Visual Impact Assessment Report

Impala Platinum Proposed Shaft 18

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PROPOSED IMPALA PLATINUM SHAFT 18, BOJANALA PLATINUM DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

Specialist Study Report
VISUAL IMPACT ASSESSMENT

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Project No:	1336/E11NW
Report Revision No:	Rev 02
Date Issued:	September 2013
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Reference:	Impala Shafts 18

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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). Aesthetic value is always discussed within the context of the region.

Aesthetically significant place

A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (after New York, Department of Environment 2000).

Aesthetic impact

Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by virtue of its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).

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's 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 around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

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EXECUTIVE SUMMARY

Approach adopted for the study

Landscape character, landscape quality and “sense of place” were used to rate the value of the visual resource of the study area (receiving environment). The extent to which the proposed project will affect views in the study area was determined i.e. the visual impact. The severity of the visual impact was rated using visibility, visual intrusion, visual exposure, sense of place and sensitivity criteria. The significance of impact was then determined using a ranking scale based on the Hacking method and criteria.

Findings

The proposed Impala No. 18 Shaft Complex will *definitely* exert a negative on the visual environment.

During the construction and operational phases the significance of the impact on the future Welbekend Heritage Area, the communities as well as sections of the roads through the study area will be *moderate* when worst case scenarios are considered.

During the closure phases the rating would drop to *low* should all mitigation measures be implemented successfully and effectively.

Support infrastructure including power and pipe lines running parallel to roads connecting the proposed shaft complex to the existing shafts 17, 14 and 11 complexes as well as traffic along these connection and access roads, would all add cumulatively to the negative visual impact from the existing shaft complexes as well as the negative visual impact that would arise from the proposed intervention.

Mitigation measures are proposed, which primarily relate to ‘good housekeeping’, during all phases of the project but due to the scale and nature of the activities, the significance of impact rating will not reduce significantly for most of the visual receptors.

NLA

1.0 INTRODUCTION

1.1 Project

Impala Platinum Limited (Impala) is proposing an additional Vertical Shaft Complex, Shaft 18 (here after referred to as 'the project'). The project is located within Impala's converted mining rights area at its Rustenburg operations. This mining rights area falls within the Rustenburg Local Municipality and the Bojanala Platinum District Municipality in the North West Province. Metago Environmental Engineers have been appointed as the lead Environmental Consultant for this project. As part of the Environmental Impact Assessment process, the visual impact of the proposed shafts needs to be addressed. Newtown Landscape Architects (NLA) have been appointed by Metago to undertake a specialist study on the impact of the proposed project on the visual environment. Refer to Figure 1 'Locality'.

1.2 Description of the Project Components

The main aim of the proposed project is to replace production from older shafts that are reaching the end of their life. Surface infrastructure for the shaft complex will include: the establishment of a new vertical shaft complex (No. 18 Shaft), associated linear infrastructure, central STP, underground mining section, residue facility, water management facilities, various other support infrastructure and services, new sewage treatment plant/s and tailings plants for preparation of tailings for use as support, ventilation barriers at the No 17 and 18 Shafts as well as linear infrastructure between No. 17 Shaft and No. 18 Shaft. The new sewage treatment plant/s are required to provide sewage treatment capacity in this section of the Impala converted mining rights (CMR) area as well as to ensure a supply of grey water to be used for mining, instead of valuable potable water.

The bulk of construction activities to enable building up to full production are estimated at ten years, commencing mid June 2015, pending the EIA authorization process. The Life of the Mine will be approximately 25 – 35 years. Typical operating times will be 06h00 – 16h00 and 22h00 – 06h00. Continuous operations would be possible once steady state mining has been reached. With regards to closure, topsoil will be stripped in the areas designated for surface infrastructure. The topsoil will be stockpiled and used in rehabilitation after closure. Overburden from the development of the shaft and underground mine areas will be disposed of to a mine residue facility. The backfilling of mine residue into mine voids will assist with more effective ventilation and safer mining. The shaft will be sealed with an engineered reinforced concrete plug after backfilling. Only the waste rock dumps will remain as the surface area will be leveled and re-vegetated as required.

1.3 Terms and Reference / Scope of Work

Based on the general requirements for a comprehensive Visual Impact Assessment (VIA), the following scope of work had been established:

- Conduct a field survey to study the area to the extent that the extent of the receiving environment can be documented and adequately described.

- Describe the visual resource (i.e. receiving environment).
- Describe and map the landscape character of the study area. The description of the landscape will focus 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 the proposed intrusion of the project by overlaying the project 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 components within its landscape context.
- Rate the impact on the visual environment and sense of place of the proposed project based on accepted international criteria and the method described below and in Appendix C.
- Suggest mitigation measures that could mitigate the negative impacts of the proposed project.
- Produce a report outlining the findings.

Refer to Item 2 'Approach & Methodology' for a detailed description of the above mentioned process.

1.4 Aim of the Study

The main aim of the study is to ensure that the visual consequences of the proposed project are understood and adequately considered in the planning process. The objectives of the study are:

- To define the visual resource and sense of place of the study area;
- To identify the sensitive receptors / lines of site;
- To determine and rate the visual impact;
- To simulate the key proposed infrastructure components against the visual baseline;
- To assess the cumulative visual impact; and
- To provide input, together with Metago and other specialists into visual management measures to minimize negative visual impacts.

2.0 APPROACH & METHODOLOGY

A field survey was undertaken on 20 June 2011 and the area scrutinized. Sensitive viewing areas were visited and photographs taken from these areas towards the proposed shafts. The study area is defined as a 12.5 km radius about the proposed project site (Refer to Figure 4). Beyond this distance the proposed shafts would be 'absorbed' into the landscape setting and would therefore have an insignificant impact on sensitive views.

Landscape character, landscape quality and sense of place were used to evaluate the *visual resource*. A qualitative evaluation of the landscape is essentially a subjective matter. In this study the evaluation is determined using the criteria discussed in Appendix B and the professional opinion of the author.

The *landscape impact* of the proposed shafts project was measured as the change to the fabric and character and of the landscape caused by the physical presence of the tailings dam.

Visual impacts are a subset of landscape impacts. They relate solely to changes in available views of the landscape, and the effects of those changes on people. The severity of that change (i.e. *visual impact*) is the degree to which the change compromises, enhances or maintains the visual quality of a particular area.

Visual impact is determined using *visual intrusion*, *visibility* and *visual exposure* criteria and is concerned with:

- The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- The overall impact on visual amenity, which can range from degradation through to enhancement;

To arrive at a significance rating the severity of impact is qualified with spatial, duration and probability criteria (refer to Appendix C). The visual impact process is graphically illustrated in the diagram below.

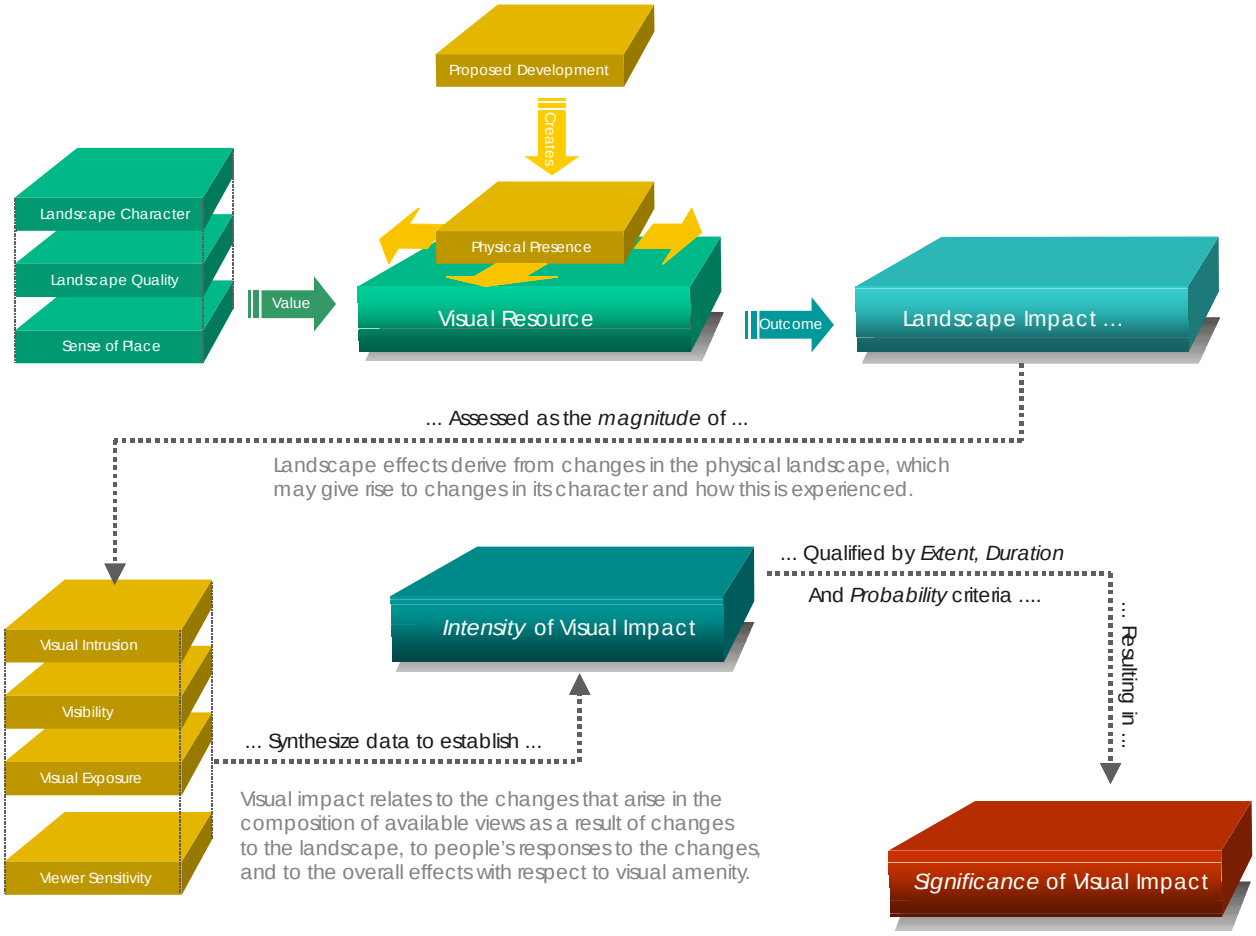

Diagram 1: Visual Impact Process

3.0 VISUAL RESOURCE DESCRIPTION

3.1 Landscape Character

The study area is situated in an area of gently undulating plains at an average altitude of 1 130 metres above mean sea level (mamsl). The topography in the study area is mostly flat, gently sloping to the drainage lines, which eventually feed the Elands River system. Hills, rising up to 250m above the plain, occur along the eastern edge of the study area (refer to Figures 5 to 9).

As a result of Impala's mining activities, the natural vegetation in the mine lease has generally been disturbed and fragmented. The proposed shaft is primarily situated in the Marikana thornveld. The divide between Marikana and Zeerust thornveld occurs mostly along the eastern edge of the study area and is characterised by open to dense short thorny woodland dominated by Acacia species with a grassy herbaceous layer. The hills tend to have a denser cover with rocky outcrops prevalent. Tall shrubs can also be found on the hills along with a dense grass cover.

Current land use within the study area comprises settlements in the east (Serube, Mafika and Kanana) and western portions of the site (Luka North and Luka South) and Freedom Park in the south (refer to Figure 10). The western section of the study area is dominated by Impala's existing mining activities as is illustrated in Figures 2 and 5 to 9.

3.2 Sense of Place and Aesthetic Value

Landscapes with greater diversity or containing "distinctive" features are classified as having a higher scenic value than landscapes with low diversity, few distinctive features, or more "common" elements. Generally, the greater the diversity of form, line, texture, and colour in a landscape unit or area, the greater the potential for high scenic value. Scenic quality classifications are:

- High - distinctive landscape often with a strong sense of place
- Moderate - common landscape
- Low - minimal landscape often with a weak sense of place

'Land types' each with its dominant landscape characteristic, sense of place and aesthetic value within the study area had been identified as follows. Land types with a *low* scenic quality classification include roads, railways, power infrastructure, towns / townships / built up areas and mining areas. A *moderate* rating was assigned to the grasslands and agricultural fields and land types with a *high* scenic quality included Pilanesberg Nature Reserve, the 'Welbekend' heritage area, natural hills and koppies as well as rivers, water courses, wetlands, and water bodies in the study area. These land types are mapped in Figure 10.

It is difficult to separate out the aesthetic value of a landscape into its component parts, yet an attempt is made

here. Using the criteria and values defined in Appendix C along with the discussion on landscape character, the overall visual quality of the study area is rated from low (western section) to high (eastern section), within the context of the sub-region.

The western section of the study area leaves an overriding impression (sense of place) of a flat and relatively featureless natural landscape, dominated by mining, utility and township land uses. These areas are considered to have a low visual quality i.e. the landscape generally is negative in character with few, if any, valued features. Scope for positive enhancement could occur. The proposed Impala No. 18 Shaft project occurs within this landscape type.

The hills and koppies, which occur along the eastern side of the site create a contained, complex yet coherent spatial dimension, which invites the visitor into a scene dominated by these natural edges and which add 'wildness' to the scene. These factors combine to evoke a strong emotional response in the visitor, created by a landscape that is somewhat unique and has a distinct character of its own. This landscape type has a visual quality that is rated high i.e. a 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. It may be sensitive to change in general and may be detrimentally affected if change is inappropriately dealt with.

A moderate value is placed on the grasslands, which occur in the northern and middle sections of the study area. The proposed new shafts occur within this landscape type.

A summary of the scenic quality of the various landscape types is contained in Table 1 below.

Table 1: Value of the Visual Resource - Scenic Quality

High *Hills and associated grasslands (eastern sector of study area)*	**Moderate** *Grasslands (central and northern sector of study area)*	**Low** *Mining and township areas (western section of study area and south eastern section)*
These landscape types are considered to have a *high* value because they are:	These landscape types are considered to have a *moderate* value because they are:	These landscape types are considered to have a *low* value because they are:
Distinct landscapes that exhibit a very positive character with valued features that combine to give the experience of unity, richness and harmony. They are landscapes that may be considered to be of particular importance to conserve and which have a strong sense of place. They may be sensitive to change in general and may be detrimentally affected if change is inappropriately dealt with.	Common landscapes that exhibit some positive character but which have evidence of alteration / degradation / erosion of features resulting in areas of more mixed character. They are 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.	Minimal landscapes generally negative in character with few, if any, valued features due to their inherent characteristics or due to major negative man-made impacts. Scope for positive enhancement could occur.

In conclusion, the value of the visual resource when the various landscape types are taken together as being representative of the quality of the study area's landscape, the rating is ***moderate*** within the context of the study area.

3.3 Views

The project sites are visually exposed primarily due to the relatively flat nature of the landscape and the lack of tall vegetation (refer to Figures 5 to 9). Public views (sensitive viewing areas) to the project sites would be experienced by people living in and visiting the adjacent settlements. These include: Maile (approximately 3.7km north-east of proposed No. 18 Shaft), Diepkuil (approximately 5.7km east of proposed No. 18 Shaft), Tsitsing (approximately 9.0km south-east of proposed No. 18 Shaft), Serutube and Mafika (approximately 12.0km and 12.4km respectively, south-east of proposed No. 18 Shaft), Ga-Luka North and South (approximately 4.8km and 6.1km respectively, south-west of proposed No. 18 Shaft) and Rasimone, Robega and Chaneng (approximately 9.8km west of proposed No. 18 Shaft).

All these public views are however from a relatively low vantage point as is evident in the photographs illustrated in Figures 5 to 9. The result of this is that the sites would only be visible from the periphery of the residential areas and from the roads that service these settlements and the mining area (refer to Figure 1).

Views from R510 would mostly be obscured and blocked by township developments and the hills that run along the south-eastern side of the affected farms. Views from the R556 would be open and orientated towards the proposed development sites, but would mostly be distant i.e. over 5.0 km from the sites. Views towards proposed No. 18 Shaft along the access road, D513, would be open.

The author is not aware of tourist properties within the study area, however a heritage site proposed in the Royal Bafokeng Nation Masterplan for the area (Welbekend – see Figure 4) is proposed south-east of the proposed No. 18 Shaft site. Views from this vantage point would portray the Project in the background of views to the north-west.

4.0 LANDSCAPE IMPACT and VISUAL IMPACT

4.1 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 projects will be *high* due primarily to the change that will result from the initial scarring and disturbance of the landscape, which would require the removal of a substantial amount of woody vegetation, and the scale of the operations. During the construction phase, the landscape change will be evident with the removal of vegetation and the extensive earthworks required to create the Shaft Complex.

Once construction has been completed and the operation begins, an obvious change to the landscape characteristics of the site will remain evident. 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.

4.2 Visibility and Visual Exposure

The 'zone of potential influence' i.e. the distance beyond which views to the project sites would not be greatly influenced by the presence of its proposed structures, was set at 12,5 km. The study area used to determine visual impact is therefore limited to a radius of 12,5 km about the project sites. Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m.

The viewshed analysis depicted in Figure 12, confirms this and illustrates that the projects would potentially be visible from within a majority of places within the zone of potential influence i.e. ***highly*** visible because the development is potentially visible from over half the zone of potential influence, and views would mostly be unobstructed. Table 2 below summarizes this. However, it should be noted that views of the proposed shaft complexes and support infrastructure could in some cases be blocked by existing vegetation, as illustrated in the photo simulation in Figure 18 (view 8) because of the nature of the landscape and the scale of the project components relative to the viewer and the viewpoint.

Table 2: Visibility of project components

High	Moderate	Low to Insignificant
Visual Receptors If the proposed project is potentially 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 proposed project is potentially visible from less than half the zone of potential influence, and / or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the proposed project is potentially visible from less than a quarter of the zone of potential influence, and / or views are mostly obstructed and / or few viewers are affected.

The visual exposure of the proposed shaft complex and support infrastructure would result in ***low*** exposure (viewed in the background of a scene) to people living in and visiting the residences along the peripheries of all the communities. With exception, the north-eastern edges of Ga-Luka North borders on the ***moderate*** exposure range.

Due to topographic relief, project components would not be visible from Kanana and Freedom Park located to the south of the proposed shaft.

Although views towards the proposed shaft complex from the R510 and R556 would be open and unobstructed, visual exposure would be ***low*** as the projects would appear in the background for travellers along these routes. Views from the D513 would appear in the middle ground of travellers along this route resulting in a ***moderate*** exposure.

4.3 Visual Intrusion

Visual intrusion is directly related to *landscape impact* and the nature of intrusion (physical characteristics) of a project component on the visual quality of the environment and its compatibility / discord with the landscape and surrounding land use.

Section 3.3 describes the public areas (sensitive viewing sites) from which the project sites would potentially be visible. Although *visibility is high*, virtually every public view to the project sites would be from a low perspective and have mining infrastructure as a backdrop or at least within the view (refer to Figures 5 to 9). This is because the residential areas and public roads are not elevated above the grassland plains.

The proposed new shaft complex would be viewed against the backdrop of the existing mining infrastructure and be 'absorbed' into the scene. This ultimately makes it difficult to see. Photo simulations in Figures 13 to 17 (views 1 – 3, 6 and 7) illustrate this phenomenon, which is typical of views along the R556, section of R510 along western edges of Tsitsing and road connecting the R556 and R565 through Rasimone, Robega and Chaneng. The proposed project activities would tend to 'blend' with and be associated with the characteristics of the existing landscape and be absorbed into the scene, refer to photo simulation of view 6 on Figure 16. Sometimes existing vegetation would hide the proposed projects reducing visual intrusion as is portrayed in the photo simulation on Figure 18. The most dramatic change to the existing scene would occur where the proposed shaft is closer to existing roads e.g. the access route to No. 14 Shaft as illustrated in the photo simulation of view 9 on Figure 19. From Table 3 below it can be concluded that the proposed new shaft complex would result in a ***moderate*** visual intrusion for receptors due to it having a moderate negative effect on the visual quality of the landscape being partially compatible with land use patterns within the study area. From key views, the structures of the Project would be partially 'absorbed' into the landscape resulting in a moderate negative effect on the visual quality of the landscape.

Table 3 below summarizes the visual intrusion criteria and rates the worst case scenario for project components either individually or collectively on sensitive viewing areas.

Table 3: Visual Intrusion

High	Moderate	Low	Positive
	For the proposed Welbekend Heritage Area, all communities as well as sections of the R556 and D513 roads		
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.

4.4 Severity of Visual Impact

Visual impact is 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 quality of views in the area as perceived by people visiting, working or living in the area.

4.4.1 Impact on Sense of Place

For the reasons given in the Section 4.2, the project is expected to have a cumulative impact on the sense of place of the study area. The presence of mining and processing activities contributes to the current sense of place (as described in Section 3.2), albeit a negative contribution, and therefore helps establish the aesthetic characteristics for the study area. The proposed new shaft complex will therefore have a negative impact on the visual quality of the study area but to a far lesser degree than would have been the case if no other mining processing activities were present. Nevertheless, this does not mean that methods to reduce the impact of project should not be considered.

Perhaps the feature that would have the greatest visual impact is the impact of the project at night. The lights associated with the activities at the proposed shaft complexes would contribute to the already prevalent light pollution generated by existing mining and urban areas.

4.4.2 Severity of Visual Impact

The *severity* of the visual impact is assessed using the worst-case scenario, the synthesis of the criteria given in Appendix C and the discussion in the body of this report. In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement (Institute of Environmental Assessment & The Landscape Institute (1996)). The impact on sensitive viewing areas will vary and thus ratings are given for the various sectors (as set out earlier in the report) of the study area. Refer to Table 4 below for Severity rating.

Table 4: Severity of Visual Impact

High	Moderate	Low	Negligible
	For the proposed Welbekend Heritage Area, Maile, Diepkuil and sections of the D513	*For Tsitsing, Ga-Luka North and South and sections of 'internal' local roads*	*For Serutube, Mafika, Kanana, Freedom Park, Rasimone, Robega, Chaneng and sections of R556 south of Pilanes-berg Nature Reserve*
A major alteration to key elements / features / characteristics of the baseline.	Partial loss of or alteration to key elements / features / characteristics of the baseline.	Minor loss of or alteration to key elements / features / characteristics of the baseline.	Very minor loss or alteration to key elements / features / characteristics of the baseline.
I.e. Pre-development landscape or view and the introduction of elements considered to be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and the introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and the introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and the introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.
High scenic quality impacts would result.	Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

5.0 MITIGATING MEASURES

When considering mitigation measures to reduce the visual impact, three rules should be considered. Mitigation measures should be:

- Economically feasible;
- Effective (time allowed for implementation and provision for management/maintenance)
- Visually acceptable (within the context of the existing landscape).

To address these measures the following principles should be considered:

- Mitigation should be planned to fit into the existing landscape character or to enhance it. It should respect and build upon landscape distinctiveness.
- Mitigation should primarily aim to blend the proposed development into its surroundings and generally reduce its visibility.
- It should be recognised that many mitigation measures, especially planting / rehabilitation, are not immediately effective.

The following actions are proposed for each site:

5.1 Site Development

- Ensure that all existing vegetation, especially along the periphery of the site, is retained during the construction phase to act as visual screens and dust collectors and to break the monotony that would be evident of vast expanses of exposed earth.
- With the construction of the proposed components the minimum amount of existing vegetation and topsoil should be removed. Ensure, wherever possible, all existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive viewers.

5.2 Earthworks

Dust suppression techniques should be in place at all times during the construction and operational phases.

- Only the footprint of the proposed site should be exposed. In all other areas the vegetation should be retained.

5.3 Screening

Screening to screen close-up views should be introduced along the edges of the shaft complexes as described below:

- Where the vegetation intrudes onto the site it should be retained.
- An ecological approach to landscaping is recommended. Should plants be introduced into the project, choice should be guided by ecological rather than horticultural principles.
- Indigenous trees and shrubs should be planted in clumps to screen views from the future Welbekend Heritage Area.

5.4 Access Roads

- Internal roads should be surfaced to minimise dust. During the construction phase all dirt roads will require an effective dust suppression management programme such as regular watering and / or the use of non-polluting chemicals that will retain moisture in the road surface.
- Where a paved road surface is required, paving materials with 'earthy' tones that complement the natural red / brown colours and textures of the soils in the area should be used.

5.5 Lighting

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 sites – this is especially relevant where the project activities are exposed to residential properties in the near communities.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.

6.0 SIGNIFICANCE OF VISUAL IMPACT

Tables 5 to 7 summarizes the activities that will have an impact on the visual environment. It also describes the type of impact during the construction, operational and decommissioning phases. The severity of impact, rated in Table 4, is qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact. The criteria used in Tables 5 to 7 are summarised in Appendix D (Hacking Method). The significance of the impact is predicted using the worst-case scenario of an activity. Mitigation measures are possible but even when applied properly to best practice mining activities, the reduction in impact, although significant, is not substantial enough to significantly reduce the impact of the proposed activities. This is primarily due to the nature, scale and form of the proposed processes and features. The ratings with mitigation assume that the measures as proposed in Section 5.0 are effectively applied.

Table 5: Visual Impact Assessment – Construction / Operational / Closure Phases

Welbekend Heritage Area, Communities, Roads

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE							
	Before mitigation				After mitigation			
	C	**x**	**P**	**SIG**	**C**	**x**	**P**	**SIG**
Construction Phase	M		H	**H**	M		H	**H**
Construction activities, topographical change, removal of vegetation, surface disturbance, dust, visual disturbance, shaft complex , contractors lay down area, workshops & storage areas, stockpiles, water management infrastructure, explosives magazine, ROM piles, haul roads, temporary access roads, temporary services (water & electricity), ventilation infrastructure, drill rigs, portable compressors, settling ponds, earthworks.								
Operational Phase	M		H	**H**	M		H	**H**
Activities in and around shaft complex, un-surfaced roads will create dust, growth of waste rock dumps,								
Decommissioning	L		H	**M**	L		L	**L**
Currently the conceptual plan is to remove surface infrastructure and rehabilitate the disturbed areas. The closure objective is to return the land to pre-mining potential.								

Note:

C = Consequence

P = Probability

Sig = Significance

7.0 CONCLUSION

The proposed Impala No. 18 Shaft Complex will *definitely* exert a negative on the visual environment.

During the construction and operational phases the significance of the impact on the future Welbekend Heritage Area, the communities as well as sections of the roads through the study area will be *moderate* when worst case scenarios are considered.

During the closure phases the rating would drop to *low* should all mitigation measures be implemented successfully and effectively.

Support infrastructure including power and pipe lines running parallel to roads connecting the proposed shaft complex to the existing shafts 14 and 11 complexes as well as traffic along these connection and access roads, would all add cumulatively to the negative visual impact from the existing shaft complexes as well as the negative visual impact that would arise from the proposed intervention.

Mitigation measures are proposed, which primarily relate to 'good housekeeping', during all phases of the project but due to the scale and nature of the activities, the significance of impact rating will not reduce significantly for most of the visual receptors.

NLA

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APPENDIX A: FIGURES

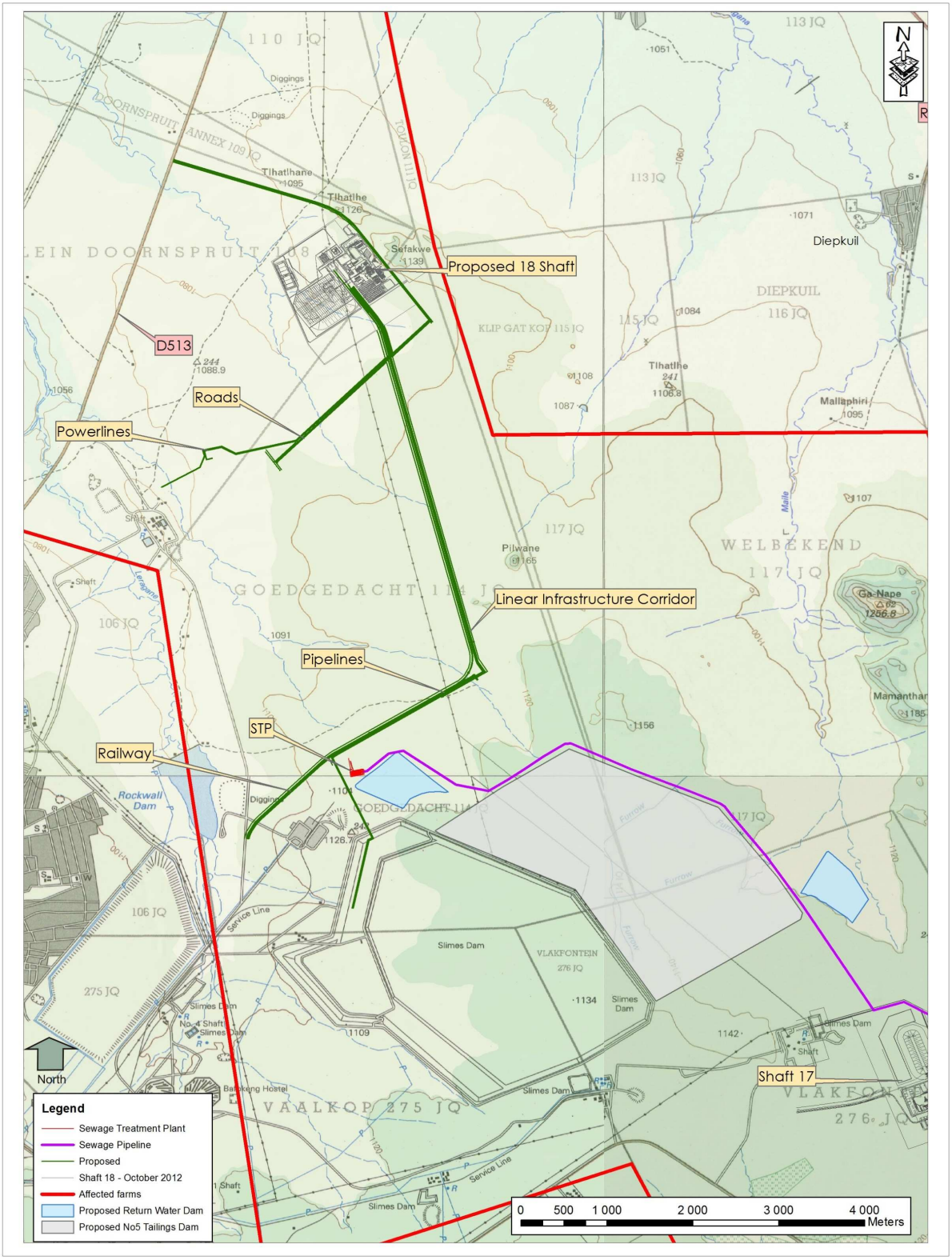


Figure 1: LOCALITY - Impala Shaft 18

April 2013

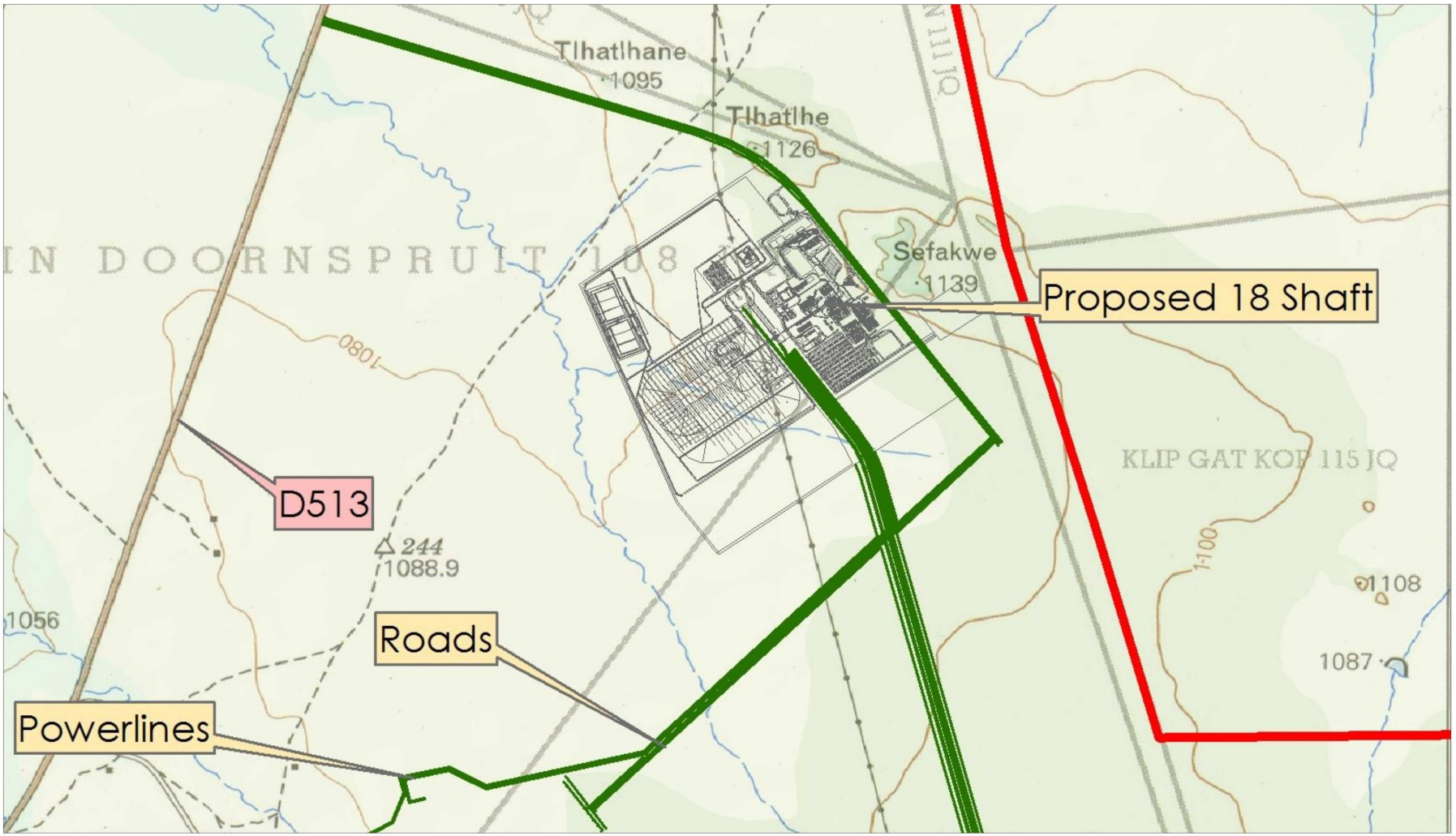


Figure 2: LAYOUT - Impala Shaft 18

April 2013

View of existing shaft complex similar to proposed Shaft 18

Figure 3: PROJECT COMPONENTS - Impala Shaft 18

April 2013

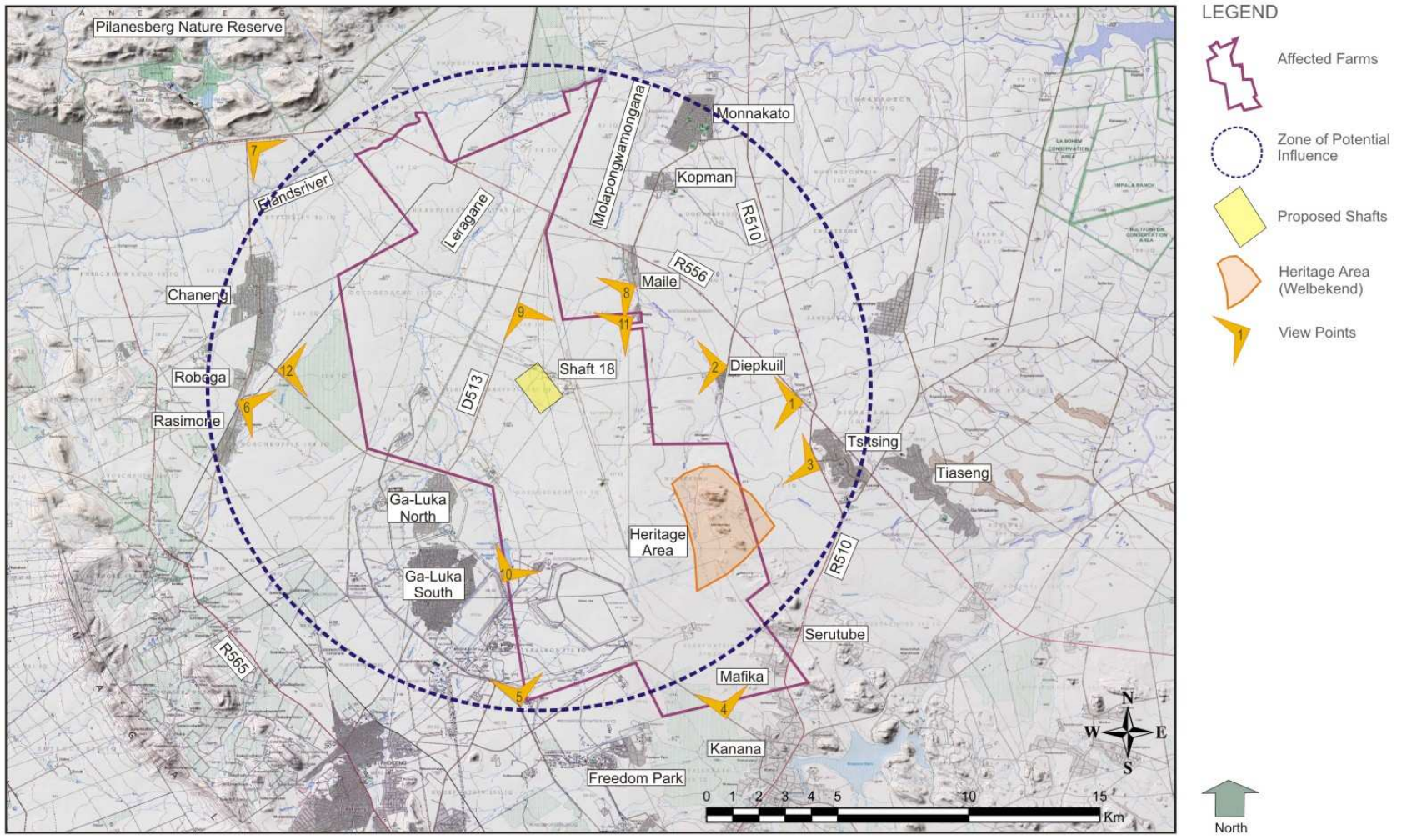


Figure 4: VIEWS - Impala Shaft 18

September 2013

View 1: View from R556 just north of R556 and R510 crossing, looking north-west

View 2: View from Diepkuil settlement, looking west

Refer to Figure 4 for location of views

Figure 5: LANDSCAPE CHARACTER (Views 1 & 2) - Impala Shaft 18

April 2013

View 3: View from R510 west of Tsitsing, looking north-west

View4: View from road to Shaft 14, looking north

Refer to Figure 4 for location of views

Figure 6: LANDSCAPE CHARACTER (Views 3 & 4) - Impala Shaft 18

April 2013

View 5: View from unknown road south-west of existing tailings dam No. 4, looking north-east

View 6: View from Robega residential settlement, looking east

Refer to Figure 4 for location of views

Figure 7: LANDSCAPE CHARACTER (Views 5 & 6) - Impala Shaft 18

April 2013

View 7: View from R556 south of Pilanesberg Nature Reserve, looking south-east

View 8: View from Maile settlement, looking south-west

Refer to Figure 4 for location of views

Figure 8: LANDSCAPE CHARACTER (Views 7 & 8) - Impala Shaft 18

April 2013

View 9: View from D513, looking south-east

View 10: View from between tailings dam No. 4 and Ga-Luka South, looking north

Refer to Figure 4 for location of views

Figure 9: LANDSCAPE CHARACTER (Views 9 & 10) - Impala Shaft 18

April 2013

View 11: View from southern extension of Maile township, looking south-west

View 12: View from road between Chaneng and Ga-Luka North, looking east

Refer to Figure 4 for location of views

Figure 10: LANDSCAPE CHARACTER (Views 11 & 12) - Impala Shaft 18

April 2013

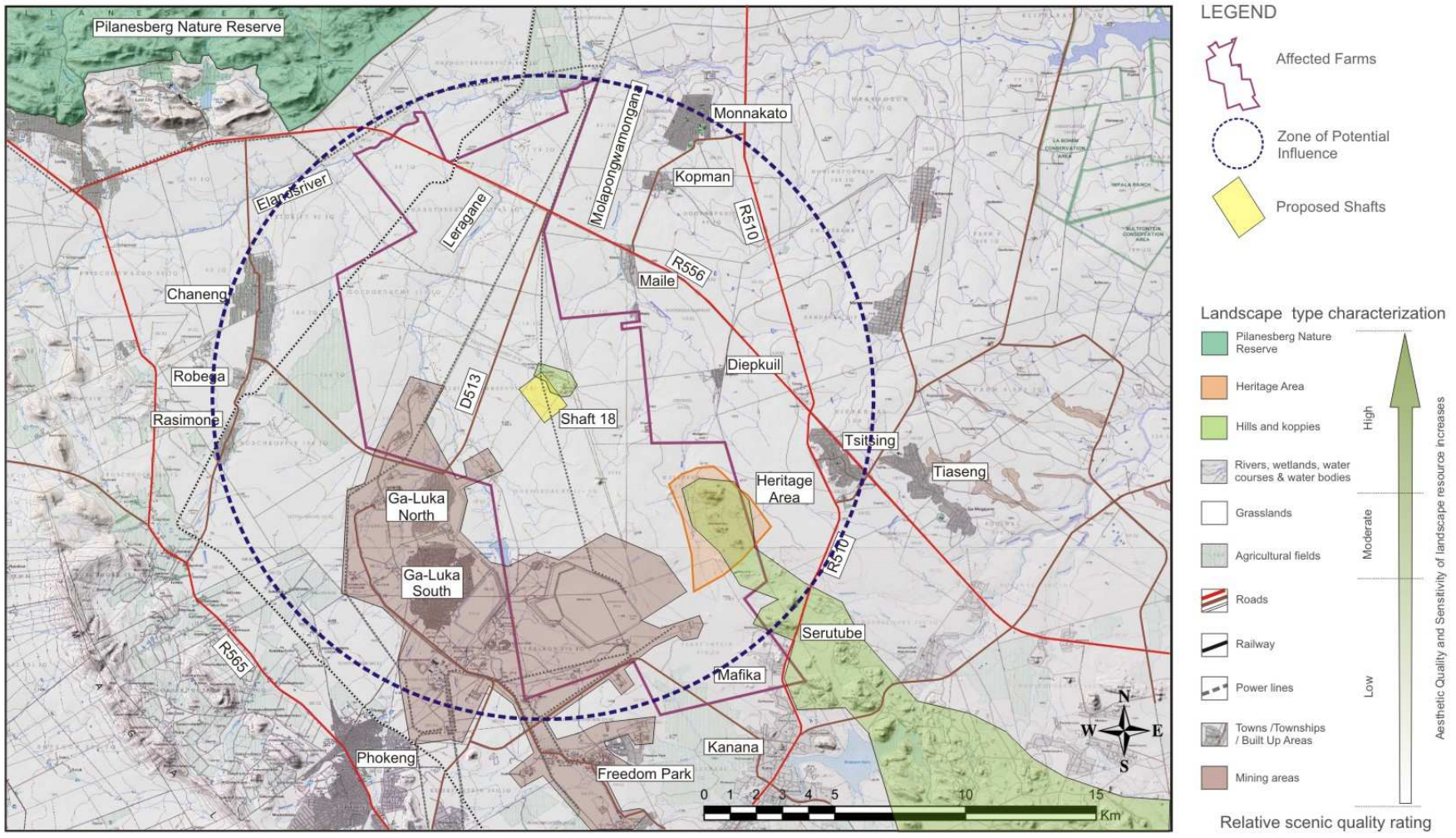
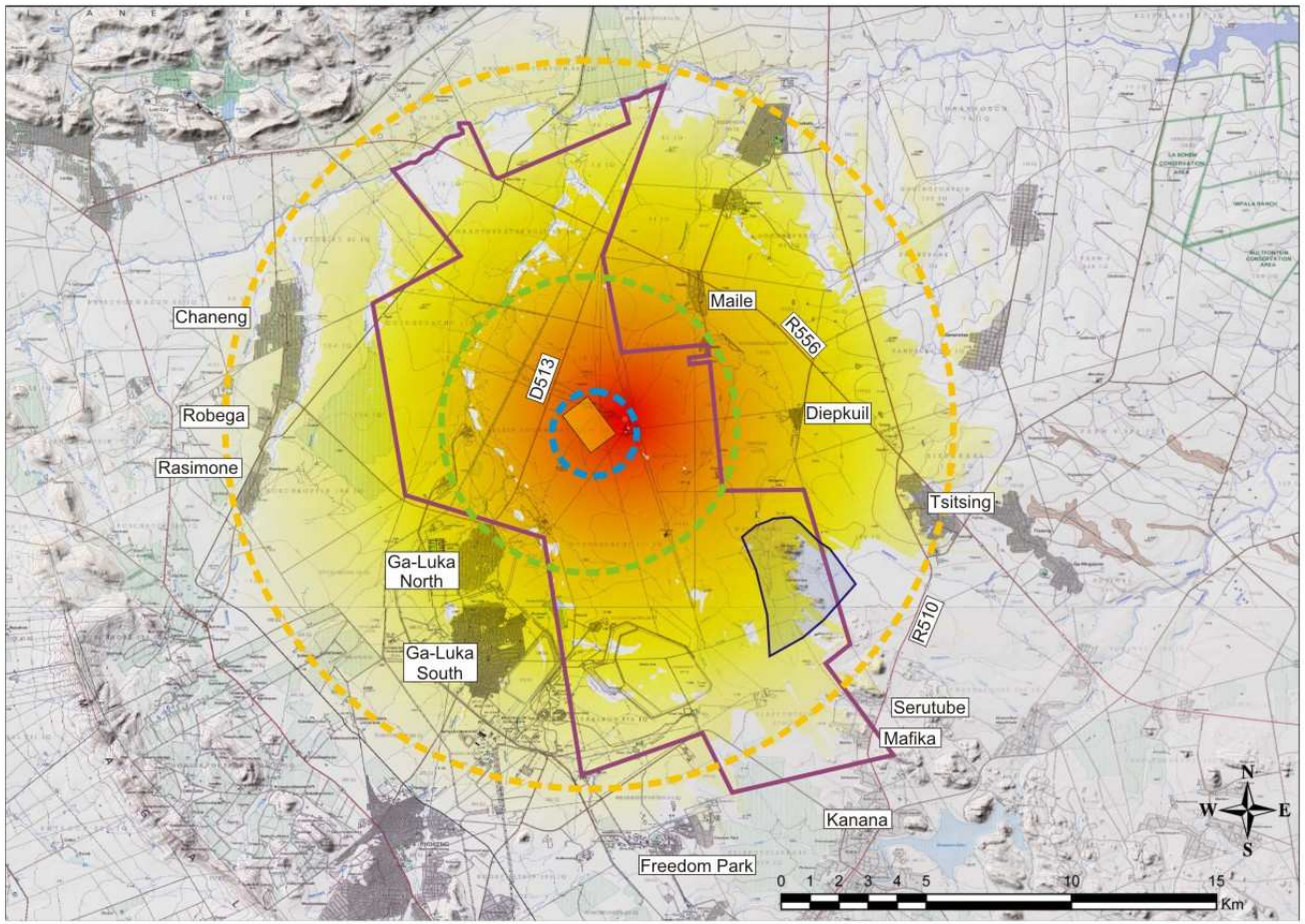


Figure 11: VISUAL RESOURCE - Impala Shaft 18

September 2013



LEGEND

Affected Farms

Proposed Shafts

Heritage Area

Visual Exposure

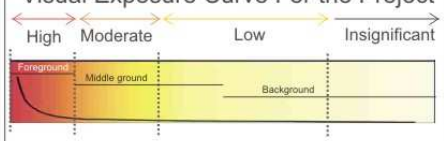
High: 0 - 1.5km

Moderate: 1.5km - 5.0km

Low: 5.0 - 12.5km

Insignificant: 12.5km <

Visual Exposure Curve For the Project



Gradient of curve is proportional to size of object i.e. Steeper curve signifies larger object, this equals greater exposure and visual impact

Figure 12: VIEWSHED - Impala Shaft 18

September 2013

Before (View 1): View from R556 just north of R556 and R510 crossing, looking north-west

After

Refer to Figure 4 for location of views

Figure 13: SIMULATION (View 1) - Impala Shaft 18

April 2013

Before (View 2): View from Diepkuil settlement, looking west

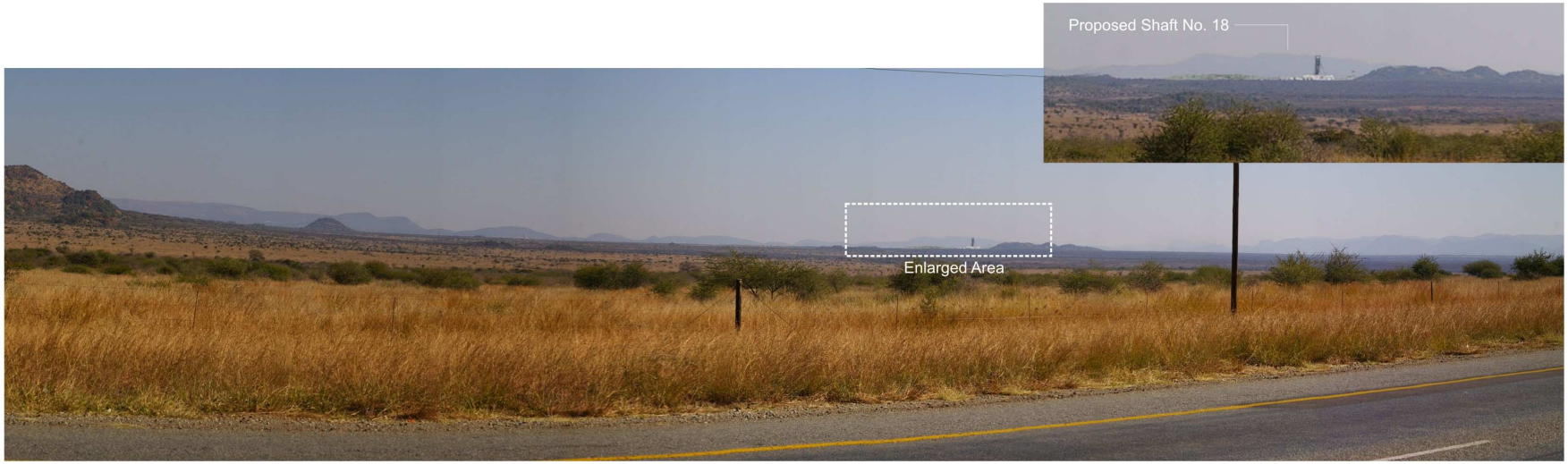
After

Refer to Figure 4 for location of views

Figure 14: SIMULATION (View 2) - Impala Shaft 18

April 2013

Before (View 3): View from R510 west of Tsitsing, looking north-west



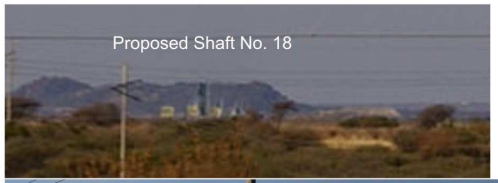
After

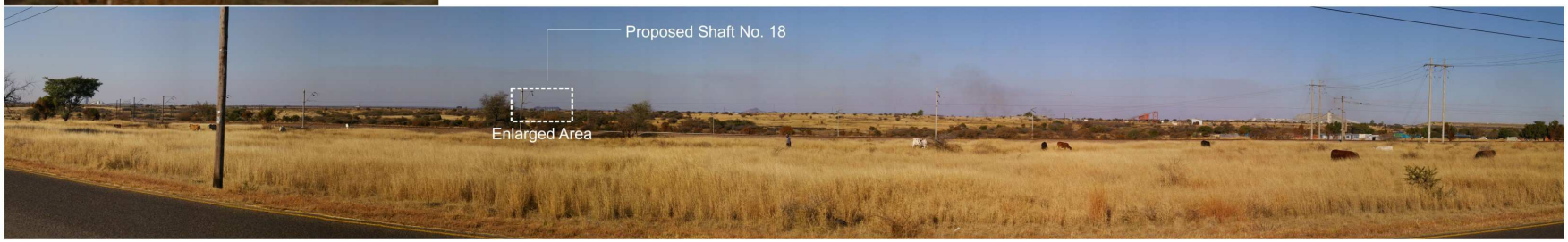
Refer to Figure 4 for location of views

Figure 15: SIMULATION (View 3) - Impala Shaft 18

April 2013

Before (View 6): View from Robega residential settlement, looking east





After

Refer to Figure 4 for location of views

Figure 16: SIMULATION (View 6) - Impala Shaft 18

April 2013

Before (View 7): View from R556 south of Pilanesberg Nature Reserve, looking south-east

After

Refer to Figure 4 for location of views

Figure 17: SIMULATION (View 7) - Impala Shaft 18

April 2013

Before (View 8): View from Maile settlement, looking south-west

After

Refer to Figure 4 for location of views

Figure 18: SIMULATION (View 8) - Impala Shaft 18

April 2013

Before (View 9): View from D513, looking south-east

After

Refer to Figure 4 for location of views

Figure 19: SIMULATION (View 9) - Impala Shaft 18

April 2013

Before (View 11): View from southern extension of Maile township, looking south-west

After

Refer to Figure 4 for location of views

Figure 20: SIMULATION (View 11) - Impala Shaft 18

April 2013

APPENDIX B: 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)
(after Crawford 1994 and The Visual Resource Management System, Developed by The Bureau of Land Management (BLM) in the Department of the Interior of the USA Government).

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 - topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured;
- Where water forms are present - The degree to which water dominates the scene is the primary consideration in selecting the rating score;
- 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 considering "colour" are variety, contrast, and harmony.
- Where diverse patterns of grasslands and trees occur - 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. Consider also smaller scale vegetational features which add striking and intriguing detail elements to the landscape (e.g. gnarled or wind beaten trees, and Quiver trees);
- 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.
- Where natural landscape increases and man-made landscape decreases;
- And where land use compatibility increases and land use edge diversity decreases - 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.

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). Refer also to Appendix A for further elaboration.

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 Beauty of Visual Resource

In determining the scenic 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

Derived from The Landscape Institute with the Institute of Environmental Management and Assessment (2002)

High (Distinct)	Moderate (Common)	Low (Minimal)
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.

Scenic Quality Inventory and Evaluation Chart

(Developed by: The Bureau of Land Management (BLM), In the Department of the Interior of the USA Government)

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	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**
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element. **3**	Subtle color 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. *** 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 favorably 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**

APPENDIX C: METHOD FOR DETERMINING THE *SEVERITY* 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 than 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.

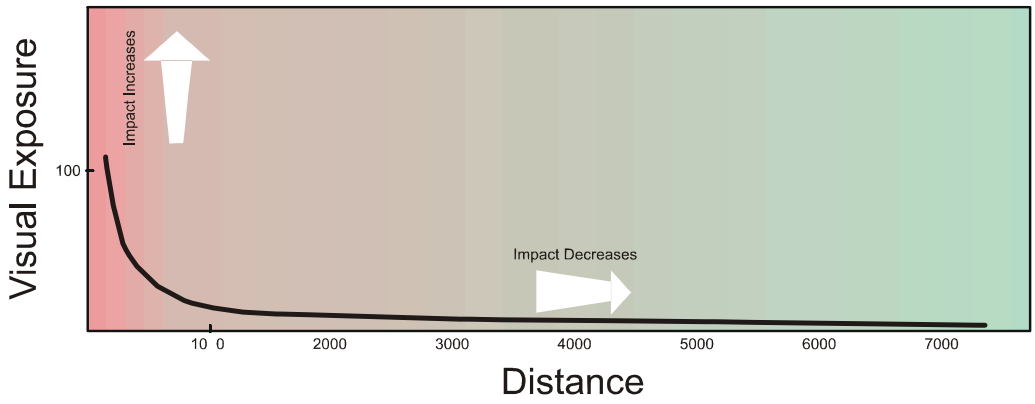
Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

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

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, on trains 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 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	Moderate	Low
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

Severity 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.	Partial loss of or alteration to key elements/features/characteristics of the baseline.	Minor loss of or alteration to key elements/features/characteristics of the baseline.	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 considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	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 receiving landscape.	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.	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.	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 D: CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT

The impact assessment methodology is based on the Hacking method of determination of the significance of impacts (Hacking, 1998). Part A provides the definition for determining impact consequence (combining severity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate / measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable / will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable / will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional / national

PART B: DETERMINING CONSEQUENCE					
SEVERITY = L					
DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
SEVERITY = M					
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY = H					
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional / national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite / Continuous	**H**	**Medium**	**Medium**	**High**
	Possible / frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely / seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

APPENDIX E: 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 F: 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 G: DECLARATION OF INDEPENDENCE

I, Mitha C Cilliers hereby declare that Newtown Landscape Architects cc, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

Consultant name: Mitha Cilliers

Signature:

Date: 2013-07-01

APPENDIX H: CURRICULUM VITAE OF AUTHORS

Since 1994

Graham Young PrLArch

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Graham is a landscape architect with thirty years' experience. He has worked in Southern Africa and Canada and has valuable expertise in the practice of landscape architecture, urban design and environmental planning. He is also a senior lecturer, teaching urban design and landscape architecture at post and under graduate levels at the University of Pretoria. He also specializes in Visual Impact Assessments.

EXPERIENCE: **NEWTOWN LANDSCAPE ARCHITECTS cc.** ***Member***

Current — Responsible for project management, landscape design, urban design, and visual impact assessment.

Senior Lecturer: Department of Architecture, University of Pretoria.

1991 - 1994 **GRAHAM A YOUNG LANDSCAPE ARCHITECT** - ***Sole proprietor***

1988 - 1989 — Designed major transit and CBD based urban design schemes; designed commercial and recreational landscapes and a regional urban park; participated in inter-disciplinary consulting teams that produced master plans for various beachfront areas in KwaZulu Natal and a mountain resort in the Drakensberg.

1989 - 1991 **CANADA** - ***Free Lance***

Designed golf courses and carried out golf course feasibility studies (Robert Heaslip and Associates); developed landscape site plans and an end-use plan for an abandoned mine (du Toit, Allsopp and Hillier); conducted a visual analysis of a proposed landfill site. .

1980 - 1988 **KDM (FORMERLY DAMES AND MOORE)** - *Started as a Senior Landscape Architect and was appointed Partner in charge of Landscape Architecture and Environmental Planning in 1984*. Designed commercial, corporate and urban landscapes; completed landscape site plans; developed end-use master plans for urban parks, college and technikon sites; carried out ecological planning studies for factories, motorways and a railway line.

1978 - 1980 **DAYSON & DE VILLIERS** - ***Staff Landscape Architect***

Designed various caravan parks; designed a recreation complex for a public resort; conducted a visual analysis for the recreation planning of Pilgrims Rest; and designed and supervised the installation of various private gardens.

EDUCATION:

Bachelor of Landscape Architecture, 1978, (BLArch), University of Toronto, Canada;

Completing a master's degree in Landscape Architecture, University of Pretoria; Thesis: Visual Impact Assessment;

Senior Lecturer - Department of Architecture, University of Pretoria.

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2001);

Board of Control for Landscape Architects of South Africa (1987) – Vice Chairman 1988 to 1989;

Professional Member - Institute of Landscape Architects Southern Africa (1982) – President 1986 - 1988;

Member Planning Professions Board 1987 to 1989;

Member International Association of Impact Assessment;

AWARDS:

Torsanlorenzo International Prize, Landscape design and protection 2nd Prize Section B: Urban Green Spaces, for Intermediate Phase Freedom Park (2009)

Phase 1 and Intermediate Phase Freedom Park: Special Mention World Architecture Festival, Nature Category (2008)

Moroka Park Precinct, Soweto: ILASA Merit Award for Design (2005) and Gold Medal United Nations Liveable Communities (LivCom) Award (2007)

Isivivane, Freedom Park: ILASA Presidential Award of Excellence Design (2005)

Information Kiosk, Freedom Park: ILASA Merit Award for Design (2005)

Moroka – Mofola Open Space Framework, Soweto: ILASA Merit Award for Planning (2005)

Mpumalanga Provincial Government Complex: ILASA Presidential Award of Excellence (with KWP Landscape Architects for Design (2003)

Specialist Impact Report: Visual Environment, Sibaya Resort and Entertainment World: ILASA Merit Award for Environmental Planning (1999);

Gillooly's Farm, Bedfordview (with Dayson and DeVilliers): ILASA Merit Award for Design;

COMPETITIONS:

Pan African Parliament International Design competition – with MMA architects (2007) Finalist

Leeuwpan Regional Wetland Park for the Ekurhuleni Metro Municipality (2004) Landscape Architectural Consultant on Department of Trade and Industries Building (2002) – Finalist

Landscape Architecture Consultant on Project Phoenix Architectural Competition, Pretoria (1999): Winner;

Mpumalanga Legislature Buildings (1998): Commissioned;

Toyota Fountain (1985): First Prize - commissioned;

Bedfordview Bike/Walkway System - Van Buuren Road (1982): First Prize -commissioned;
Portland Cement Institute Display Park (1982): Second Prize

CONTRIBUTOR:

Joubert, O, 10 Years + *100 Buildings – Architecture in a Democratic South Africa Bell-Roberts Gallery and Publishing*, South Africa (2009)

– Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng

Galindo, M, *Collection Landscape Architecture*, Braun, Switzerland (2009)

– Freedom Park Phase Intermediate Phase (NBGM), Pretoria, Gauteng

In *1000 X Landscapes*, Verlagshaus Braun, Germany (2008)

– Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng
– Riverside Government Complex (NLAKWP), Nelspruit, Mpumalanga;
– Moroka Dam Parks Precinct, Soweto, Gauteng.

In *Johannesburg: Emerging/Diverging Metropolis*, Mendrision Academy Press, Italy (2007)

- Moroka Dam Parks Precinct, Soweto, Gauteng.

Since 1994

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Mitha is a landscape architect with nine years experience. She has worked as Landscape Architect in South Africa and Angola and has valuable expertise in the practice of landscape architecture and environmental planning. She is currently employed by Newtown Landscape Architects.

EXPERIENCE:

Current *Landscape Architect:*

NEWTOWN Landscape Architects cc.

Visual Impact Assessments

Landscape Maintenance Auditing

Landscape Design

2008 to 2013 *Consultant*:

NEWTOWN Landscape Architects cc.

Visual Impact Assessments

KWP Landscape Architects & Environmental Consultants

Landscape Maintenance Auditing

Landscape Design and draughting

REAL Landscapes

Landscape Design

2005 – 2007 *Landscape Architect:*

KWP Landscape Architects & Environmental Consultants

Landscape design for various types of projects ranging from residential garden design to industrial landscaping, including the landscape upgrade of the SASOL plant in Secunda.

General project administration and documentation including Bill of Quantities, Tender

Evaluation and site inspections.

Landscape Maintenance Auditing at the Nelspruit Riverside Government Offices

Preparation of Environmental Impact Assessment Reports for proposed housing developments.

Environmental Control Officer on various residential housing developments.

2003 – 2004 *Candidate Landscape Architect:*

Sigma Gibb – part of the GIBB Africa Group

Co-Landscape Architect on a residential housing estate in Luanda, Angola.

Design and draughting for various projects in Angola.

2003 *Candidate Landscape Architect:*

NEWTOWN Landscape Architects cc.

Design and draughting various projects ranging from private residential gardens to public parks.

Project administration including Bills of Quantities and Tender Evaluation and site inspections

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2007)

Committee Member – South African Council for Landscape Architectural Profession (2009 & 2011- - 2012)

EDUCATION:

Bachelor of Landscape Architecture, 2001, (BLArch), University of Pretoria.