Visual Impact Assessment Report

Proposed Doornhoek Fluorspar Project, Zeerust, North-West Province

Yonanda Martin

Graham Young

Newtown Landscape Architects

PROPOSED DOORNHOEK FLUORSPAR PROJECT

ZEERUST, NORTH-WEST PROVINCE

Submitted to:

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Prepared By:	Yonanda Martin (Pri.Sci.Nat)
Reviewed By:	Graham Young (Pr LArch)
Reference:	Doornhoek Fluorspar Project

EXPERTISE OF SPECIALISTS

Name:	Graham A Young
Qualification:	Pr LArch
Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Institute of Landscape Architects of South Africa (ILASA)
Experience in Years:	33 years
Experience	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 specializes in Visual Impact Assessments and has won an Institute of Landscape Architects Merit Award for his VIA work.

Name:	Yonanda Martin
Qualification:	MSc. (Env.)
Professional Registration:	Pri. Sci. Nat.
Experience in Years:	10 years
Experience	Yonanda Martin has been doing visual impact assessments for Newtown Landscape Architects since 2006. She has experience in a wide range of visual impact assessments which include visual impacts for game lodges, transmission lines, roads, mines and telecommunication masts. Projects that she worked on include: • **Eskom Ngwedi Substation** (PBAI), North West Province • **NBC Belfast Project** (Exxaro), Mpumalanga • **Tamboti Platinum Mine** (Metago), Limpopo • **De Wittekrans** (GCS), Mpumalanga • **Dorsfontein West Expansion** (GCS (Pty) Ltd), Kriel • **Ferreira Coal Mining** (GCS (Pty) Ltd), Ermelo • **Eskom Honingklip** (Kv3 Engineers), Muldersdrift • **SANRAL PWV3** (Jeffares & Green), Hartbeespoort

DECLARATION OF INDEPENDENCE

I, Graham Young, declare that –

- I am contracted as the Visual Impact Assessment Specialist for the Doornhoek Fluorpar Project;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998), Environmental Impact Assessment Regulations 2010 and 2014, and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Graham Young

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SPECIALIST REPORTING REQUIREMENTS

Specialist Reporting Requirements According to Appendix 6 of the National Environmental Management Act (Act 107 of 1998), Environmental Impact Assessment Regulation 2014	
Requirement	**Relevant section in report**
Details of the specialist who prepared the report	Page ii, Appendix D
The expertise of that person to compile a specialist report including a curriculum vitae	Page ii , Appendix D
A declaration that the person is independent in a form as may be specified by the competent authority	Page iii
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3 – 1.4
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.2
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 3
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 5 & 6
An identification of any areas to be avoided, including buffers	Section 7
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 11, Figures 24 & 25
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 11
Any mitigation measures for inclusion in the EMPr	Section 12
Any conditions for inclusion in the environmental authorisation	Section 12
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 14
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 14
A description of any consultation process that was undertaken during the course of carrying out the study	Section 6

A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

ACRONYMS, ABBREVIATIONS & GLOSSARY

Acronyms & Abbreviations	
CSIR	Council for Scientific and Industrial Research
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme Report
IFC	International Finance Corporation
NLA	Newtown Landscape Architects
ROM	Run-of-mine
SACLAP	South African Council for the Landscape Architectural Profession
TSF	Tailings Storage Facility
VIA	Visual Impact Assessment

Glossary	
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).
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).
Study area	For the purposes of this report the Doornhoek Fluorspar Project Study area refers to the proposed project footprint / project site as well as 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) which is a 10km radius surrounding the proposed project footprint / site.
Project Footprint / Site	For the purposes of this report the Doornhoek Fluorspar Project *site* / *footprint* refers to the actual layout of the project.
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 around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

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1. INTRODUCTION

1.1 Project Overview and Background

Newtown Landscape Architects (NLA) was commissioned by Exigo to carry out a Visual Impact Assessment (VIA) for the proposed Doornhoek Fluorspar Project, North West Province ("the Project"). The Project would encompass open pit mining with associated top structures and infrastructure. This will include facilities such as a process plant, topsoil stockpiles, overburden dumps, Tailings Storage Facility (TSF), roads and other infrastructure.

1.2 Proposed Study Area

The proposed Doornhoek Fluorspar Project is located on portions of Rhenosterfontein 304 JP and the Farm 306 JP which is located approximately 22km south-east of Zeerust, North West Province. Refer to Figure 1: Locality Map

1.3 Objective of the Specialist Study

The main aim of the visual impact specialist study is to ensure that the visual / aesthetic consequences of the proposed project are understood and adequately considered in the environmental planning process. In the final assessment phase, detailed mitigation measures that could reduce the impact of the Project, will be proposed.

1.4 Terms and Reference

A specialist study is required to assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Conduct field surveys of the proposed project area and photograph the area from sensitive viewing points;
- Describe the landscape character of the area;
- Describe the sense of place and scenic quality;
- Identify potential sensitive viewers;
- Identify potential visual impacts;
- Describe possible mitigation measures.

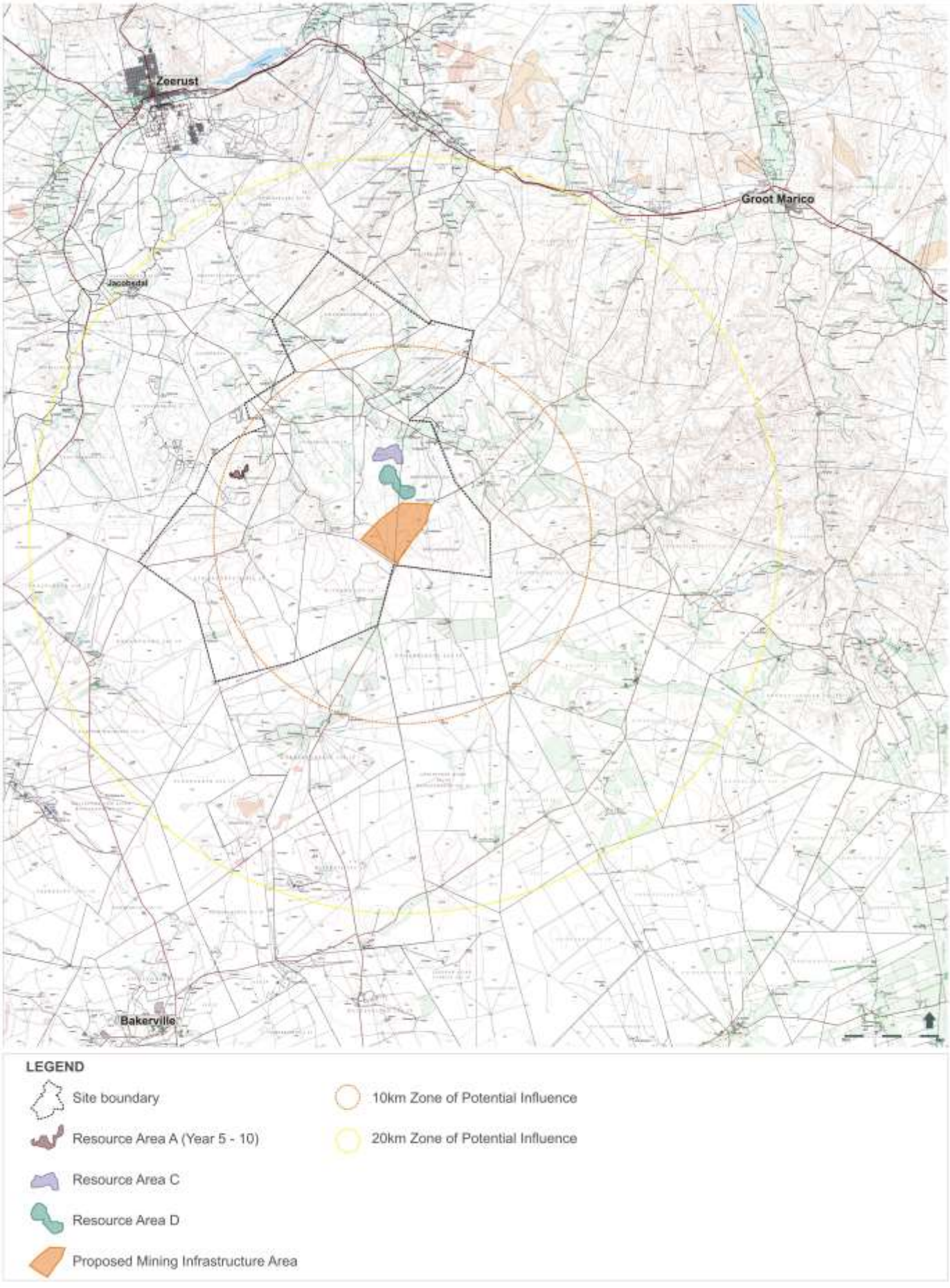


Figure 1: LOCALITY MAP - Doornhoek Fluorspar

1.5 Assumption, Uncertainties and Limitations

The following assumptions limitations have been made in the study:

- The study uses the worst case scenario in predicting impacts (day time and night time);
- The viewshed analyses considered only the topography of the area and did not factor in any features such as existing trees and other obstacles. This means that the spatial patterns generated in the analyses are inclined towards the worst case-scenario rather than the actual situation;
- The extent of the study area is determined by the zone of potential influence, which in this study relates to a radius about the project site of 10km. At 10km and beyond the Project would recede into background views.
- The computer model for the 3D depiction of the project components is based on CAD information provided to NLA by the project engineers / environmental practitioner.

2. LEGAL REQUIREMENTS AND GUIDELINES

This report adheres to the following legal requirements and guideline documents.

2.1 National Guidelines

National Environmental Management Act (Act 107 of 1998) EIA Regulations

The specialist report is in accordance to the specification on conducting specialist studies as per Government Gazette (GN) R 543 of the National Environmental Management Act (NEMA) Act 107 of 1998. The mitigation measures as stipulated in the specialist report can be used as part of the Environmental Management Plan (EMP) and will be in support of the Environmental Impact Assessment (EIA).

The NEMA Protected Areas Act (57 of 2003)

The main aim of the Act is to identify and protect natural landscapes. According to the 2010 regulations there are specific regulations for compilation of specialist report. This VIA report adheres to these specifications.

The National Heritage Resources Act (25 of 1999)

The Act is applicable to the protection of heritage resources and includes the visual resources such as cultural landscapes, nature reserves, proclaimed scenic routes and urban conservation areas.

Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)

Although the guidelines were specifically compiled for the Province of the Western Cape it provides guidance that will be appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.

2.2 International Guidelines

World Bank's IFC Standards

The World Bank's IFC Standards: Environmental, Health and Safety Guidelines for Mining refers to Visual Impact Assessments by stating that:

"Mining operations, and in particular surface mining activities, may result in negative visual impacts to resources associated with other landscape uses such as recreation or tourism. Potential contributors to visual impacts include high walls, erosion, discoloured water, haul roads, waste dumps, slurry ponds, abandoned mining equipment and structures, garbage and refuse dumps, open pits, and deforestation. Mining operations should prevent and minimize negative visual impacts through consultation with local communities about potential post-closure land use, incorporating visual impact assessment into the mine reclamation process. Reclaimed lands should, to the extent feasible, conform to the visual aspects of the surrounding landscape. The reclamation design and procedures should take into consideration the proximity to public viewpoints and the visual impact within the context of the viewing distance. Mitigation measures

may include strategic placement of screening materials including trees and use of appropriate plant species in the reclamation phase as well as modification in the placement of ancillary facilities and access roads."

The specialists study is in accordance to the IFC Performance Standards (Performance Standard 1: Social and Environmental Assessment and Management Systems) for the undertaking of Environmental Assessments and contributes to the EIA for the proposed Project.

International Guidelines

The guidelines listed below were used as part of the research done for the methodology and mitigation measures:

- Program Policy on Assessing and Mitigating Visual Impacts (Sama 2000).
- Guidelines for Landscape and Visual Impact Assessment (Institute of Environmental Assessment & The Landscape Institute 1996).

3. APPROACH AND METHODOLOGY

3.1 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).

3.1.1 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.

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 and 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 B 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 recognized 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).

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 criteria given in Appendix B are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

3.1.2 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).

3.1.3 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 combination of the natural landscape (mountains, streams and the vegetation) together with the manmade structures (residential areas, roads, mining activities and power lines) contribute to the sense of place for the study area. It is these land-uses, which define the area and establish its identity.

3.1.4 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. This may be determined with respect to its 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 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 traveling through or past the affected landscape in cars or other transport modes;
- People at their place of work.

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

3.1.5 Landscape Impact

The landscape impact of a proposed development is measured as the change to the fabric, character and quality of the landscape caused by the physical presence of the proposed development. Identifying and describing the nature and intensity (severity) 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). In order 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 is then observable and an assessment of the anticipated visual intrusion can be made.

3.1.6 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 with 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).

3.1.7 Severity of Visual Impact

The severity 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 severity 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 Appendix B, C and D. Image 1 below, graphically illustrates the visual impact process:

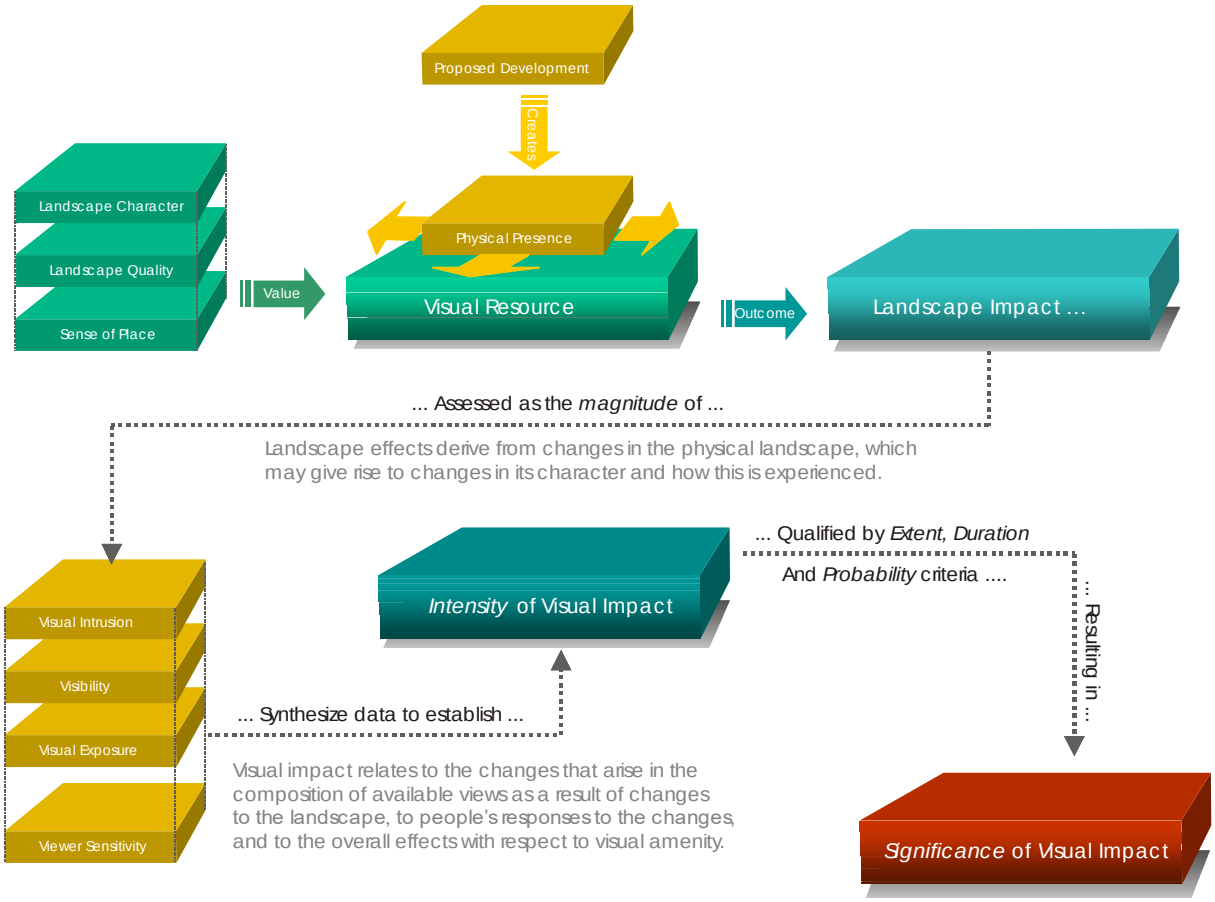


Image 1: Visual Impact Process

3.1.8 Significance of Visual Impact

A combined quantitative and qualitative methodology, as supplied by the Environmental Practitioner, was used to describe the impacts for: significance, spatial scale, temporal scale, probability and degree of certainty. A summary of each of the qualitative descriptions along with the equivalent quantitative rating scale is given in Annexure C.

3.2 Methodology

The following method was used:

- Site visit: A field survey was undertaken and the study area scrutinized to the extent that the receiving environment could be documented and adequately described. The field survey was conducted on 7 and 8 June 2016.
- Project components: The physical characteristics of the project components were described and illustrated;
- General landscape characterization: The 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 B);
- The **landscape character** of the study area was described. The description of the landscape focused on the nature and character of the landscape rather than the response of a viewer;
- The **quality of the landscape** was described. Aesthetic appeal was described using recognized contemporary research in perceptual psychology as the basis;
- The **sense of place** of the study area was described as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities was the spatial form and character of the natural landscape together with the cultural transformations associated with the historic / current use of the land;
- Potential **sensitive viewers** were identified.
- Measures that could **mitigate the negative impacts** of the proposed project were recommended.

4. DESCRIPTION OF THE PROJECT

SA Fluorite (Pty) Limited and Southern Palace 398 (Pty) Limited are exploration and mining companies which hold prospecting rights over the proposed mining area as shown on Figure 1: Locality Map. The controlling interest in both these companies is held by the ERG Group which is planning on consolidating the prospecting rights and applying for a mining right over the consolidated area.

Prospecting activities which were carried out over the past few years indicated that economically viable concentrations of fluorspar may be found underlying these properties, and hence the reason for applying for a consolidated mining right.

Due to poor international market conditions it will be necessary to gradually phase in the mining activities, and to divide the mining activities into two phases. The first phase will take place on portions of Rhenosterfontein 304 JP, and the second phase will take place on portions of the Farm 306 JP.

The first phase of mining (year 5-10) will take place on portions of the farm Rhenosterfontein 304 JP (Resource Area A), and the second phase (year 10-30) will take place on portions of the Farm 306 JP (Resource Areas C &D). The mine surface infrastructure is proposed to be located on the above farm.

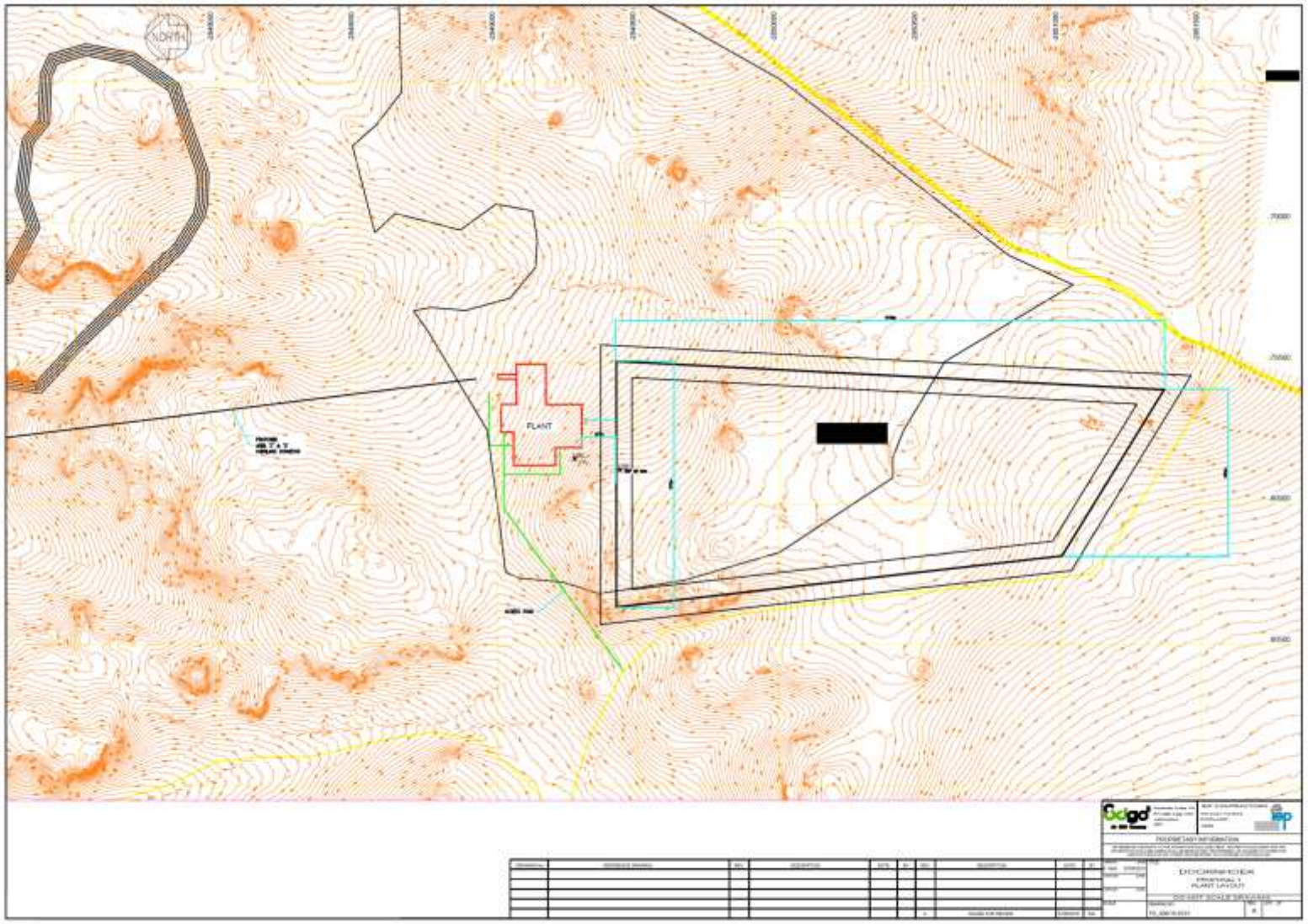
Physical mining will only begin in year 5 after the mining license has been granted. Road and plant construction will take place in the years before this.

Refer to Figure 1: Locality Map and Figures 2 - 5: Project Alternatives for the proposed layouts.

5. PROJECT ALTERNATIVES

There are currently four project alternatives for the location of the plant and the TSF. These alternatives have been identified during the Scoping Phase and will be assessed during the Impact Assessment Phase of the project.

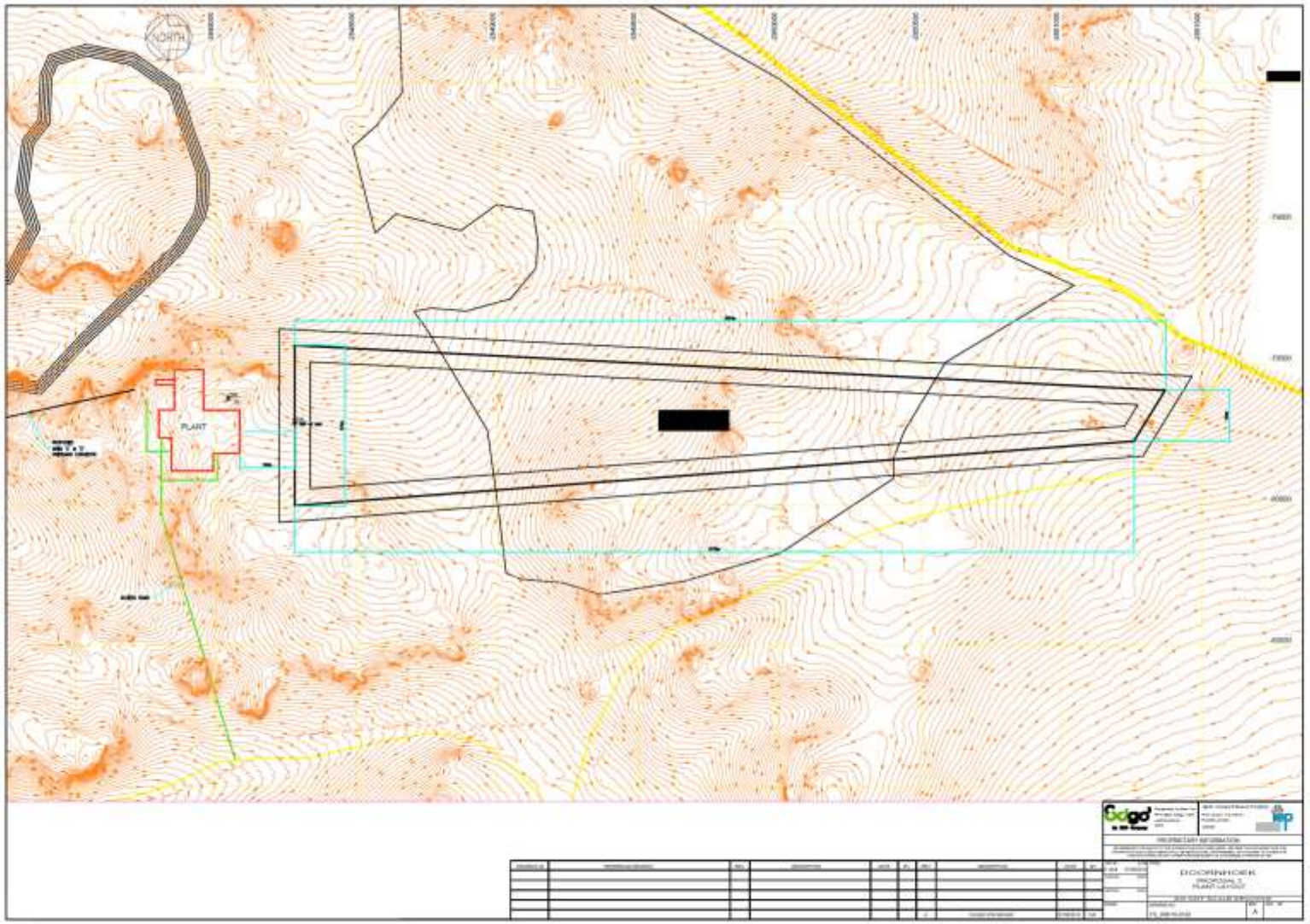
The four project alternatives can be viewed on Figures 2 – 5: Project Alternatives.



Project alternatives as provided by Exigo3

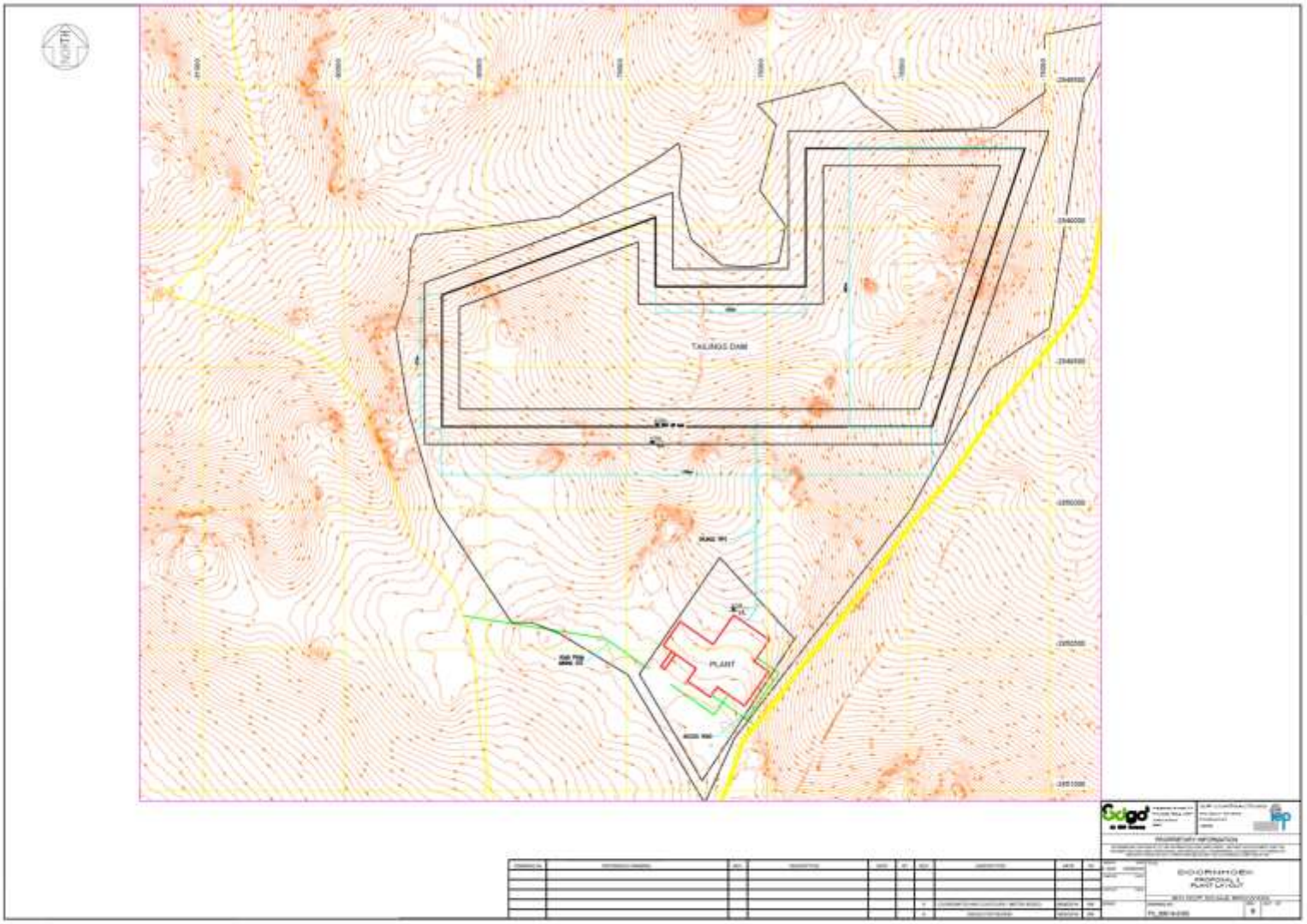
Figure 2: ALTERNATIVE 1 - Doornhoek Fluorspar

September 2016



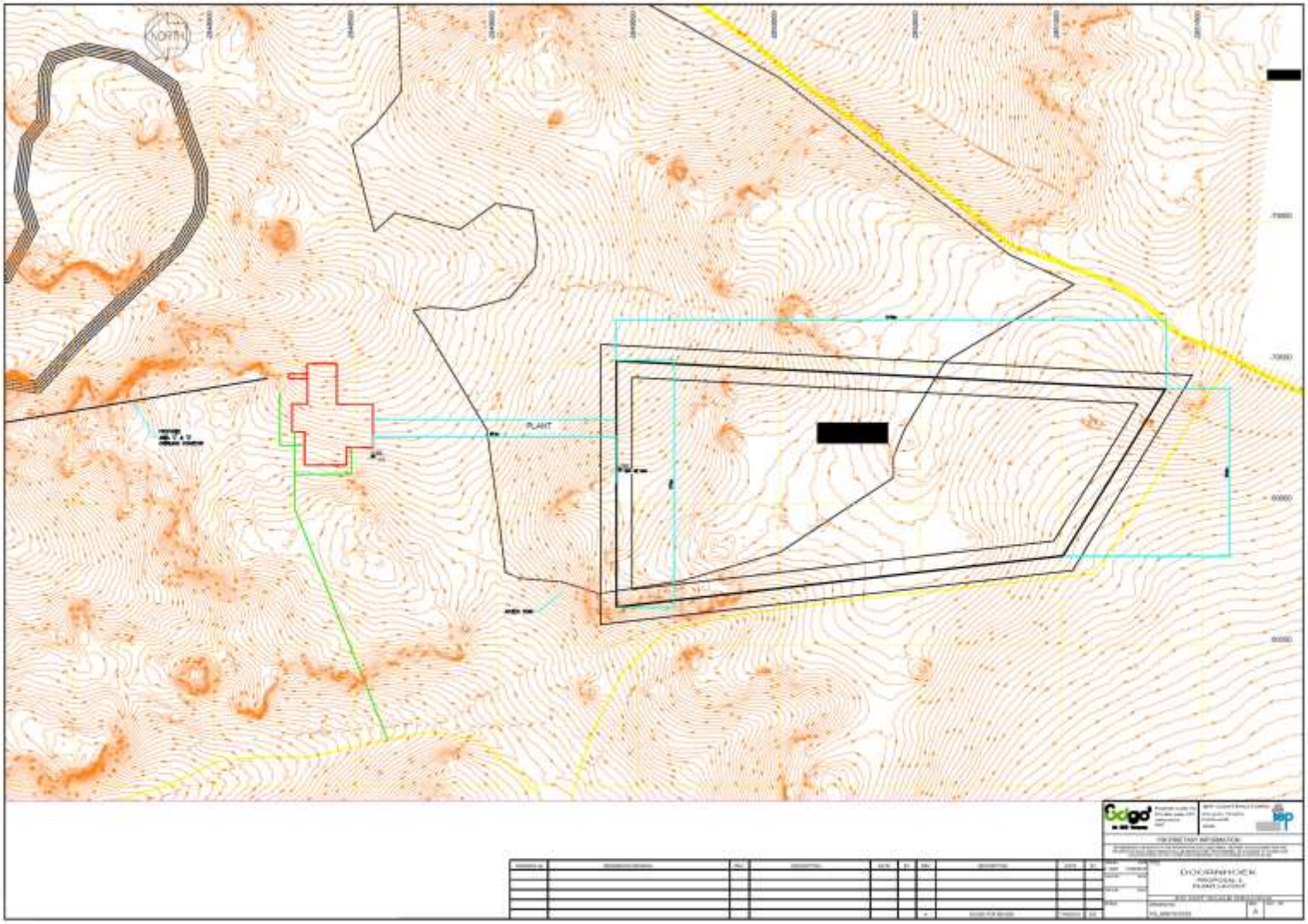
Project alternatives as provided by Exigo3

Figure 3: ALTERNATIVE 2 - Doornhoek Fluorspar



Project alternatives as provided by Exigo3

Figure 4: ALTERNATIVE 3 - Doornhoek Fluorspar



Project alternatives as provided by Exigo3

Figure 5: ALTERNATIVE 4 - Doornhoek Fluorspar

6. VISUAL ISSUES

Typical issues associated with mining projects of this nature are:

- Who will be able to see the new development?
- What will it look like and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area and if so how?
- What will be the impact of the development at night?
- What will the cumulative impact be?

The public participation process was done by Exigo Sustainability and during this process no visual concerns were raised.

7. THE ENVIRONMENTAL SETTING

7.1 The Study Area

For the following section, refer to views on Figures 7 to 14. The locations for panorama views are indicated on Figure 6.

The project is located in the Moot Plains Bushveld vegetation unit. This vegetation unit is characterised by open to closed, low, often thorny savanna dominated by various species of *Acacia* in the bottomlands and plains as well as woodlands of varying height and density on the lower hillsides (Mucina, L. & Rutherford, M.C. (eds), 2006). The surrounding landscape is a combination of Zeerust Thornveld and Carletonville Dolomite Grassland which is characterised by valley, ridges and slightly undulating plains with rocky ridges (Mucina, L. & Rutherford, M.C. (eds), 2006).

7.2 Surrounding Land Use

7.2.1 Residential

The residential component consist of three types of residential areas, farmsteads that are spread out through the site, workers housing and more formal residential areas associated with towns such as Zeerust.

7.2.2 Agriculture

The dominant vegetation in the area is the open grassland that is used by farmers for grazing of both cattle and game. There are smaller areas that are used for crop production as well as chicken farms (E&S Chickens, FMS Vlakvallei Farms).

7.2.3 Tourism

Tourism in the area includes game farms / lodges and camping sites such as the Witdoorn 4x4 Camp Site. During the site visit the following game farms / lodges were noted; Marikwa Game Farm, Mmalogaga Game Ranch, Die Rabe's and Emerald Panther Lodge. Refer to view 8 and 9 on Figure 10.

7.2.4 Infrastructure, Industries and Mining

Infrastructure in the study area includes Eskom power lines as well as the Telkom Tower / SANDF Tower. There is old mining infrastructure located in the area that has been identified for the Resource Area A for years 5 – 10 of mining operations. Refer to view A and B on Figure 14. There is a small charcoal industry located in the study area, refer to view 13 on Figure 11.

7.2.5 Transportation systems

Most of the roads in the study area are dirt roads with some tarred roads that lead to towns such as Zeerust, Groot Marico and Koster. There is no railway line within the study area and access to the N4 will be with one of the local roads which could either be a tarred or dirt roads. It is however proposed to transport the product from the mine to a rail siding in proximity of the mine from where it will be railed to the Durban Harbour or port of choice. The nearest siding is located near Jacobsdal.

7.3 Landscape Character

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

The Project study area has a rolling topography which varies from slightly undulating open grasslands to deeper valleys and ridges created by the Klein-Marico River and associated tributaries. The vegetation is a combination of bushveld / woodlands, with dense medium sized trees, and open grassland areas.

The man-made structures are limited to the few farmsteads, agricultural activities and lodges / game farms located within the study area. Although there is infrastructure in the study area it is not dominating the area.

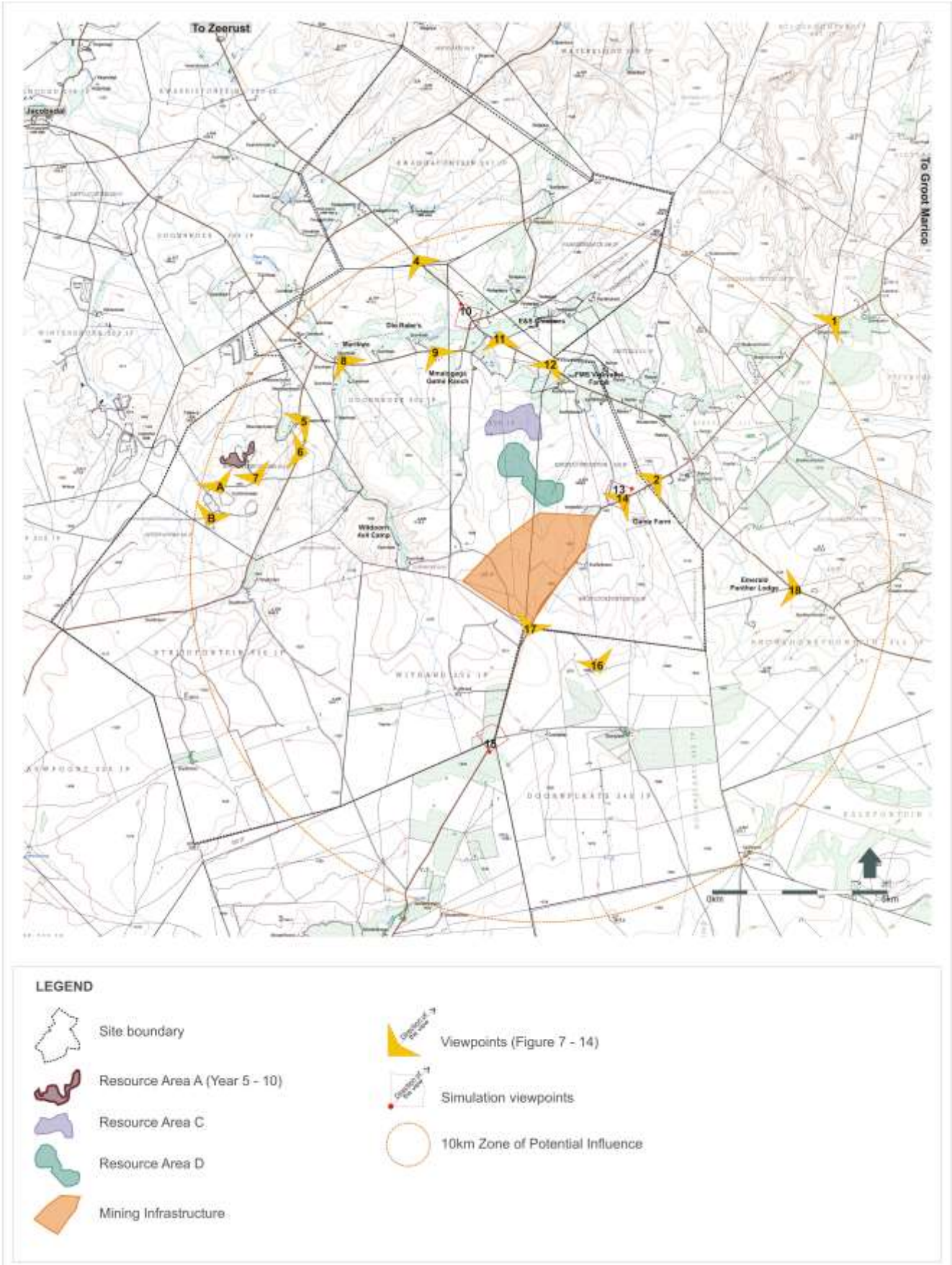


Figure 6: VIEWPOINTS - Doornhoek Fluorspar

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View 1: View from local dirt road towards the proposed mining infrastructure area, photo taken towards the south-west (8.3km from site).

View 2: View from local dirt road towards the proposed infrastructure area, photo taken towards the south-west (1.9km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 7: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 3: View from local road (Groot Marico Rd) towards the proposed Resource Area C, photo taken towards the south-west (10.7km from site).

View 4: View from local road (Kwaggafontein) towards the proposed Resource Area C, photo taken towards the south-west (5.3km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 8: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 5: View from local road (Lichtenburg Rd) towards Resource Area A, photo taken towards the west (1.4km from site).

View 6: View from local road (Lichtenburg Rd) towards Resource Area A, photo taken towards the west (1.3km from site).

View 7: View from existing mining area towards the proposed new pit area (Resource Area A), photo taken towards the north (0.7km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 9: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 8: View from local dirt road (Marikwa Game Farm) towards Resource Area C, photo taken towards the south-east (4.6km from site).

View 9: View from local dirt road (Mmalogaga Game Ranch) towards Resource Area C, photo taken towards the south-east (2.3km from site).

View 10: View from local road towards Resource Area C, photo taken towards the south (2.8km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 10: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 11: View from local road (E & S Chickens) towards Resource Area C, photo taken towards the south (1.9km from site).

View 12: View from local road towards Resource Area C, photo taken towards the south (1.2km from site).

View 13: View from local dirt road towards Resource Area D, photo taken towards the west (1.8km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 11: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 14: View from local dirt road towards Resource Area D, photo taken towards the west (1.8km from site).

View 15: View from local dirt road towards the Mining Infrastructure Area (Plant & TSF), photo taken towards the north (1.8km from site).

View 16: View from local dirt road towards the Mining Infrastructure Area (Plant & TSF), photo taken towards the north-west (1.1km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 12: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View 17a: View from local dirt road towards the south of the Mining Infrastructure Area (Plant & TSF).

View 17b: View from local dirt road towards the Mining Infrastructure Area (Plant & TSF), photo taken towards the north.

View 18: View from local road (Koster Road) towards the Mining Infrastructure Area (Plant & TSF), photo taken towards the west (6km from site).

Refer to Figures 6 for the location of the viewpoints

Figure 13: LANDSCAPE CHARACTER - Doornhoek Fluorspar

View A: View towards the existing mining infrastructure, open pit mining area

View B: View towards the existing mining infrastructure, plant and open pit mining area

Refer to Figures 6 for the location of the viewpoints

Figure 14: LANDSCAPE CHARACTER - Doornhoek Fluorspar

8. VISUAL RESOURCE

8.1 Visual Resource Value / Scenic Quality

It is difficult to separate out the aesthetic value of a landscape into its component parts as it is always viewed as a composite of them, yet an attempt is made here to also illustrate the sensitivity of the various landscape types to visual intrusion. The spatial distribution of the landscape types discussed in 5.3 is illustrated in Figure 15: Landscape Quality. The figures also rate the relative scenic quality of each landscape type and its sensitivity

Scenic quality ratings (using the scenic quality rating criteria described in Appendix C) were assigned to each of the landscape types defined in Figure 16. The *highest* value is assigned to Klein-Marico River, associated streams and game farms. Other water bodies, the open grassland was considered to have a *moderate* scenic value.

The agricultural fields, farmsteads and towns were rated as *moderate*. The landscape types with the *lowest* scenic quality include the roads, power lines and existing mines. Although there are old mining structures located within the study area the landscape is dominated by a natural environment which gives the study area a ***high*** visual resource value. As a result of this rating, the study area is regarded to be highly sensitive to change to the landscape. A summary of the visual resource values is tabulated in Table 1 below.

Table 1: Value of the Visual Resource

(After The Landscape Institute with the Institute of Environmental Management and Assessment, 2002)

High	**Moderate**	**Low**
Klein-Marico River, associated streams and Game Farms	Ridge, Grassland, Agricultural Fields and Farmsteads	Roads, power lines and the old mine
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.	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.	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.
Sensitivity: It is sensitive to change in general and will be	Sensitivity: It is potentially sensitive to change in general and change	

detrimentally affected if change is inappropriately dealt with.	may be detrimental if inappropriately dealt with

8.2 Sense of Place

The sense of place for the proposed study area derives from the combination of all landscape types and their impact on the senses. The ridgeline, rivers / streams, grassland, woodlands, game farms and agricultural fields give the area a pastoral sense of place. Even though there are old mining infrastructure located within the study area these structures are hidden away and the mine hasn't been operational in the last few years. As a result it can be said that the mining activities are forgotten and therefore the study area has a pastoral sense of place.

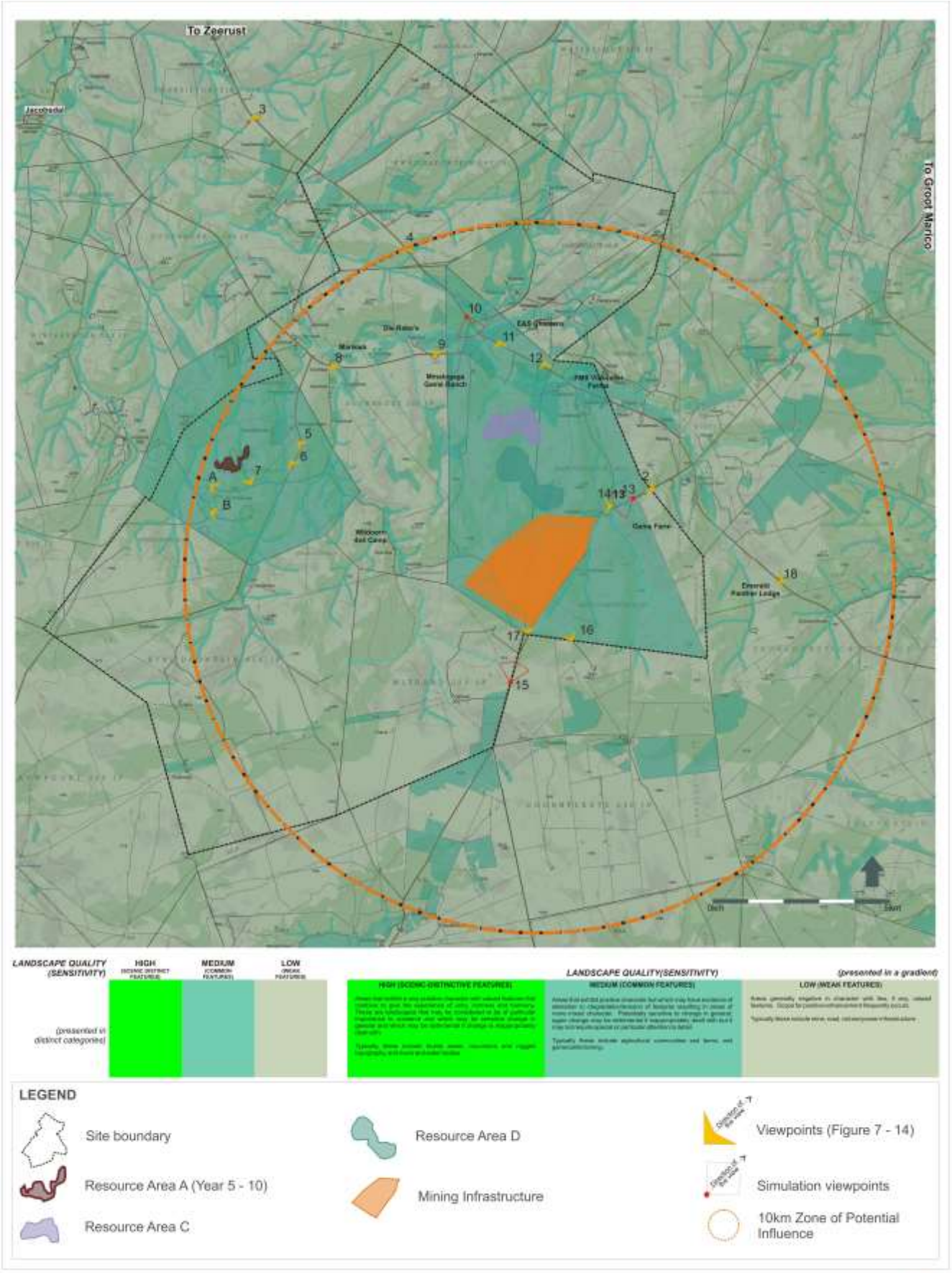

Figure 15: LANDSCAPE QUALITY - Doornhoek Fluorspar

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9. VISUAL RECEPTORS

9.1 Views

Visual receptors would include people travelling along the local roads, residents staying in the farmsteads or workers' residences, people visiting game farms / lodges located within the study area.

9.1.1 Potential Sensitive Viewers

Most of the sensitive viewers are located in an arc towards the north, north-east and north-west of the Project site. The following viewers were identified as potential sensitive viewers during the site visit, refer to Figure 16: Potential Sensitive Viewers.

Table 2: Potential Sensitivity of Visual Receptors

High	**Moderate**	**Low**
Farmsteads, worker's residence's, farmers travelling along dirt roads, traveler's travelling to game farms, game farms	Motorist travelling through the study area	Employees in the mining / industrial sector or motorist travelling for mining purposes
Visitors of tourist attractions and travelling along local 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.	Visitors and people working within the study area and travelling along local roads whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

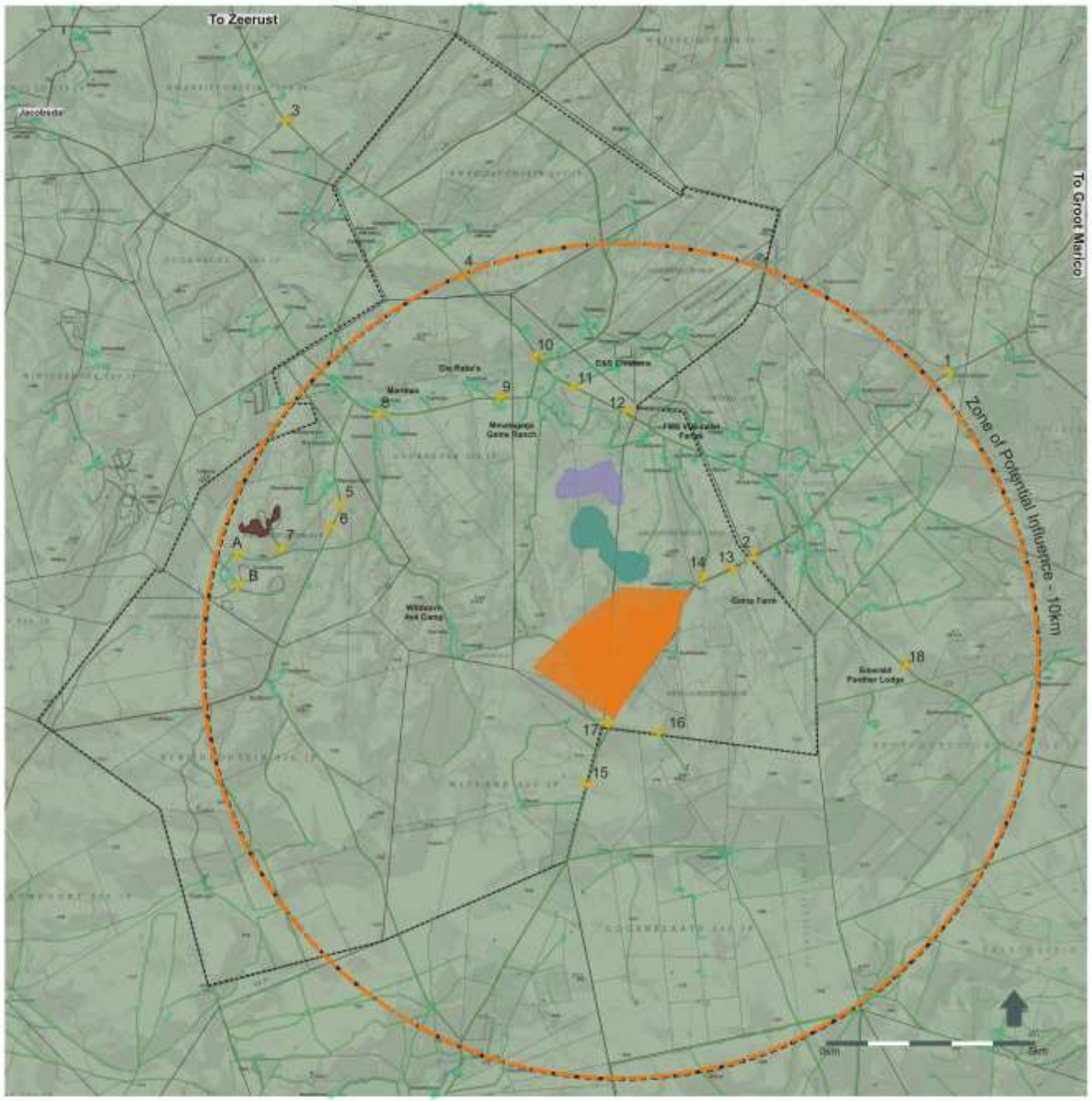

Figure 16: POTENTIAL SENSITIVE VIEWERS - Doornhoek Fluorspar

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10. LANDSCAPE IMPACT

10.1 Landscape Impact

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of the intervention) of the Doornhoek Fluorspar project is predicted to be *high* due to effect of the project's activities as described in Section 4 on the site. The activities will be extensive and although there are similar mining infrastructure in the area the existing mining infrastructure is screened due to the topography of the area. The proposed Doornhoek Fluorspar will therefore be in contrast to the surrounding land use and will appear 'out of place'. The proposed project will have a negative landscape impact.

As stated in the approach section, the physical change to the landscape at the project site must be understood in terms of its visibility (impact on sensitive views) and its effect on the visual aesthetics of the study area (intensity of impact on the baseline resource). The following sections discuss the effect that the Doornhoek Fluorspar project could have on the visual and aesthetic environment.

11. VISUAL IMPACT

Visual impacts will be caused by activities and infrastructure in all project phases i.e. construction, operational, decommissioning and closure. The activities associated with the plant, will be visible (day and night), to varying degrees from varying distances around the project site. During construction of infrastructure within the project site this visibility will be influenced by the increase in activities, removal of vegetation, exposure of earth and the construction of the tall structures. During operation/decommissioning/closure phases the visual qualities of the project site will be influenced by the success and effectiveness of rehabilitation measures.

The *intensity* 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. Consequence is a function of intensity, spatial extent and duration and significance is the function of consequence and probability. Refer also to Appendix C and Figure A.

11.1 Potential Receptors

Areas and sites considered potentially sensitive to project activities in the study area are, tourist facilities, public roads and settlement areas (residential areas). Figure 16 identifies the these places relative to the project site and rates receptor sensitivity (worst case scenario) in terms of high, medium and low sensitivity. Typically, high receptor sensitivity, includes people using outdoor recreational/tourism facilities, public rights of way and residents of housing areas, whose intention or interest may be focused on the landscape; medium sensitivity relates to people engaged in outdoor sport or recreation (other than appreciation of the landscape i.e. hunting); and low sensitivity would 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). Refer also to Appendix B.

Most of the sensitive viewers are located in an arc towards the north, north-east and north-west of the Project site. Most public views to the Doornhoek Fluorspar project would be experienced by people traveling along the road bordering the eastern boundary of the project site (potential foreground and middleground views of the project site – refer also to Figures 11, 12 and 13), people visiting the nearby lodges and game farms (middleground views – Figure 10, 12 and 13) and farmers travelling on the local dirt roads (middleground views – Figure 10 and 11). Most of the panoramic views were taken at elevated points along the public routes, due to the rolling topography of the area the proposed project will not be visible for the full extend that people travel along these public routes.

Private views from nearby farmsteads/homesteads (north west, north and north east of the site) will vary depending on the orientation of the houses as well as the position (elevation) within the topography. There are three lodges/game farms located within the study area (Mmalogaga Game Ranch, Game Farm, Witdoorn 4x4 Camp and Emerald Panther Lodge) and visitors to these lodges/game farms might have views towards the proposed project while driving around or when staying at the lodge/game farms.

11.2 Visibility, Visual Exposure and Visual Intrusion

The 'zone of potential influence' was established at 10km. Over 10km the impact of the proposed Doornhoek Fluorspar project and associated activities would have reduced due to the diminishing effect of distance and atmospheric conditions (haze) on visibility. Also, at this distance the project's features would recede into the background of views, thus being 'absorbed' into the landscape setting. Visual exposure is determined by qualifying the view with a distance rating to indicate the degree of intrusion and visual acuity.

At night the above would also be true, however, the project's light sources would stand out against the dark skies since there are no similar activities within the project site. Most of the light sources are from farmsteads/homestead or lodges/game farms.

11.2.1.1 Visibility

In determining the visibility of the Doormhoek Fluorspar project the heights of the various project components were used. Offsets starting at 5m above ground level (i.e. most project components would be visible) through to 55m (TSF) were used to generate the viewsheds. The offset for the plant was 28m. These are evident in Figures 17 to 23. It can be seen from the patterns generated by the viewsheds that the proposed project operations would be highly visible within the study area and that sensitive viewing areas would be impacted.

It must be understood that these patterns represent *potential* viewing sites and illustrate the absolute worst case scenario i.e. the landscape without vegetation. It is imperative that the viewsheds be understood in terms of the site visit findings as illustrated in the panoramas in Figures 7 to 14, the simulations in Figures 24 and 25 and the fact that the study area has a rolling topography. The project site is located within a savannah/woodlans landscape which would effectively block some of the views to the site especially if the viewer/viewpoint is surrounded by vegetation and/or located within a lower lying area (Figures 7 and 10). Visibility of the project components (Resource Areas C & D, plant and TSF) from sensitive viewing areas was considered to be *high.* Resource Area A was considered to have a *low* visibility since the mining area will be located within the existing mining site (Figure 9 and 14) and will mostly be screened due to the topography and vegetation of the area. When comparing the viewsheds of the four layout alternatives it is clear that the pattern of the viewshed is more or less the same. The viewshed for Layout Alternative 1 indicates that the proposed plant and TSF will be more visible to the west of the project site when compared to Layout Alternative 4, which has a similar layout. The difference however is the location of the plant. The plant will be less visible on Layout Alternative 4 as it is located in a valley. Layout Alternative 3 will be more visible from the sensitive viewers located in the northern arch when comparing it with the other three alternatives. The visibility of Layout Alternative 2 will be similar to that of Layout Alternative 1.

11.2.1.2 Visual Exposure and Sensitivity

Table 3, 4 and 5 below indicates the potential exposure of the various sensitive viewing areas to the project components (Resource Area C & D, plant and TSF). 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. Again it must be realized that although the exposure ratings given below would contribute to the intensity of impact, the effect of vegetation and topography would completely or partially block some of these views. The exposure, generally, would be considered to be *moderate* with only a few sensitive viewers that will experience the project in their foreground view. Table 3, 4 and 5 below identifies sensitive receptor areas within the study area.

Table 3: Sensitive Receptors – Visual Exposure of the Project Plant and TSF

	Foreground view i.e. 0 – 0.8km from Project Site	Middle-ground view i.e. 0.8 - 3km from Project Site	Background view i.e. 3km - 10km from Project Site	Far Background i.e. greater than 10km from Project Site
Public roads	**x**	**x**	**x**	**x**
Witdoorn 4x4 Camp		**x**	**x**	
Mmalogaga Game Ranch		**x**	**x**	
Game Farm	**x**	**x**	**x**	
Emerald Panther Lodge			**x**	
Farmsteads/Homesteads			**x**	**x**

Table 4: Sensitive Receptors – Visual Exposure of the Project Resource Area C

	Foreground view i.e. 0 – 0.8km from Project Site	Middle-ground view i.e. 0.8 - 3km from Project Site	Background view i.e. 3km - 10km from Project Site	Far Background i.e. greater than 10km from Project Site
Public roads		**x**	**x**	**x**
Witdoorn 4x4 Camp				
Mmalogaga Game Ranch	**x**	**x**		
Game Farm				
Emerald Panther Lodge				
Farmsteads/Homesteads	**x**	**x**	**x**	**x**

Table 5: Sensitive Receptors – Visual Exposure of the Project Resource Area D

	Foreground view i.e. 0 – 0.8km from Project Site	Middle-ground view i.e. 0.8 - 3km from Project Site	Background view i.e. 3km - 10km from Project Site	Far Background i.e. greater than 10km from Project Site
Public roads		**x**	**x**	**x**
Witdoorn 4x4 Camp		**x**	**x**	
Mmalogaga Game Ranch		**x**	**x**	
Game Farm		**x**	**x**	
Emerald Panther Lodge			**x**	
Farmsteads/Homesteads		**x**	**x**	**x**

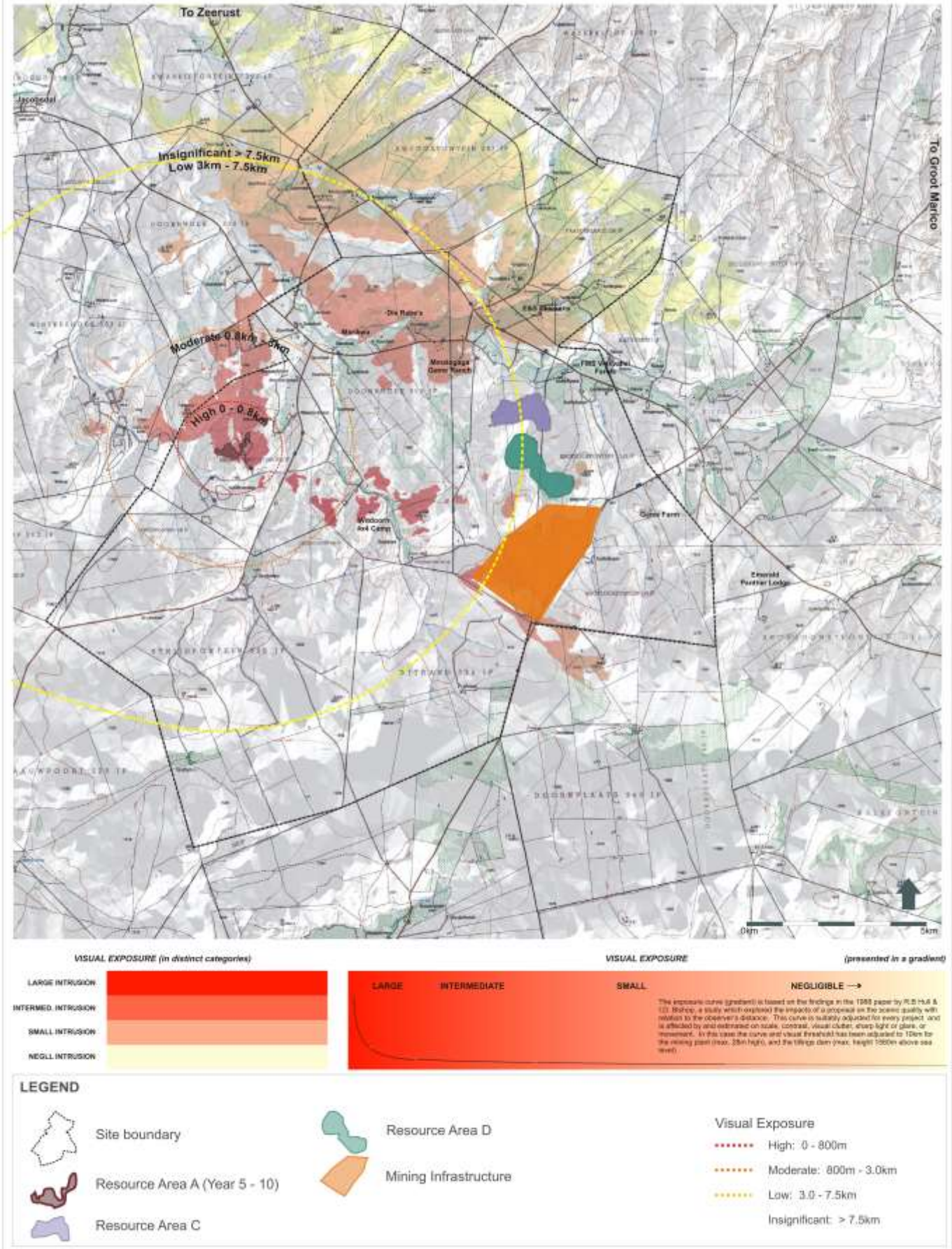

Figure 17: VIEWSHED Resource Area A (1 - 5 yrs) - Doornhoek Fluorspar

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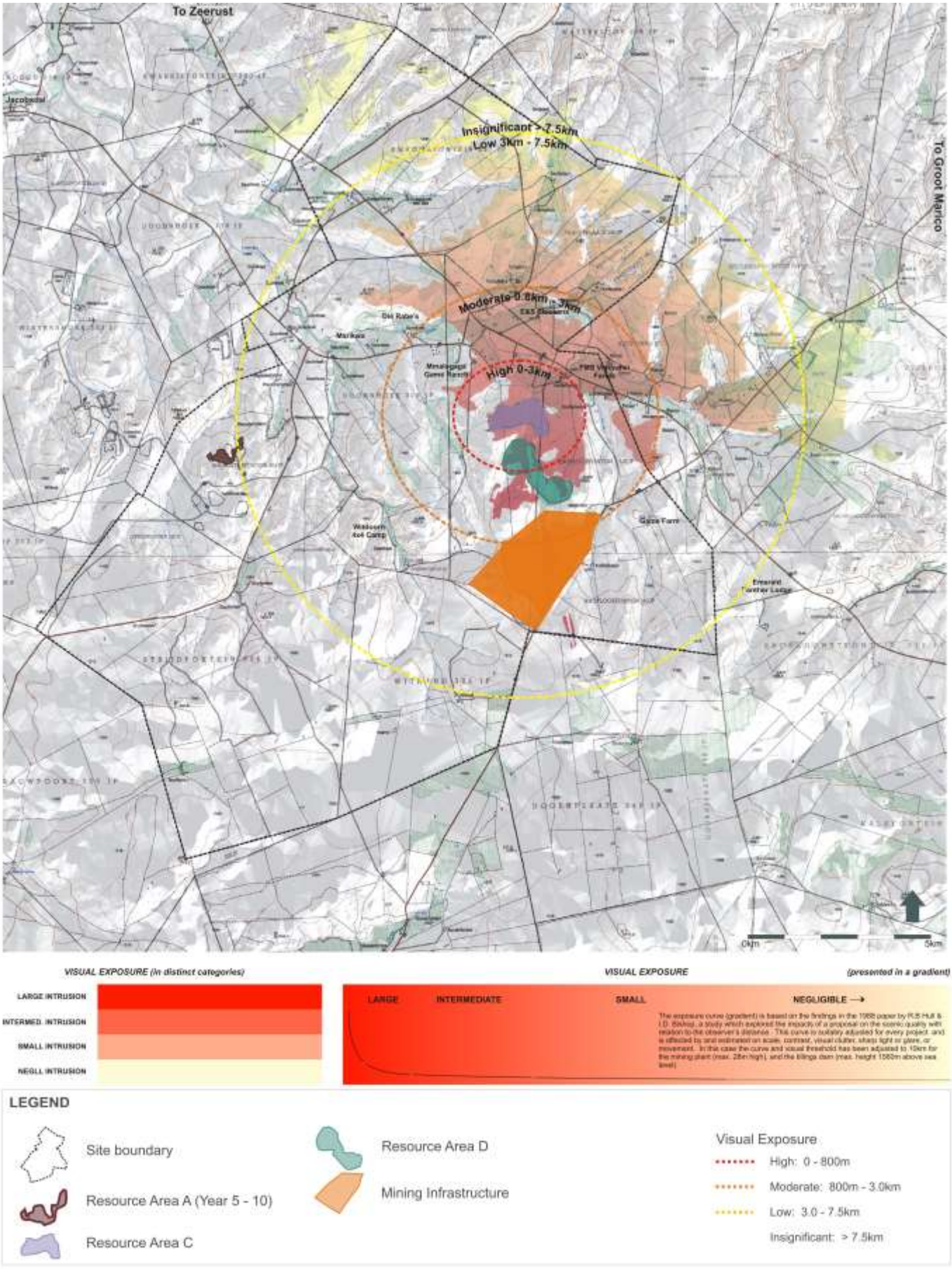

Figure 18: VIEWSHED Resource Area C - Doornhoek Fluorspar

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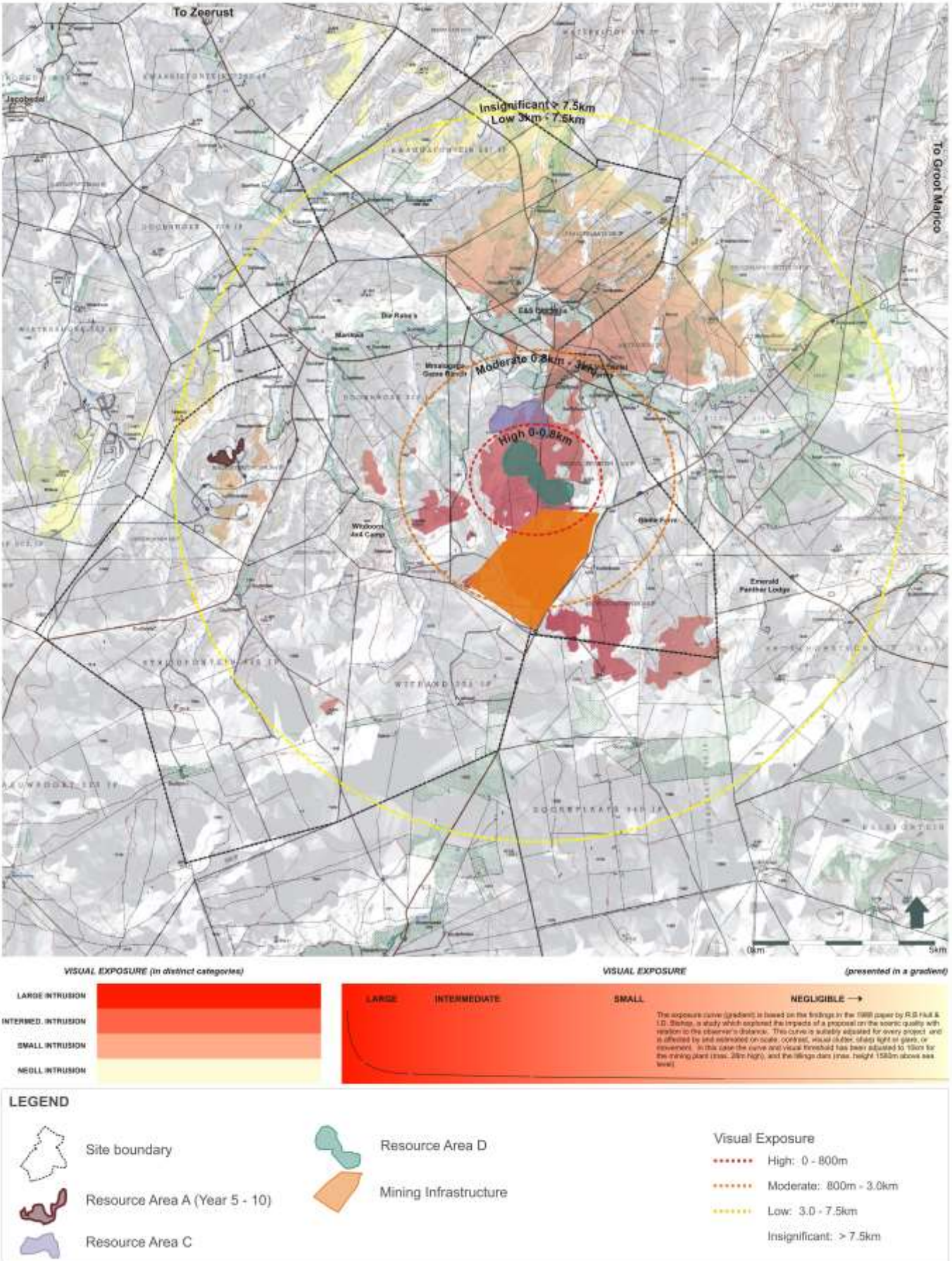

Figure 19: VIEWSHED Resource Area D - Doornhoek Fluorspar

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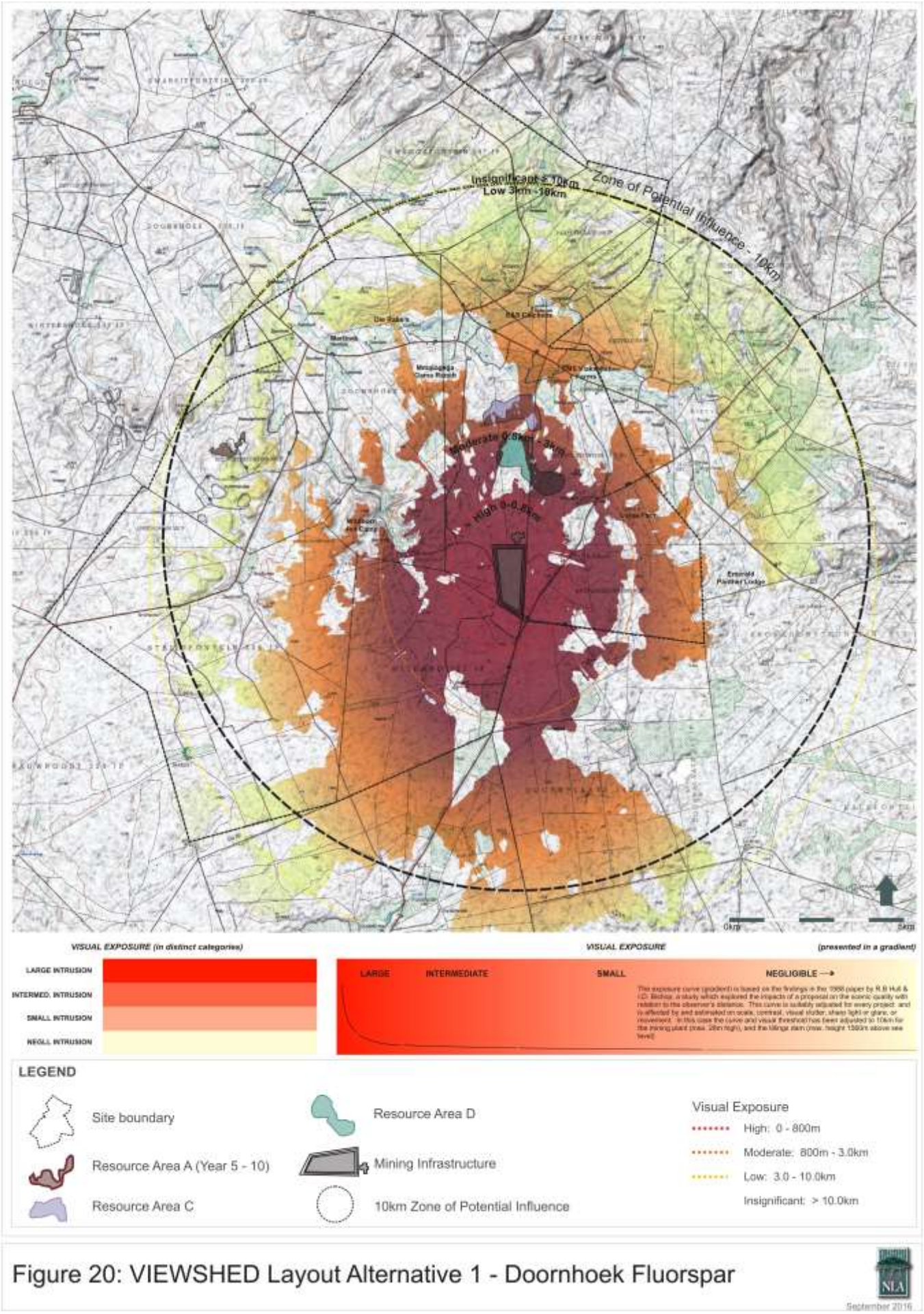

Figure 20: VIEWSHED Layout Alternative 1 - Doornhoek Fluorspar

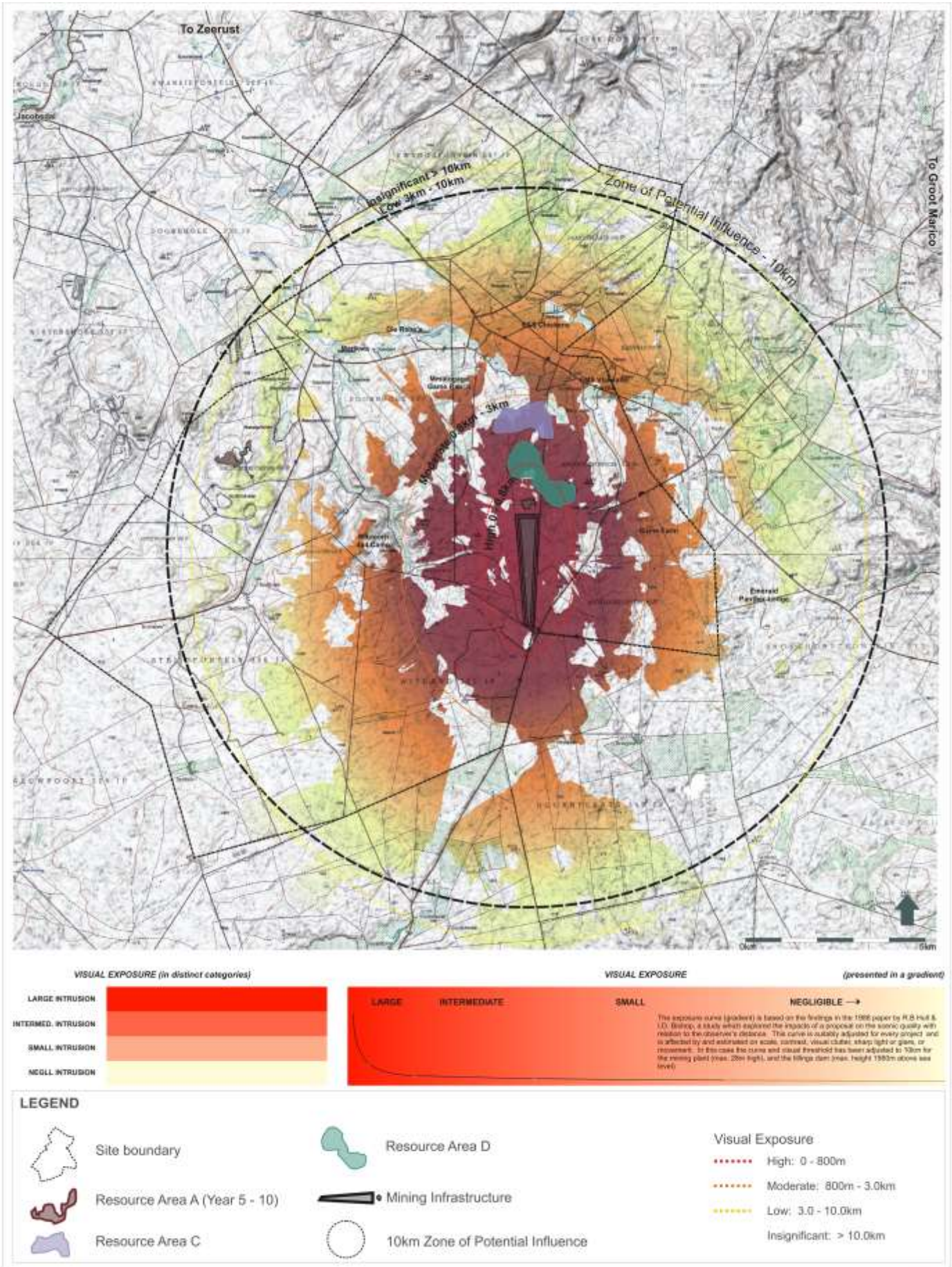

Figure 21: VIEWSHED Layout Alternative 2 - Doornhoek Fluorspar

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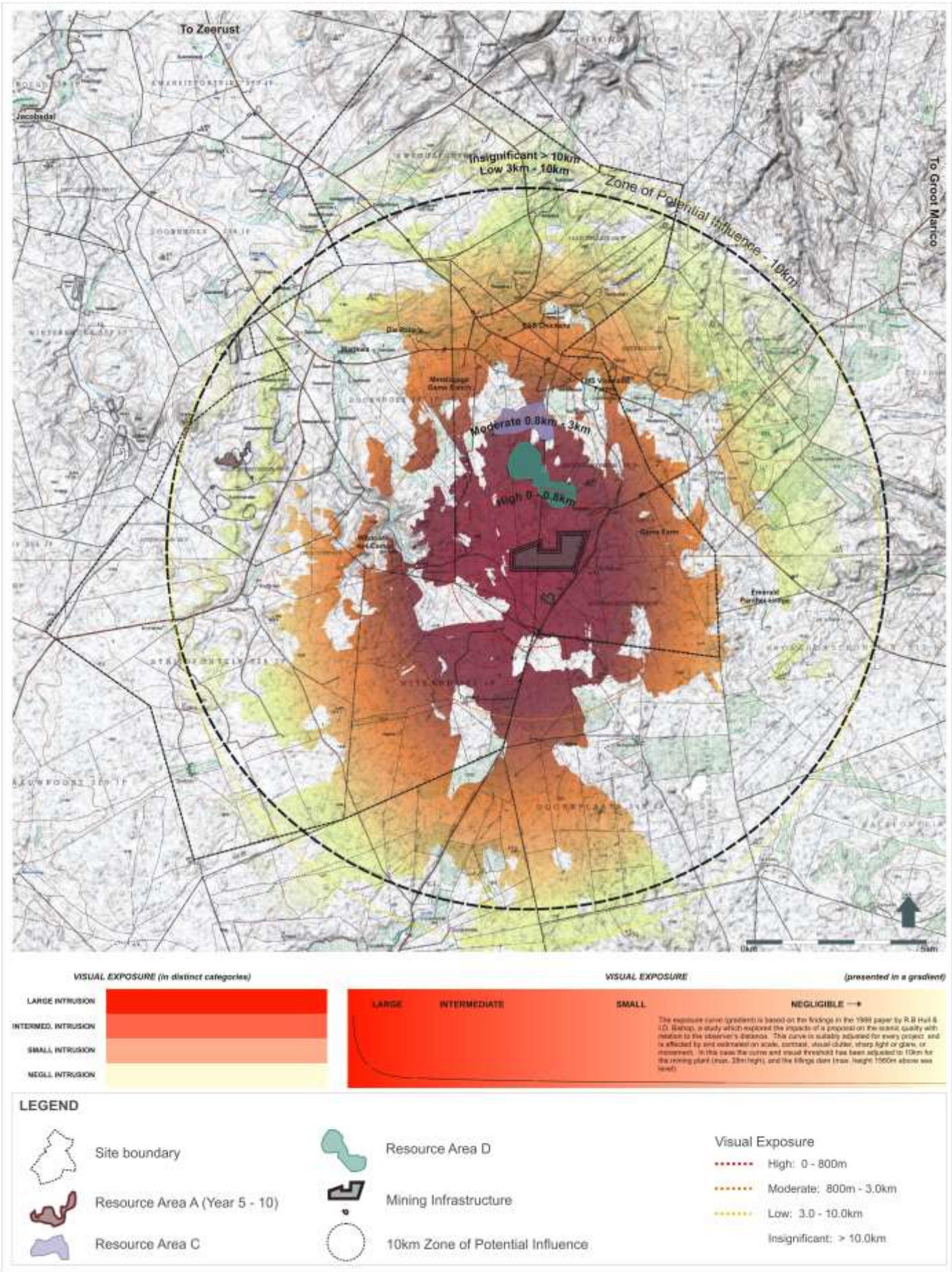

Figure 22: VIEWSHED Layout Alternative 3 - Doornhoek Fluorspar

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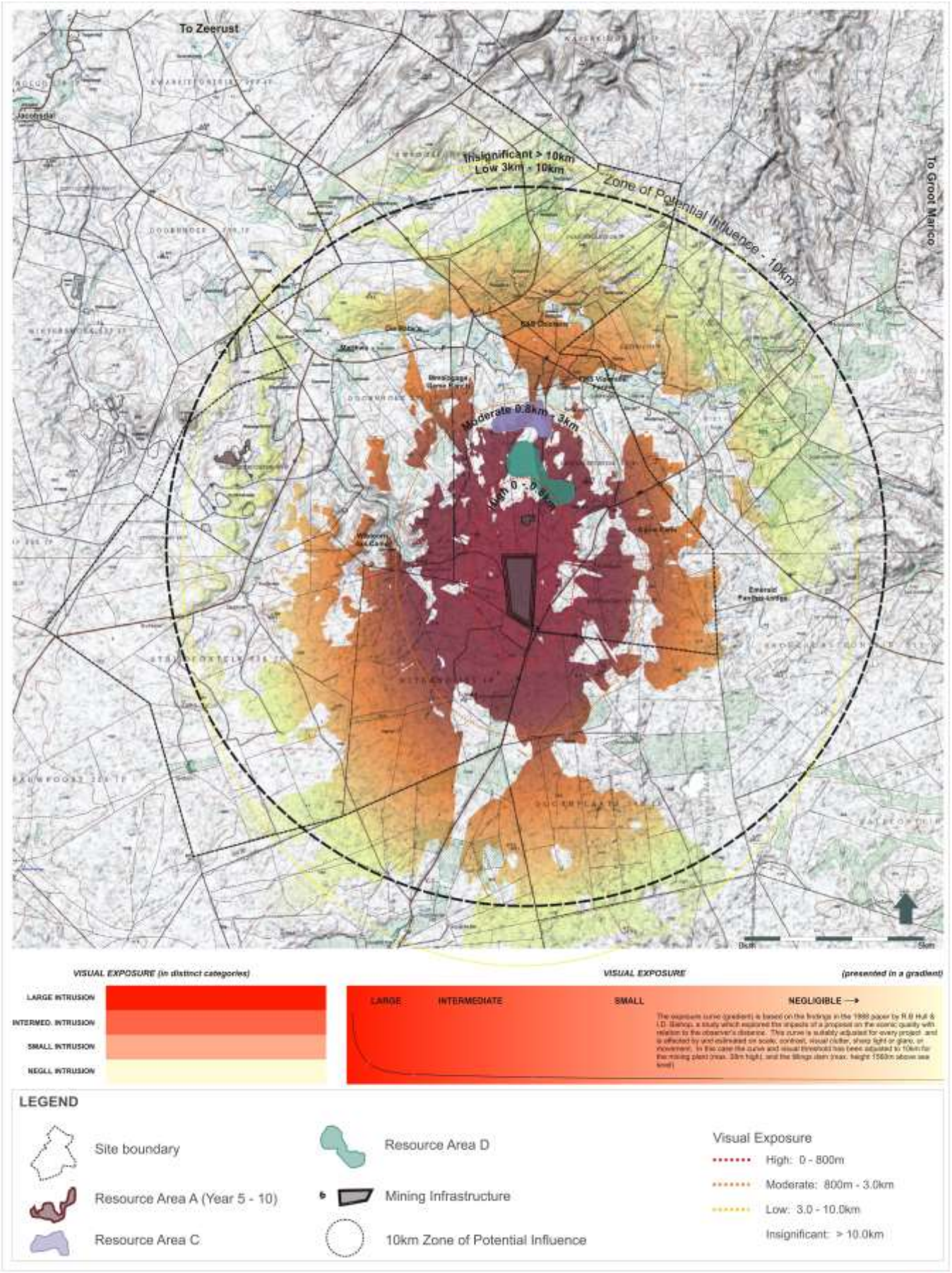

Figure 23: VIEWSHED Layout Alternative 4 - Doornhoek Fluorspar

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11.2.1.3 Visual Intrusion

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit with or disrupt / enhance the ecological and cultural aesthetic of the landscape as a whole?

The simulations in Figures 24 - 28 illustrate the effect that the Doornhoek Fluorspar project will have on the visual landscape within its context and when viewed from a variety of sensitive viewing locations about the site. The simulations illustrate the project components (Resource Area C & D, Plant and TSF) at their completed elevations i.e. the worst case scenario. It is evident, when one considers the before (current situation) and after scenarios, that the project will have a *high* visual intrusion effect on sensitive viewing areas. View 10 illustrates a typical view experienced by sensitive viewers located in the arch to the north west and of the project site as well as people travelling within the study area. This view was used to illustrate the visual intrusion of the 4 layout alternatives since the northern arch is considered to have more sensitive viewers. In the view it is clear that most of the project components will be visible. Depending on the layout alternative the plant will either be hidden behind the TSF or will be in full view of the viewer. The topography will also aid in screening Resource Area C from some of the sensitive viewing points.

Layout Alternative 4, as the preferred alternative, was further simulated from other viewpoints to the north east and south. The simulations in Figures 29 and 30 illustrate typical views from the north east, when travelling along the game farm, and from the south, when travelling along the local road. View 13, as illustrated in Figure 29, indicates that only the top part of the TSF will be visible, this is mainly due to the rolling topography of the area. People travelling along the local road or visiting the game farm will therefore catch glimpses or parts of the project and might be able to see the project components once viewed from an elevated area. This will be similar for viewers travelling along the local road to the south of the project (View 15, Figure 30). The topography will screen the view towards the project and therefore the project components will only be visible once the viewer is on an elevated area or driving close to / next to the project.

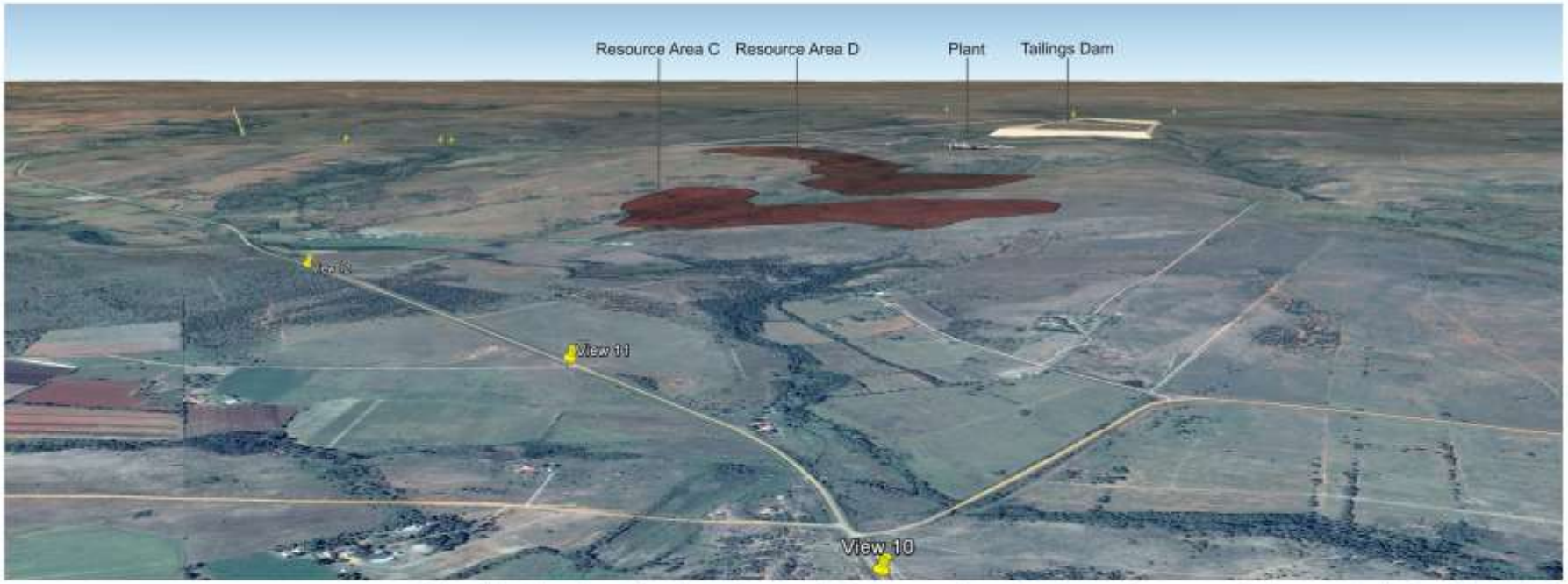
Resource Area A wasn't used or illustrated in a simulation as this section of the project will be screened from sensitive viewers due to the topography and the dense vegetation cover in the area. This is illustrated in Figure 9 and 14.

The lights associated with the Doornhoek Fluorspar project would include the lights from the plant as well as security lighting. The project area is currently exposed to lights from farmsteads, homesteads, lodges and game farms and the introduction of the lights associated with the project will result in a *high* visual intrusion during the night. Table 6 below consolidates and rates (highlighted column) the potential intrusive nature of the project assuming the worst case scenario (i.e. elevated viewing location and night time views).

Table 6: Visual Intrusion of the Project

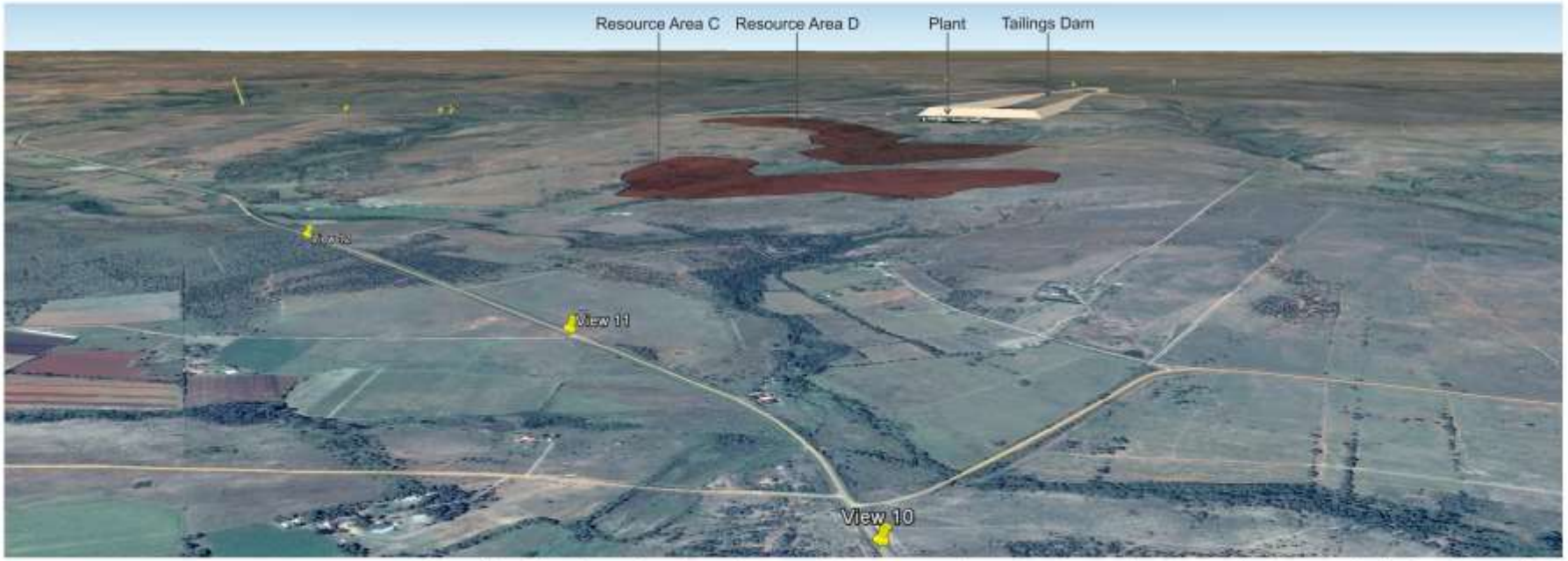
High	Moderate	Low	Positive
The proposed Doornhoek Fluorspar Project would have a substantial negative effect on the visual quality (sense of place) of the landscape relative to the baseline landscape because it would:	The proposed Doornhoek Fluorspar project would have a negative effect on the visual quality (sense of place) of the landscape;	The proposed Doornhoek Fluorspar project would have a minimal effect on the visual quality (sense of place) of the landscape;	The proposed Doornhoek Fluorspar project would have a beneficial effect on the visual quality (sense of place) of the landscape;
- **Contrast with the patterns or elements that define the structure of the landscape;**	- Have a moderate negative effect on the visual quality (sense of place) of the landscape; - Contrast moderately with the current patterns or elements that define the structure of the landscape; - Be partially compatible with land use (mining), settlement or enclosure patterns of the general area;	- Contrasts minimally with the patterns or cultural elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns;	- Enhance 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 an 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.

Figure 24: SIMULATION View 10 - Doornhoek Fluorspar



View 10: View from local road towards Resource Area C, photo taken towards the south (2.8km from site).

Figure 25: SIMULATION Layout Alternative 1 - Doornhoek Fluorspar



View 10: View from local road towards Resource Area C, photo taken towards the south (2.8km from site).

Figure 26: SIMULATION Layout Alternative 2 - Doornhoek Fluorspar

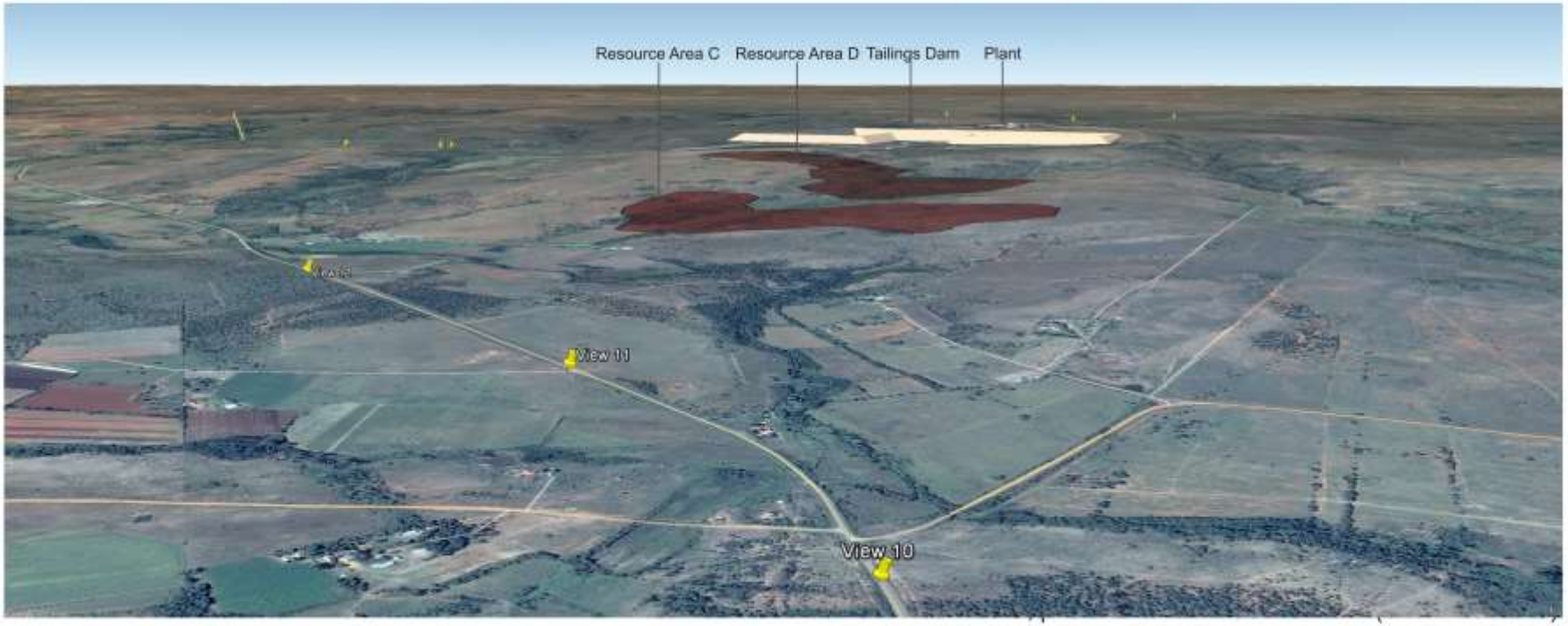
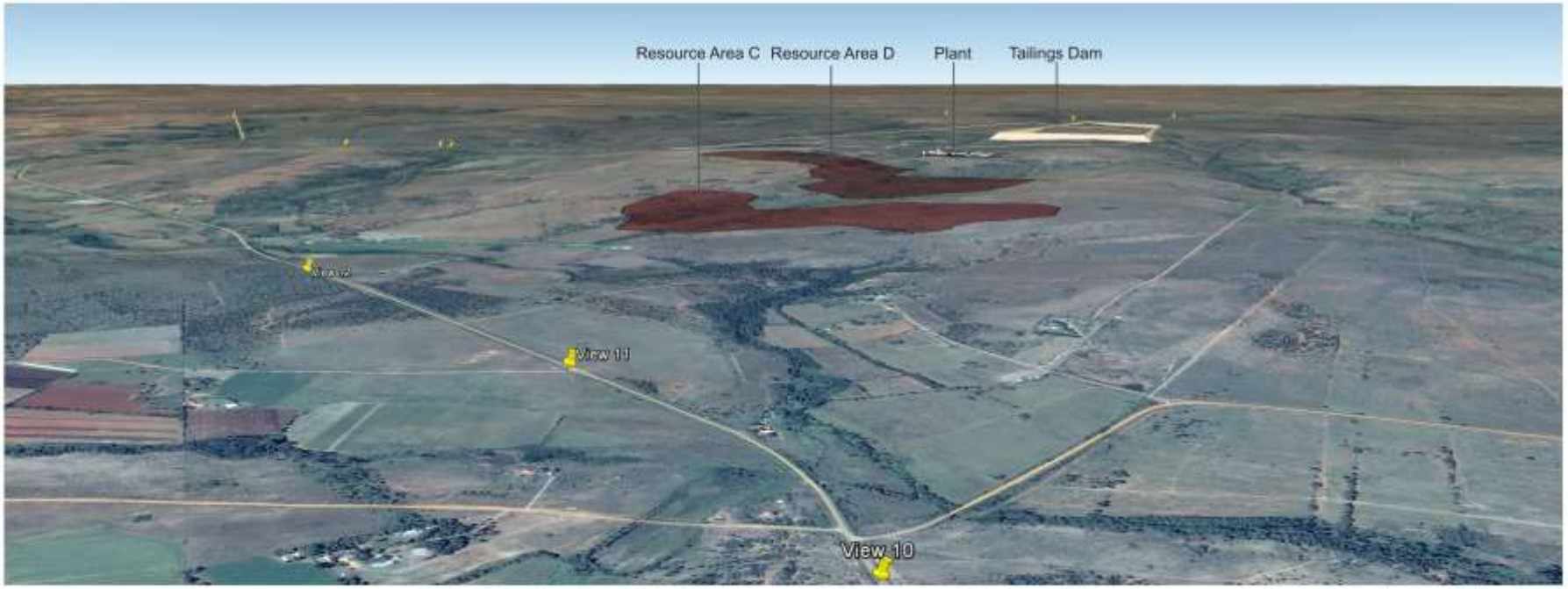
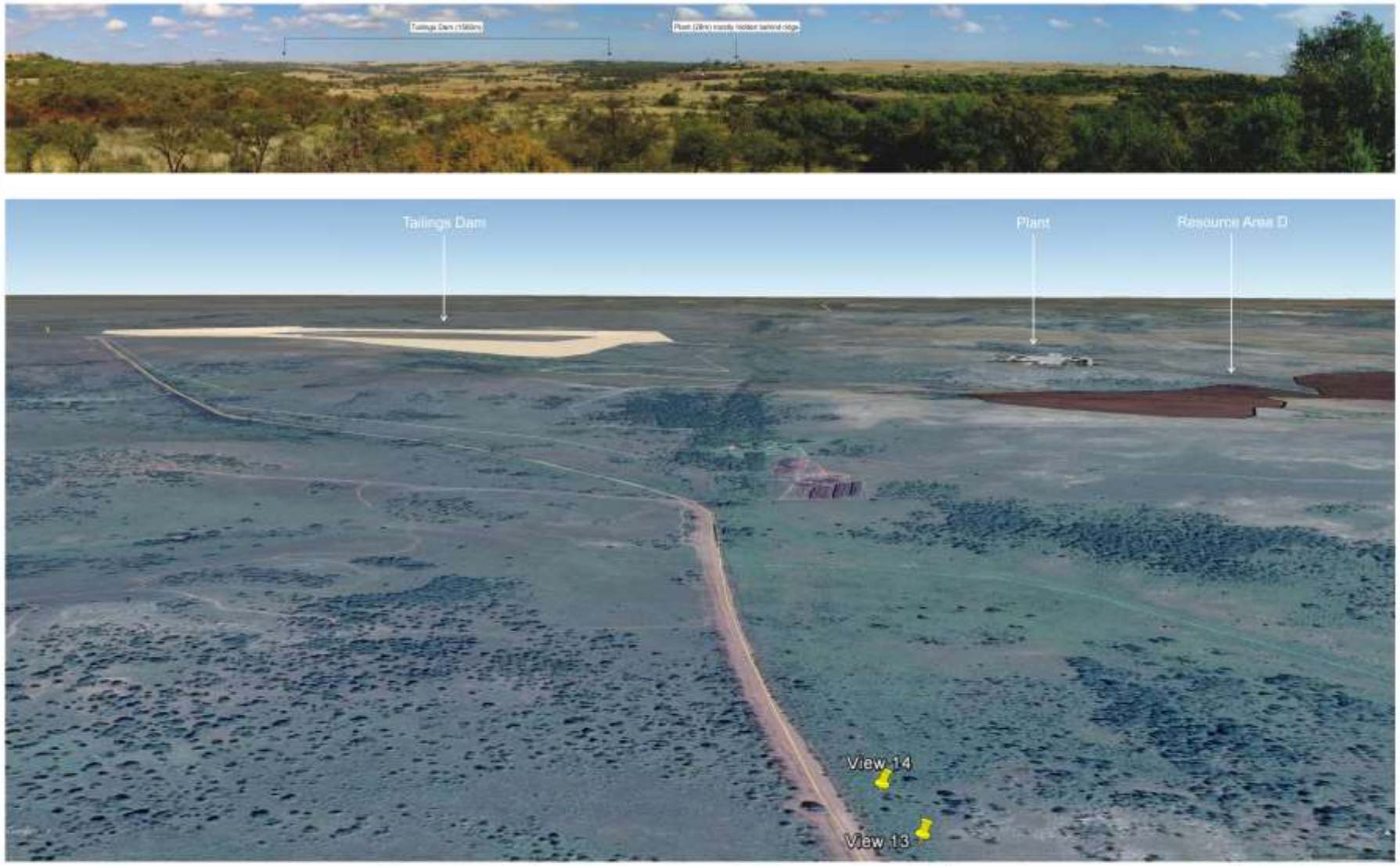


Figure 27: SIMULATION Layout Alternative 3 - Doornhoek Fluorspar



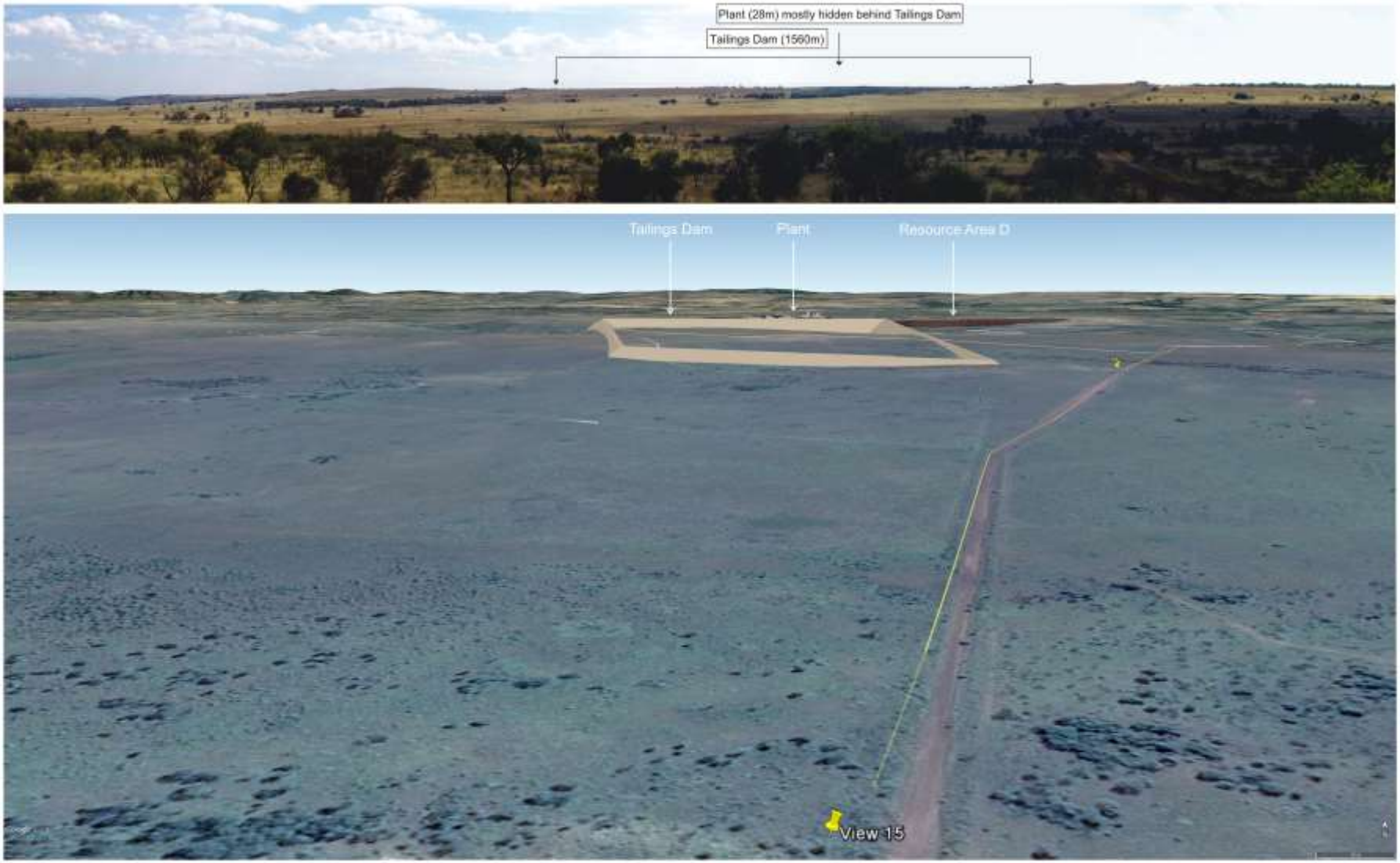
View 10: View from local road towards Resource Area C, photo taken towards the south (2.8km from site).

Figure 28: SIMULATION Layout Alternative 4 - Doornhoek Fluorspar



View 13: View from local road towards Resource Area D, photo taken towards the west (1.8km from site).

Figure 29: SIMULATION Layout Alternative 4 - Doornhoek Fluorspar



View 15: View from local dirt road towards Mining Infrastructure (TSF and Plant), photo taken towards the north (1.8km from site).

Figure 30: SIMULATION Layout Alternative 4 - Doornhoek Fluorspar

11.2.1.4 Severity of Visual Impact

Referring to discussions in Section 11 above and using the criteria listed in Table 2, the visual intrusion and *severity* of visual impact of the Project, relative to the current situation, is rated in Table 7 below. To assess the severity 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

In synthesising the criteria used to establish the *severity* 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 *intensity* of visual impact (highlighted column and based on the worst case scenario) is rated in Table 7 below. Refer also the intensity ranking table in Appendix C.

Table 7: Intensity of Visual Impact – Construction, operation and decommissioning phases

High	Moderate	Low	Negligible
The Doornhoek Fluorspar Project will cause a major alteration to key elements/features/ characteristics of the baseline (i.e. current baseline scenario) through the introduction of elements considered to be uncharacteristic when set within the	There will be a partial loss of or alteration to key elements/features/ characteristics of the visual and landscape baseline. I.e. The introduction of project elements that may be prominent but may not necessarily be considered to be substantially	Minor 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 not be uncharacteristic when set within the attributes	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 –

attributes of aspects of the current and future receiving landscape.	uncharacteristic when set within the attributes of the receiving landscape.	of the receiving landscape.	approximating the 'no change' situation.
High scenic quality impacts would result as well as impacts on sensitive viewing areas.	Moderate scenic quality impacts would result.	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

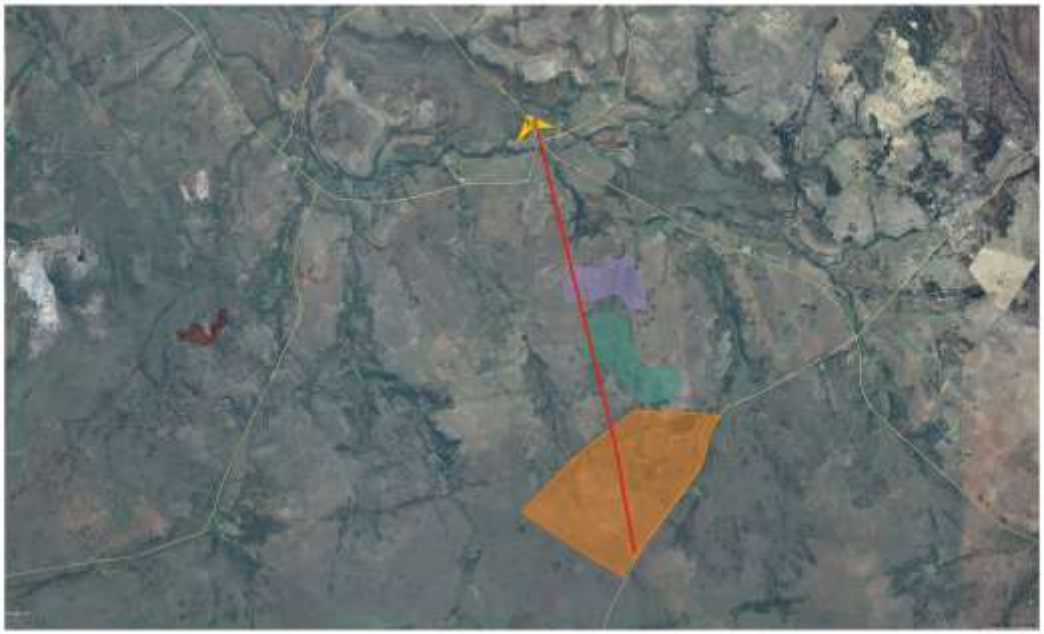
The intensity of impact is therefore predicted to be *high* (during the Construction, Operational and Decommission phases). The Doornhoek Fluorspar Project will:

- Have a high negative effect on the visual quality of the landscape. The project is not compatible with the patterns (rural/farming/game farms) that define the study area's landscape - *the study area's visual resource is rated moderate (farmsteads) to high (Klein Marco River and rolling topography). The aesthetic appeal of the study area will be compromised with the presence of the Doornhoek Fluorspar project. Although there are previously mined areas these areas are mostly screened due to its location in the rolling topography. The mining area is also covered by vegetation and shows signs of rehabilitation (Figure 14).*
- Have a high effect on key views – *From the tourist and residential vantage areas north, north east, north west and sections to the east of the project site. The proposed project activities would appear in the middle to background of most views. In some instances (Mmalogaga Game Ranch, Game Farm, homesteads/farmsteads and public roads), the activities could appear in the foreground of views.*

At closure the intensity is rated *moderate* although most of the infrastructure will be removed and the site rehabilitated the TSF will still remain on site.

A cross section of the mining activities (Resource Areas, plant and TSF) was generated in order to establish what the typical view will be from the viewers located to the north, north east and the north west of the Project site. This illustration was also used, together with the viewshed analysis, to determine what type of mitigation could be implemented in order to mitigate the visual impact of the Project.

As can be seen from Figure 30, most of the mining components will be constructed on elevated areas which make mitigation difficult. The construction of a visual berm (vegetated) along the northern boundary of the open pit Resource Area C could assist in screening views from sensitive viewers located within the northern arch towards Resource Area C. It is recommended that a combination of a vegetation screen and berm be constructed along the eastern and southern boundary of the TSF area in order to screen views from viewers driving along the road. The plant should be constructed on the lowest point (contour) possible and as little vegetation as possible should be removed around the plant area. Further mitigation measures are discussed in Section 12 below.



Aerial View of the mining area, Google Earth 2016.

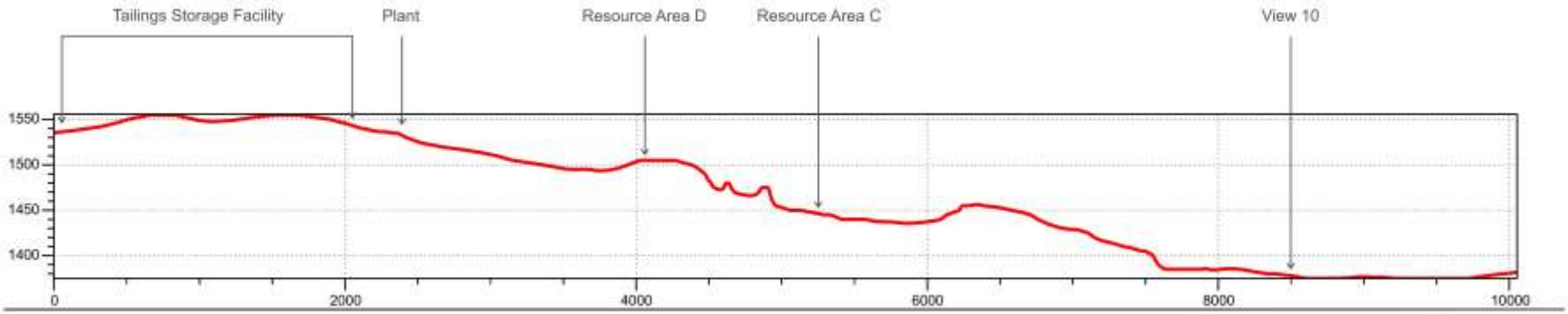


Figure 31: GRADIENT - Doornhoek Fluorspar

12. MITIGATION 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 suit 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.

The following mitigation measures are suggested and should be included as part of the Environmental Management Programme (EMPr).

12.1 Project Area Development

- It is proposed that as little vegetation as possible be removed during the construction phase, especially the area surrounding Resource Area A and the plant.
- Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the project site rehabilitation.

12.2 Earthworks

- Dust suppression techniques should be in place at all times during the construction, operational, and decommissioning / closure phases.
- Only the footprint and a small ‘construction buffer zone’ around the proposed Project should be exposed. In all other areas, the natural vegetation should be retained.

12.3 Landscaping

- A registered Professional Landscape Architect must be appointed to assist with the rehabilitation plan for the proposed project.
- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete.
- Only indigenous vegetation should be used for rehabilitation / landscaping purposes.
- Berms (vegetated) can be constructed along the northern boundary of Resource Area C, this will assist in mitigating the visual impact of the open cast mining areas.

12.4 Overburden Dump and TSF

- Final shaping and dumping should be engineered such that the sides of the dumps are articulated in a fashion that create areas of light and shadow interplay;
- Harsh, steep engineered slopes should be avoided if at all possible as these could impose an additional impact on the landscape by contrasting with existing topographic forms.
- Maintain the final landform height and slope angles for stockpiles as low as possible.
- Where slopes compatible with the surrounding landscape can be achieved, an attempt

should be made to visually soften steeper areas by avoiding strait engineered ridges and sharp changes of angle;

- Grass seeding of the dumps should be undertaken to emulate the groupings of natural vegetation in nearby hills.
- The rising wall of the TSF should be rehabilitated / grassed as the wall rises / TSF is constructed.
- Dust control measures other than water should be considered. Should water be used as a dust suppression measure it is suggested that storm water or rain water be used. The type of dust measure will depend on availability and weather conditions such as drought.
- If possible overburden should be used for visual berms. These berms must be shaped and vegetated to blend into the landscape.

Two alternatives for the deposition of overburden were suggested in order to mitigate the environmental impact of the overburden. The first involves the deposition of overburden in layers, where the outer wall will be rehabilitated as the dump becomes higher. The second method of construction of the overburden involves an "outer shell method" that can be employed for the construction of the overburden dump, which would involve the construction of an outer berm for the dump during daytime hours with a 5 meter high noise reduction starter berm. The outer shell construction method will thereby act as a noise barrier, and the construction of a berm would be very effective in screening off noise generated by trucks and earth-moving equipment operating behind the screen (as viewed from the closest receptors). The height of the berm will be approximately 5 m above the highest point on the screened work area. Refer to Image 2 below:

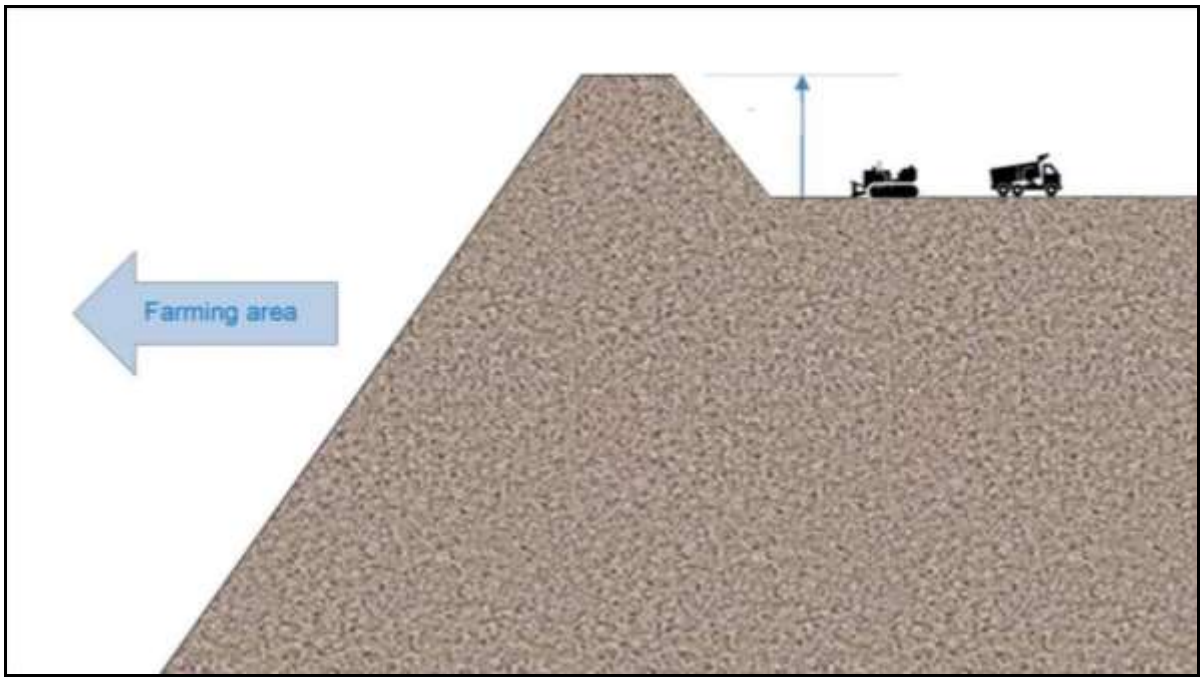


Image 2: Outer Shell Method of Construction

The proposed outer shell dumping methodology as opposed to the conventional dumping method will result in the reduction of a number of environmental impacts such as the following:

- Air Quality – impacts will be lower due to the concurrent rehabilitation which will take place with the outer shell dumping methodology.

- Visual – impacts will be lower due to the concurrent rehabilitation undertaken during the outer shell dumping methodology.
- Noise –impacts will be far lower as the outer shell dumping methodology results in the screening of noise from the nearby receptors.
- Social – Social impacts will be lower due to the lower impacts on noise, air quality and visual.

12.5 Buildings / Structures

The plant should be constructed at the lowest point (contour) possible.

12.6 Access and Haul Roads

During construction, operation, rehabilitation and closure of the Project, access and haul roads will require an effective dust suppression management programme, such as the use of non-polluting chemicals that will retain moisture on the road surface.

12.7 Lighting

Even though there are light at night in areas of the study site, light pollution should still be seriously and carefully considered and kept to a minimum. Security lighting should only be used where absolutely necessary and carefully directed.

The negative impact of 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 substation.
- Light public movement areas (pathways and roads) with low level ‘bollard’ type lights and avoid post top lighting
- Avoid high pole top security lighting along the periphery of the substation 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 switched on.

13. SIGNIFICANCE OF IMPACT

The *intensity* of impact, rated in Table 7, is further qualified with *extent*, *duration* and *probability* criteria to determine the *significance* of the visual impact. Table 8 below summarises the *significance* of the visual impact during the Construction and Decommissioning Phases. Table 9 summarises the impact during operation and Table 10 rates the *significance* of impact at Closure. These results are based on the worst-case scenario when the impacts of all aspects of the Doornhoek Fluorspar project are taken together using the impact criteria in Appendix C.

The unmitigated impact for the Construction and Decommission Phases is rated *high* significance. This is when there will be major movement and activities on the site as the structures and infrastructure are being built or decommissioned. Mitigation will be difficult during this period and the rated impact would not drop significantly even with management measures.

During the Operation Phase the significance of unmitigated impact is rated *high*. Due to the rolling topography most of the project components will be located on elevated areas which make mitigation very difficult. Even if the mitigation measures are implemented successfully it will only partially screen the project components and therefore the significance of the Project after mitigation measures are implemented will remain *high*.

At Closure, when the plant structures and associated mining infrastructure is removed and the site effectively managed and rehabilitated, the mitigated would be *moderate* since the TSF will remain on site. In the unmitigated scenario, if infrastructure is to remain, the impact would be rated *high*, as in the Operational phase.

The significance of the four layout alternatives will be the same and therefore there will only be one significance rating for the entire Project.

Table 8: Summary of the visual impact per phase of the project

CONSTRUCTION AND DECOMMISSIONING PHASES

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE					
	Probability	**Duration**	**Scale**	**Intensity**	**Significance**	**Mitigation effect**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the Doornhoek Fluorspar project and its associated infrastructure with a high impact on key views Mitigation measures are	Definite	Medium term	Site	Medium	Moderate	Can be avoided, managed or mitigated

feasible if they are effectively implemented and managed in the long term but due to the nature of the construction and decommission activities the impact will not be significantly reduced.						

Table 9: Summary of the visual impact per phase of the project

OPERATION PHASE

Potential Visual Impact	**ENVIRONMENTAL SIGNIFICANCE**					
	Probability	**Duration**	**Scale**	**Intensity**	**Significance**	**Mitigation effect**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the Doornhoek Fluorspar project and its associated infrastructure with a high impact on key views Mitigation measures are feasible if they are effectively implemented and managed in the long term but due to the nature of the construction and decommission activities the impact will not be significantly reduced.	Definite	Long term	Regional	High	High	May cause irreplaceable loss of resources

Table 10: Summary of the visual impact of the project

CLOSURE PHASE

The assumption is that the plant and associated infrastructure will be deconstructed, the TSF will remain and that rehabilitation is effective

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE					
	Probability	**Duration**	**Scale**	**Intensity**	**Significance**	**Mitigation effect**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the Doornhoek Fluorspar project and its associated infrastructure with a high impact on key views Mitigation measures are feasible if they are effectively implemented and managed in the long term but due to the nature of the construction and decommission activities the impact will not be significantly reduced.	High probable	Long term	Regional	Medium	Moderate	Can be avoided, managed or mitigated

14. CONCLUSION

The landscape of the area is characterised by a rolling topography which is created by the Klein-Marico River and associated tributaries. This together with the grassland and woodland vegetation gives the study area a high visual resource value with a pastoral sense of place.

The sensitive viewers are mostly located in an arc which stretches from the north-west to the north-east of the project site. Most of the views from this arc will include Resource Area C and D as well as the TSF and sections of the plant, as illustrated in Figures 17 – 23 and Figures 24 - 30. The visibility of the project was therefore rated as high. Due to the scenic value of the area the proposed Project will be out of place and will be visually intrusive to the study area. The overall intensity of the Doornhoek Fluorspar project was regarded as high.

The Doornhoek Fluorspar project will have a high significance during the construction, operation and decommission phase of the project. This is mainly due to the intrusiveness of the project and the sensitivity of the visual receptors in the area. During the closure phase the TSF will remain on site while the rest of the structures and infrastructures will be removed. The significance will reduce to medium.

Mitigation will be difficult and creative measures, such as vegetation berms and vegetation screens must be considered. It should be noted that even though these mitigation measures are implemented it will not fully screen views towards the proposed Project.

The four layout alternatives are very similar to each other but when comparing the four alternatives, based on the visual intrusion and visibility, the following conclusions can be made, refer to Table 11 below:

- Layout Alternative 2 and 3 will be more visible from the sensitive viewers located to the north of the site and will therefore not be considered as alternatives;
- Layout Alternative 1 will be less intrusive but will be more visible from the east of the project site;
- Layout Alternative 4 will be more intrusive but will be less visible from the east;
- Both Layout Alternatives will be visible from sections to the north of the project site.

Table 11: Comparison of the 4 Layout Alternatives

Layout Alternative	**Sensitive Viewers**	**Visual Intrusion** (Simulations: Figures 25 & 28)	**Visibility** (Viewsheds: Figures 20 & 23)
Layout Alternative 1	Northern Arch Viewers east of the site	Less intrusive when comparing the simulations	Sections to the north More visible from the east and south
Layout Alternative 4	Northern Arch Viewers east of the site	More intrusive when comparing the simulations	Sections to the north Less visible from the east and south

Based on the above mentioned it can be seen that both Site Alternative 1 and Site Alternative 4 will be acceptable as the preferred layout alternatives. The difference between the two layout alternatives is the location of the plant. The plant in Layout Alternative 1 is located close to the TSF whereas Layout Alternative 4 it is located further away from the TSF and in a lower lying area. From a visual point the plant in Layout Alternative 4 can almost be seen as a separate entity whereas Layout Alternative 1 the plant is located closer to the TSF and therefore the two components will be seen as one. Based on this it is therefore suggested that Layout Alternative 1 be used as the preferred alternative.

****NLA****

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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 the 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	Flowing, or still, but not dominant in the landscape.	Absent, or present, but not noticeable.

	dominant factor in the landscape. **5**	**3**	**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.

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. *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.	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. *Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	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. *Result* Imperceptible change resulting in a minor change to key views.	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* 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.

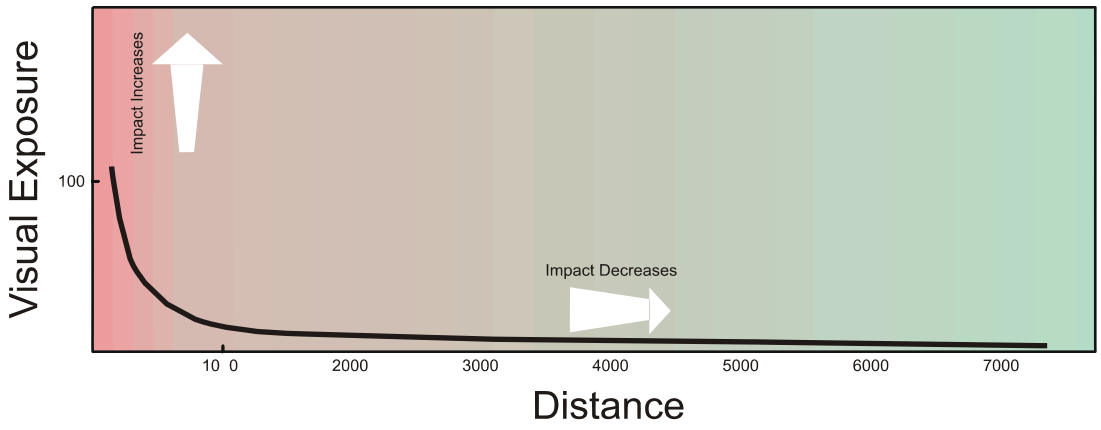
Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

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;	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);	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).
Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;	People travelling through or past the affected landscape in cars, on trains or other transport routes;	Roads going through urban and industrial areas
Occupiers of residential properties with views affected by the development.		

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 C: CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT

Probability: This describes the likelihood of the impact actually occurring.	
Improbable	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable	It is most likely that the impact will occur at some stage of the development.
Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.
Duration: The lifetime of the impact	
Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term	The impact will last up to the end of the phases, where after it will be negated.
Long term	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale: The physical and spatial size of the impact	
Local	The impacted area extends only as far as the activity, e.g. footprint
Site	The impact could affect the whole, or a measurable portion of the above mentioned properties.
Regional	The impact could affect the area including the neighbouring residential areas.
Magnitude/ Severity: Does the impact destroy the environment, or alter its function.	
Low	The impact alters the affected environment in such a way that natural processes are not affected.
Medium	The affected environment is altered, but functions and processes continue in a modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	
Negligible	The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
Low	The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate	The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

Mitigation Effect: Degree to which the impact can be managed following mitigation	
Can be reversed	Can be avoided, managed or mitigated in such a way that natural processes are not affected and returned to natural state
Can be avoided, managed or mitigated	Can be avoided, managed or mitigated to the degree that functions and processes continue in a modified way
May cause irreplaceable loss of resources	Irreversible impact (may cause irreplaceable loss of resources). Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

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.

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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.

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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

Diepsloot East Development, 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

Princess Plot 229, Princess - Environmental Assessment (S24G Application)

Uthlanong Drive Upgrade – Mogale City Local Municipalty project in Kagiso, Basic Assessment for the upgrade of the stormwater and the roads

Luipaardsvlei Landfill Site – Mogale City Local Municipalty project in Krugersdorp, the expansion of the existing landfill site.

MCLM Waste Water Treatment Works – Mogale City Local Municipalty project in Magaliesburg, the expansion of the existing facility.

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

PROFESSIONAL REGISTRATION:

Sep 2009	Professional National Scientist – 400204/09