) and the simulations (Figure 19 & 20). It should be noted that according to the viewshed analysis Plant Site Alternative 4 will be more visible than Plant Site Alternative 1 whereas Alternative 4 Discard will be less visible than that of Alternative 1. It is advised that the plant and discard not be located directly on a hill as it will increase the visibility but that the plant and discard rather be located against the hill slope away from farmsteads and motorist travelling along the main farm road.

It should also be kept in mind that the plant and discard will not entirely be screened by the topography and that mitigation measures should be followed to insure that the visual impact is reduced.

It was determined that the intensity of the visual impact of the proposed De Wittekrans project would be ***MODERATE*** to ***HIGH*** and that the significance of this impact would be ***MODERATE TO HIGH NEGATIVE.*** With successful mitigating measures the significance can be reduced to ***MODERATE***.

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Appendix A:

DETERMINING A LANDSCAPE AND THE VALUE OF THE VISUAL RESOURCE

In order to reach an understanding of the effect of development on a landscape resource, it is necessary to consider the different aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of pattern, resulting from particular combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape is a reflection of the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors;
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognize or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through

the cognitive experience of the user or viewer. In some cases these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, “beauty is in the eye of the beholder,” is often quoted to emphasize the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual complexity particularly in scenes with water, over homogeneous areas. On the basis of contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase;
- Where water forms are present;
- Where diverse patterns of grasslands and trees occur;
- Where natural landscape increases and man-made landscape decreases;
- And where land use compatibility increases and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain badlands, pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally

applied to units which would normally rate very low in score, but he influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart
(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	**Rating Criteria and Score**	.	.
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. **5**	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Flowing, or still, but not dominant in the landscape. **3**	Absent, or present, but not noticeable. **0**
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas *** 5+**	Distinctive, though somewhat similar to others within the region. **3**	Interesting within its setting, but fairly common within the region. **1**

Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony. **2**	Modifications add little or no visual variety to the area, and introduce no discordant elements. **0**	Modifications add variety but are very discordant and promote strong disharmony. **-4**

Scenic Quality (i.e. value of the visual resource)
In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource – expressed as Scenic Quality
(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	Moderate	Low
Areas that exhibit a very positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again change may be detrimental if inappropriately dealt with but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

Appendix B

METHOD FOR DETERMINING THE MAGNITUDE (Intensity) OF LANDSCAPE AND VISUAL IMPACT

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the project.

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 Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. 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 Impact

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 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 or contrast (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/contrast

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? Or conversely what is its contrast with the receiving environment. Combining landform/vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform/vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) 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/contrast 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

High	**Moderate**	**Low**	**Positive**
If the project: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns; - Is unable to be 'absorbed' into the landscape.	If the project: - 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, settlement or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the project: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns. - Is 'absorbed' into the landscape.	If the project: - 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 Notable change in landscape characteristics over an extensive area and/or intensive change over a localized area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, 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

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential 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 in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

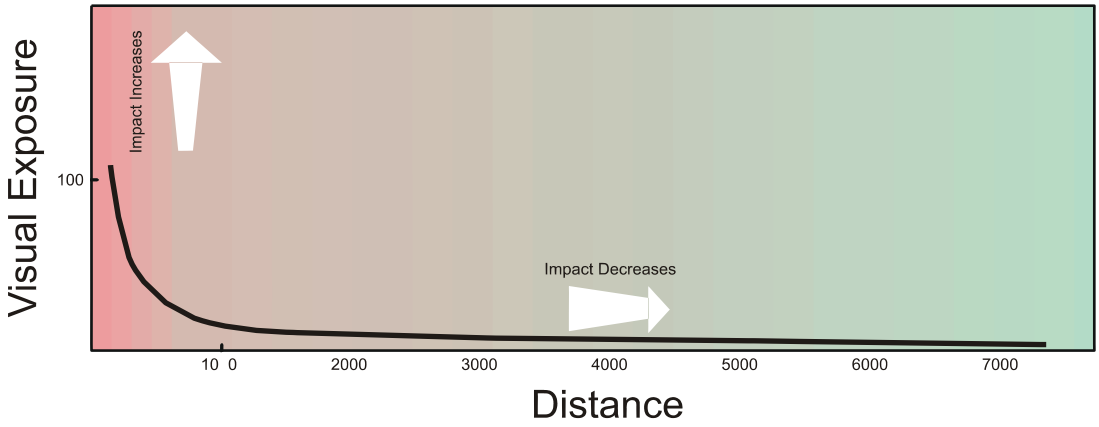
Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

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.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint;
- The expectations and occupation or activity of the receptor;
- The importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or

interest may be focused on the landscape;

- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;
- Occupiers of residential properties with views affected by the development.
- These would all be high (5)

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value); (3)
- People travelling through or past the affected landscape in cars, on trains or other transport routes; (0)
- People at their place of work. (0)

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High (5)	Moderate (3)	Low (0)
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Occupiers of residential properties with views affected by the development.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value); People travelling through or past the affected landscape in cars, on trains or other transport routes;	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through urban and industrial areas

Magnitude (Intensity) of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape,

resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. 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 parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground views.

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 and The landscape Institute (1996)).

Magnitude (Intensity) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	Partial loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the	Minor loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view an/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	Very minor loss or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.

High scenic quality impacts would result.	receiving landscape. Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

Appendix C

CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT

a) Extent

Whether the impact will occur on a scale limited to the site, local/sub-regional, or will occur at a national or international scale.

Category	Rating	Description
Site	1	Immediate project site
Local	2	Up to 5 km from the project site
Regional	3	20 km radius from the project site
Provincial	4	Provincial
National	5	South African
International	6	Neighbouring countries/overseas

b) Duration

Category	Rating	Description
Very short-term	1	Less than 1 year
Short-term	2	1 to 5 years
Medium-term	3	5 to 10 years
Long-term	4	10 to 15 years
Very long-term	5	Greater than 15 years
Permanent	6	Permanent

c) Probability of occurrence

Category	Rating	Description
Definite	3	More than 90 percent sure of a particular fact or of the likelihood of that impact occurring
Probable	2	70 to 90 percent sure of a particular fact or of the likelihood of that impact occurring
Possible	1	40 to 70 percent sure of a particular fact or of the likelihood of that impact occurring
Improbable	0	Less than 40 percent sure of a particular fact or of the likelihood of that impact occurring

d) Intensity

Category	Rating	Description

Category	Rating	Description
Very low	0	Where the impact affects the environment in such a way that natural, cultural and social functions are not affected
Low	1	Where the impact affects the environment in such a way that natural, cultural and social functions are only marginally affected
Medium	2	Where the affected environment is altered but natural, cultural and social function and processes continue albeit in a modified way
High	3	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily cease
Very high	4	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease

e) Significance

The significance of impacts of the Ferreira Mining project are assessed both with and without mitigation action and for each project phase viz. construction and operation. The significance of the identified impacts on the affected environment are described as:

Score	Significance Rating
2 – 4	Low
5 – 7	Low to Moderate
8 – 10	Moderate
11 - 13	Moderate to High
14 – 16	High
17 – 19	Very High

f) Status of the Impact

This describes whether the impact is positive (a benefit), negative (a cost), or neutral.

g) Scale of Confidence Level

The degree of confidence in the predictions, based on the availability of information and specialist knowledge stated as:

- no confidence;
- low confidence;
- reasonable confidence;
- high confidence;
- total confidence.

Appendix D

CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterize the nature and magnitude of visual intrusion of the proposed project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness: A simulation should represent important and typical views of a project.
Accuracy: The similarity between a simulation and the reality after the project has been realized.
Visual clarity: Detail, parts and overall contents have to be clearly recognizable.
Interest: A simulation should hold the attention of the viewer.
Legitimacy: A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect/designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

Appendix E

VIEWSHED ANALYSIS

A Digital Terrain Model (DTM) was created by capturing current and most up to date topographic and land use data in digital format. Using the DTM, the programme performs a viewshed analysis on the lattice surface (a fine grid of cells extending over the entire study area). Each cell has stored information relating to x, y (plan) and z (height) co-ordinates. It computes a line of sight analysis across the current lattice from a selected vantage point in a 360 degree arc to define the area from which a vantage point may be seen.

Appendix F
CURRICULUM VITAE OF AUTHORS

Since 1994

Liana Müller PrLArch
PO Box 36, Fourways, 2055
Tel: 27 11 462 6967
Cell: 082 776 4645
Fax: 27 11 462-9284
www.newla.co.za mulliana@gmail.com

Liana is a landscape architect with seven years experience. She has mainly worked in South Africa and has valuable expertise in the practice of landscape architecture, cultural and historic landscapes and environmental planning. She is also a full time lecturer, teaching Design and History of the Environment at first and second year level. She currently specializes in Visual Impact Assessments.

EXPERIENCE:

Present: *Consultant*: **NEWTOWN LANDSCAPE ARCHITECTS cc.**
2004 – 2008 Visual Impact Assessments for Residential Estates, Water Reservoirs, extensive Power Lines and Substations & various Mines and Quarries.
Developed a Conservation Management Plan for the Union Buildings Estate. Responsible for Heritage Audit of the Estate, including research into history and layout of the gardens. Included a Heritage Management Plan for the Estate.

2004 – 2008 *Consultant:* **CULTMATRIX cc.**
Responsible for the archival research and database development of all buildings, design and movables contained within significant historical governmental residences and estates.

2005 – 2008 *Lecturer:* **UNIVERSITY OF PRETORIA**
First Year Design
History of the Environment 224 & 210
Act as external examiner during final year design examinations
Act as external examiner for History of the Environment 120

2004 – 2006 *Consultant:* **ECOCONSULT cc.**
Assist in developing Rehabilitation and Management Plans for granite quarries north of Pretoria and Sekukuneland. Extensive archaeological sites were found on sites and had to be incorporated in end use plans.
Visual Impact Assessments for Townships and Tourist Developments.

2002 – 2005 *Consultant:* **STRATEGIC ENVIRONMENTAL FOCUS cc.**
Responsible for Phase 3b of the North West Biodiversity Site Inventory and Database Development. This included the research and assessment of all socially important Floral and Faunal Species in the North West Province.

Various heritage studies and assessments, including sites in Soweto, Groot Marico and around Tshwane.
Visual Impact Assessments for Residential Estates, Outdoor Signage, Road Network upgrade around Menlyn Shopping Centre & N1 Highway upgrade.
Production of landscape designs for various projects, most notably Blue IQ developments such as the Automotive Supplier Park. This also included all construction documentation and site supervision.

2000 – 2002 *Consultant:* **ENVIRONMENTAL POTENTIAL ATLAS OF SOUTH AFRICA**
Responsible for researching Cultural and Historical Heritage Sites in Pondoland in the Eastern Cape. This comprised of desktop surveys of existing information and intensive fieldwork for capturing sites according to Section 3 of the National Heritage Resources Act No. 25 of 1999. The information was then captured in the ENPAT GIS Database.
Produced promotional posters promoting the Cultural Heritage Databases of Enpat.

1999 – 2002 *Landscape Assistant:* **ATLAND LANDSCAPE ARCHITECTS**
Responsible for cultural and historical research on a number of projects, the most prominent the development of the Gongola Conservancy in the Natal Midlands.
Master plan and Sketch plan designs for the Gongola Conservancy. Tasks included the conceptual and detail development of different themed camps within the conservancy, drawing from the heritage research completed.
Assisted with the compilation of Environmental Impact Assessments and Environmental Management Plans.

1999 – 2002 *Landscape Assistant:* **NEWTOWN LANDSCAPE ARCHITECTS cc.**
Hardscape design, including the development of the National Union of Mineworkers Memorial Garden at their head office in Johannesburg.
General Project administration and documentation including Bill of Quantities and Plant Lists.
Responsible for all rendering and presentation drawings for Promotional purposes

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2006);
Board Member – Tshwane Building Heritage Association (2005 – 2007)
Member - Van Riebeek Society
Member - South African Archaeological Society
Member - Wildlife and Environment Society of South Africa

EDUCATION:

Bachelor of Landscape Architecture, 2000, (BLArch), University of Pretoria.
Currently completing Masters Degree in Anthropology: Cultural Heritage Conservation Thesis: *The Cultural Heritage of the Mpondo of Kwa Bhala, Pondoland in relation to the Natural Landscape*. University of South Africa.
Part-Time Lecturer - Department of Architecture, University of Pretoria.

Since 1994

Yonanda Martin M.Env.Sci.

Tel: 27 11
462 6967
Fax: 27 11 462-9284
www.newla.co.za yonanda@newla.co.za

B.Sc Degree in Environmental Science from the University of North West, Potchefstroom Campus (2003). M.Sc Degree in Ecological Remediation and Sustainable Utilization from the University of North West, Potchefstroom Campus (2007). She is currently employed by Newtown Landscape Architects working on the following projects.

EXPERIENCE:

Environmentalist: Newtown Landscape Architects

Responsible for the environmental work, which includes Basic Assessments, Environmental Impact Assessments (Scoping & EIA), Environmental Management Plans (EMP), Environmental Auditing as well as Visual Impact Assessments.

Current Projects:

- **Orchards Extension 49-53,** Pretoria - Environmental Impact Assessment and Environmental Management Plan
- **Tanganani Ext 8,** Johannesburg - Environmental Impact Assessment and Environmental Management Plan
- **Tanganani,** Diepsloot **-** Environmental Impact Assessment and Environmental Management Plan
- **Klerksoord Ext 25 & 26,** Pretoria – Environmental Impact Assessment
- **Ennerdale Ext 16,** Johannesburg - Environmental Impact Assessment and Environmental Management Plan
- **Glen Marais Ext 102 & 103,** Kempton Park - Basic Assessment and Environmental Management Plan
- **Lady Selbourne,** Pretoria - Environmental Impact Assessment
- **Rand Uranium** (Golder Associates Africa (Pty) Ltd), Randfontein – VIA
- **Dorsfontein West Expansion** (GCS (Pty) Ltd), Kriel – VIA
- **Mine Waste Solutions** (GCS (Pty) Ltd), Stilfontein – VIA
- **Ferreira Coal Mining** (GCS (Pty) Ltd), Ermelo – VIA
- **De Wittekrans Mining** (GCS (Pty) Ltd), Hendrina - VIA

EDUCATION:

May 2009	Public Participation Course, International Association for Public Participation, Golder Midrand
May 2008	Wetland Training Course on Delineation, Legislation and Rehabilitation, University of Pretoria.
April 2008	Environmental Impact Assessment: NEMA Regulations – A practical approach, Centre for Environmental Management: University of North West.
Feb 2008	Effective Business Writing Skills, ISIMBI
Oct 2007	Short course in Geographic Information Systems (GIS), Planet GIS
Jan 2004 – April 2007	M.Sc Degree in Ecological Remediation and Sustainable Utilization, University of North West, Potchefstroom Campus. Thesis: Tree vitality along the urbanization gradient in Potchefstroom, South Africa.
Jan 2001 – Dec 2003	B.Sc Degree in Environmental Science, University of Potchefstroom