VISUAL IMPACT ASSESSMENT

PROPOSED WESKUSFLEUR SUBSTATION,

CAPE TOWN

WESTERN CAPE PROVINCE

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Prepared for:

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This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, South Africa. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate this VIA.

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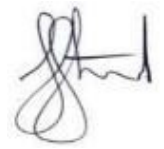

Stephen Stead

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LIST OF ACRONYMS

APHP	Association of Professional Heritage Practitioners
BLM	Bureau of Land Management (United States)
BPEO	Best Practicable Environmental Option
CALP	Collaborative for Advanced Landscape Planning
DEA&DP	Department of Environmental Affairs and Development Planning (South Africa)
DEM	Digital Elevation Model
DoC	Degree of Contrast
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographic Information System
I&APs	Interested and Affected Parties
IDP	Infrastructure Development Plan
IEMA	Institute of Environmental Management and Assessment (United Kingdom)
IEMP	Integrated Environmental Management Plan
KOP	Key Observation Point
MAMSL	Metres above mean sea level
NELPAG	New England Light Pollution Advisory Group
PSDF	Provincial Spatial Development Framework
ROD	Record of Decision
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management
ZVI	Zone of Visual Influence

GLOSSARY

Best Practicable Environmental Option (BPEO)
This is the option that provides the most benefit, or causes the least damage, to the environment as a whole, at a cost acceptable to society, in the long, as well as the short, term.

Cumulative Impact
The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

Impact (visual)
A description of the effect of an aspect of a development on a specified component of the visual, aesthetic or scenic environment, within a defined time and space.

Issue (visual)
Issues are concerns related to the proposed development, generally phrased as questions, taking the form of “what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?”

Key Observation Points (KOPs)
KOPs refer to receptors (people affected by the visual influence of a project) located in the most critical locations surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.

Management Actions
Actions that enhance the benefits of a proposed development, or avoid, mitigate, restore or compensate for, negative impacts.

Receptors
Individuals, groups or communities who would be subject to the visual influence of a particular project.

Sense of Place
The unique quality or character of a place, whether natural, rural or urban.

Scenic Corridor
A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.

Scoping
The process of determining the key issues, and the space and time boundaries, to be addressed in an environmental assessment.

Viewshed
The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area in which, or the extent to which, the landscape modification is likely to be seen.

Visual absorption capacity (VAC)
Visual absorption capacity is defined as the ability of the receiving landscape to absorb physical changes without the wholesale transformation in its visual character and quality.

Zone of Visual Influence (ZVI)
The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'

1 INTRODUCTION

VRM Africa was appointed by Lidwala Environmental and Planning Services on behalf of Eskom Holdings to undertake a Visual Impact Assessment (VIA) for the proposed Weskusfleur Substation Project. The proposed sites are located at the Koeberg Nuclear Power Station (Koeberg) near Melkbosstrand, 30 km north of Cape Town on the West Coast. The project locality map below indicates the proposed project site in the Western Cape Province north of Cape Town.

The proposed 400/132kV Weskusfleur Substation is proposed in the vicinity of the existing Koeberg Substation in order to:

- Improve the existing 400kV reliability
- Cater for load growth on the 132 kV network for the 20-year horizon.
- Prevent overloading of existing 400kV busbar
- Replace 30 year old technology/equipment.

(Proposed Project EIA Background Information Document)

Figure 1: Project regional locality map

2 APPROACH TO STUDY

2.1 Terms of Reference

The scope of the study is to cover the entire affected project area. This includes a site visit of the full site extent, as well as where potential impacts may occur beyond the site boundaries such as cumulative impacts.

- All available secondary data relevant to the affected project area to be collated and analysed.
- Information was sourced from the following previous studies of the area:
    - CVdV Africa. 2004. Draft Visual Scoping Report for the Construction of the Omega Electrical Substation Cape West Coast.

Cumulative effects are to be considered in all impact reports.

- Specific attention is to be given to the following:
    - Quantify and assess existing scenic resources/visual characteristics on, and around, the proposed site.
    - Evaluate and classify the landscape in terms of sensitivity to a changing land use.
    - Determine viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
    - Determine visual issues, including those identified in the public participation process.
    - Review the legal framework that may have implications for visual/scenic resources.
    - Assess the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project.
    - Identify possible mitigation measures to reduce negative visual impacts for inclusion into the project design, including input into the Environmental Management Plan (EMP).

2.2 Summary of Visual Impact Assessment Methodology

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management‘s (BLM) Visual Resource Management method. This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using a standard assessment criteria and involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification brought about by a project, against the same elements found in the existing natural landscape. *(BLM. USDI. 2004)*

The first step in the VIA process is determining the existing landscape context. A regional landscape survey is undertaken, which identifies defining landscape features that surround the site of a proposed development, and sets the scene for the VIA process to follow. These features, also referred to as visual issues, are assessed for their scenic quality/worth. A VIA also assesses to what degree people, who make use of these locations (e.g. a nearby holiday resort), would be sensitive to change(s) in their views, brought about by a proposed project (e.g. a mine). *(Assessment undertaken up to this point falls within the ambit of the Field Study.)*

These people are referred to as receptors and are identified early on in the VIA process. Only those sensitive receptors who qualify as Key Observation Points (KOPs) by applying certain criteria, are used to measure the amount of contrast generated by changes caused by project activities, against the existing landscape (i.e. visual impact).

Visibility is sub-divided into 3 distance zones based on relative visibility from travel routes or observation points. Proximity to surrounding receptors is evaluated in terms of these distance buffers: foreground zone is less than 6km, background zone is from 6 to 24 km, and seldom seen has no receptors. Viewshed maps are generated that indicate the overall area where the project activities would be visible, and in which distance buffer zone the receptors fall.

The landscape character of the proposed project site is then surveyed to identify areas of similar land use and landscape character. These areas are evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape’s integrity, but this can be

achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be “absorbed” or “disappear”, into the landscape). The areas identified on site are categorised into these Classes by using a matrix developed by BLM Visual Resource Management, which is then represented in a visual sensitivity map. *(Assessment undertaken up to this point falls within the ambit of the Baseline Study.)*

The proposed project activities are then finally assessed from the KOPs around the site to see whether the visual objectives (VRM Classes) defined for the site, are met in terms of measuring the potential change to the site’s form, line, colour and texture visual elements, as a result of the proposed project (i.e. are the expected changes within acceptable parameters to ensure that the visual character of the landscape is kept intact and, if not, what can be done by the project to ensure that it is). Photo montages are generated to represent the expected change in the views, as seen from each KOP and, if class objectives are not met, to also show how proposed mitigation measures could improve the same views.

Using the impact assessment method provided by the environmental consultant, each project activity is then assessed for its visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors on whether the proposed activities meet the recommended visual objectives defined, to protect the landscape character of the area. Recommendations are made and mitigations are provided.

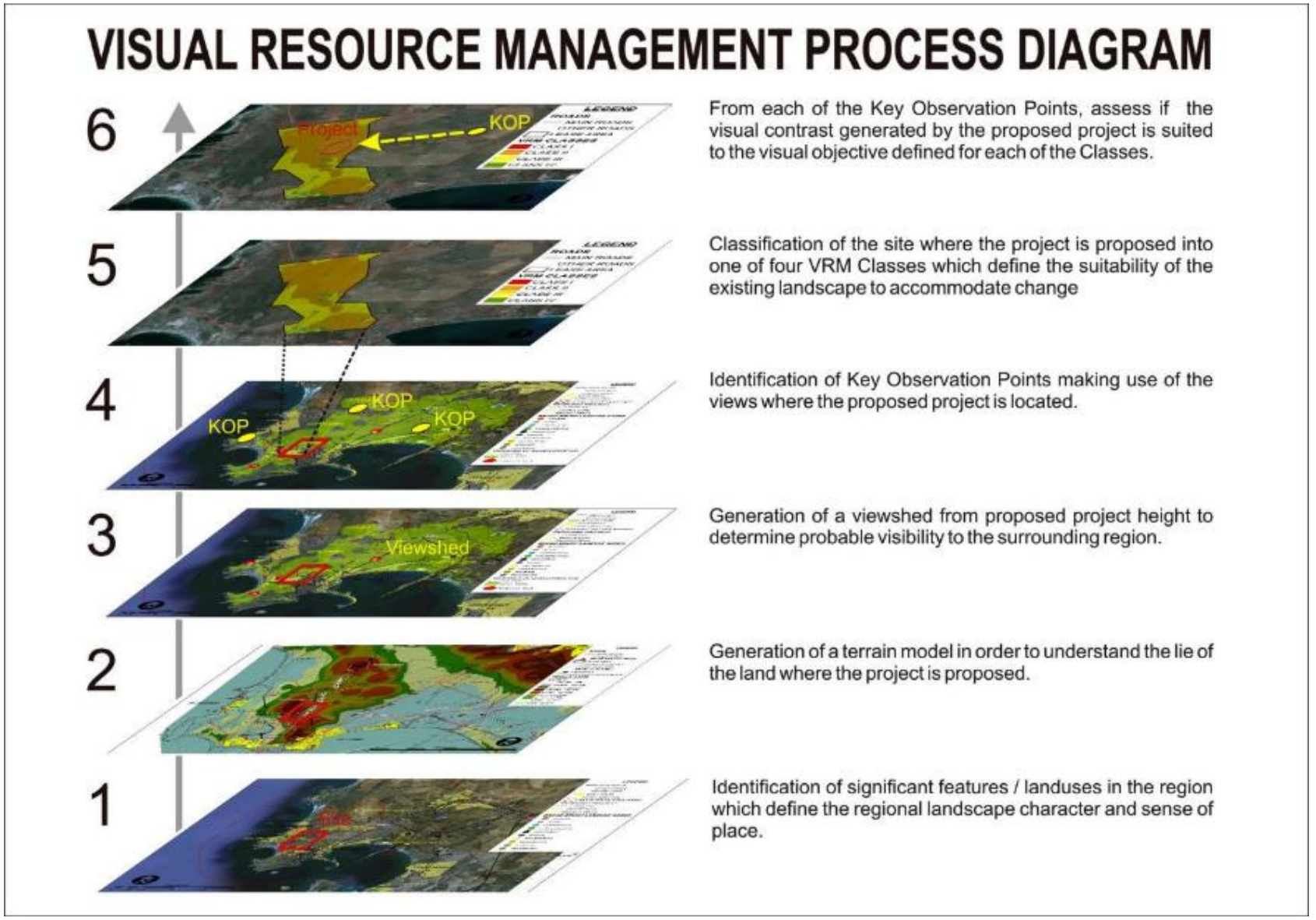

Figure 2: VRM process diagram

2.3 Limitations and Assumptions

- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of Google Earth Pro for mapping is licensed for use in this document.
- Some of the mapping in this document was created using Bing Maps (previously *Live Search Maps*, *Windows Live Maps*, *Windows Live Local*, and *MSN Virtual Earth*) and powered by the Bing Maps for Enterprise framework.
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
    - The ASTGTM_S2 3E014 and ASTGTM_S24E014 data set. ASTER GDEM is a product of METI in Japan and NASA in USA. *(ASTER GDEM. METI / NASA. 2011)*
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure *(Lange 1994)*. The project deliverables, including electronic copies of reports, maps, data, shape files and photographs, are based on the author's professional knowledge, as well as available information. The study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.
- In some areas, access was restricted and only partial views of the site could be undertaken.

3 LEGISLATIVE CONTEXT

3.1 Applicable Laws and Policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be viewed in the context of the planning policies from the following organisations:

- Western Cape Provincial SDF
- DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes
- City of Cape Town Draft SDF (2009)
- City of Cape Town Draft Blaauwberg Planning SDF/EMF (2009).

DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place
- The consideration of both the natural and the cultural landscape, and their inter-relatedness
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as aesthetic value or sense of place
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project
- The need to determine the value of visual/aesthetic resources through public involvement.

City of Cape Town Draft Blaauwberg Planning SDF/EMF (2009)

- Development opportunities in Melkbosstrand include areas of residential development (market and entry-level opportunities), mixed use, and commercial opportunities on publicly-owned land
- Proposals should also take biodiversity corridor requirements into consideration
- Koeberg emergency planning zones: Development within the district needs to comply with the NNR regulations related to the Koeberg emergency planning zones
- Natural open space: Guiding development away from sensitive areas and enhancing key assets (the Rietvlei, coast and conservation areas)
- Power generation and its impact on future development.

3.2 Surrounding Project Data

Environmental Impact Assessments have been completed on the following projects in the same area. This project needs to be assessed within the context of the following data:

- Arcus GIBB (Pty) Ltd (2011) ***Revised*** Draft Environmental Impact Assessment Report for the Eskom Nuclear Power Station and Associated Infrastructure (Nuclear-1) DEA&DP 12/12/20/944
    - Nuclear-1 Duynefontein Sensitivity Map
- Savannah Environmental (2012) Final Environmental Impact Report for the Proposed Omega-Stikland Transmission Power Lines
- Savannah Environmental (2012) Final Environmental Impact Report for the Proposed Koeberg Integration Project, Western Cape Province: Koeberg 2 – Omega Transmission Power Lines

- CVdV Africa. 2004. Draft Visual Scoping Report for the Construction of the Omega Electrical Substation Cape West Coast. Eyethu Engineers.

3.3 Relevant Standards to Comply With

The International Finance Corporation (IFC) prescribes eight performance standards (PS) on environmental and social sustainability. The first is to identify and evaluate the environmental and social risks and impacts of a project, as well as to avoid, minimise or compensate for any such impacts. Under Performance Standard 6, ecosystem services are organized into four categories, with visual/aesthetic benefits falling into the category of cultural services, which are the non-material benefits people obtain from ecosystems. *(IFC. 2012)* This emotional enrichment that people experience and obtain from cultural ecosystems services is described by The Millennium Ecosystem Assessment, 2005, Ecosystems and Human Well-being: Synthesis report as follows: "Cultural ecosystems services: the non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences." *(Millennium Ecosystem Assessment. 2005)*

The above includes the following, amongst others:

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising;
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations;
- Sense of place: Many people value the "sense of place" that is associated with recognised features of their environment, including aspects of the ecosystem;
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

The visual experience is not limited to the visual senses, but is a multisensory emotional involvement experienced by people when they perceive a specific scene, landmark, landscape, etc. The assessment subject of Visual Impact assessment (VIA) is in itself a result of human perception.

4 PROJECT DESCRIPTION

The proposed project public EIA Background Information Document states the need and justification for the Weskusfleur Substation. Eskom Holdings SOC Limited initiated a study to investigate possible alternatives and solutions to address the long term reliability and improvement of the existing 400kV Gas Insulated System substation (GIS) at Koeberg Nuclear Power Station in the Western Grid. Eskom Holdings SOC Limited's (Eskom) core business is the generation, transmission and distribution of electricity throughout South Africa. Electricity by its nature cannot be stored and must be used as it is generated. Therefore electricity is generated according to supply-demand requirements. Being a nuclear power station, it is vital that the reliability of the electrical infrastructure associated with this power station is never compromised. The station is also critical for grid stability in the Western Cape.

The following motivations were provided by Eskom:

- The current 400kV GIS substation has been in operation for almost 30 years and there are concerns regarding its reliability as it is difficult to repair as a result of discontinued technology. There is also no space for additional 132 kV feeder bays at Koeberg Substation to accommodate future requirements for new lines.
- Cater for load growth on the 132 kV network for the 20-year horizon.
- Prevent overloading of existing 400kV busbar
- Replace 30 year old technology/equipment

The proposed project requires the following activities:

- Weskusfleur Substation with 400/132kV Busbar Integration
- Turn-in Transmission Lines
- Access Roads
- Lights at night would include security lighting in and around the perimeter of the proposed substation.
- Eskom have indicated that telecommunication masts of 60m (as a worst case scenario) will be put at substations
- The construction of the transmission power lines up to 40m in height, leading to the Substation would also be required with a turn-in area. The construction of the transmission power lines may require the construction of related access roads.

Two substation alternative were taken through from the scoping stage of the assessment, Alternative 1 and 4 (see Figure 4 on page 20).

Alternative 1 is a GIS type structure to replace the existing GIS structure. According to the Lidwala scoping report, a Gas Insulated Substation uses sulphur hexafluoride (SF6) gas which has superior dielectric properties, at moderate pressure for phase to phase and phase to ground insulation. In GIS the high-voltage conductors, circuit breaker interrupters, switches, current transformers, voltage transformers and lightning arresters are encapsulated in SF6 gas inside grounded metal enclosures. The housing structure would be approximately 10m in height and cover an area of 9750 square metres.

Alternative 4 AIS is a conventional open space substation that is constructed according to standardized minimal distances (clearance) between phase and earth. It is normally used for outdoor substations and in very few cases used for indoor substations. The substation is based on single power system equipment's and thus replacement of single equipment by equipment's from other manufacturers is possible. The substation is easily accessible and expandable. The infrastructure would be approximately 20m in height and cover an area of 247 500 square metres.

(Lidwala, 2014)

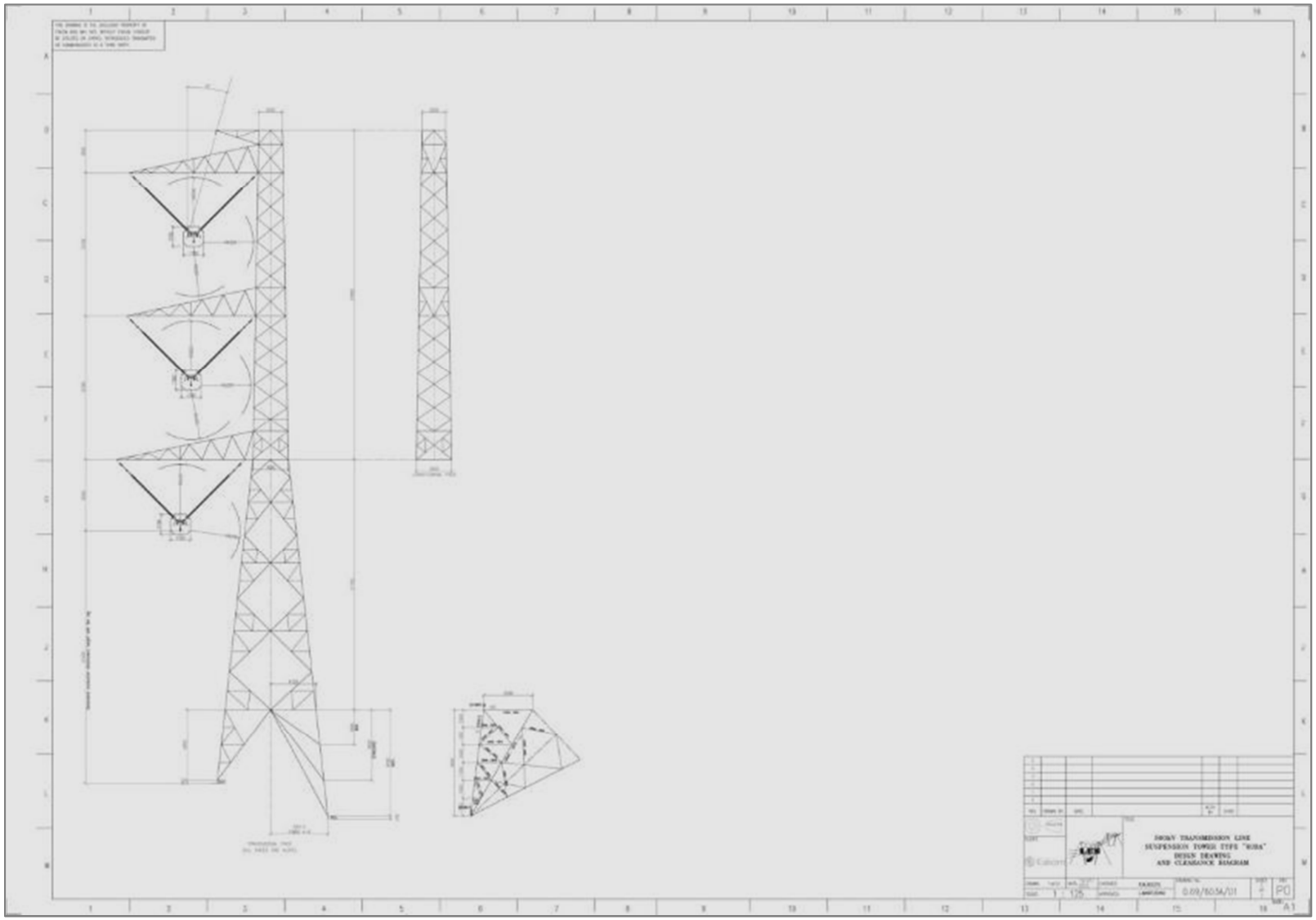

Figure 3: Proposed transmission line suspension tower

5 NATURE OF THE RECEIVING ENVIRONMENT

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, land form, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' *(Spon Press, 2002).* The first step in the VIA process is determining the existing landscape context of the region and of the site(s) where the project is proposed.

The proposed sites are located within the City of Cape Town Metropolitan Municipality in the area adjacent to the existing Koeberg Nuclear Power Station (Koeberg) near Melkbosstrand, 30 km north of Cape Town on the West Coast. The area is bounded to the north by the West Coast District Municipality, to the north east by Cape Winelands District Municipality, to the south east by the Overberg District Municipality and to the south and west by the Atlantic Ocean. Koeberg is currently the only commercial nuclear power station in the country, and the sole commercial one in the entire African continent. Koeberg is owned and operated by the country's only national electricity supplier, Eskom. *(Savannah. 2012)*

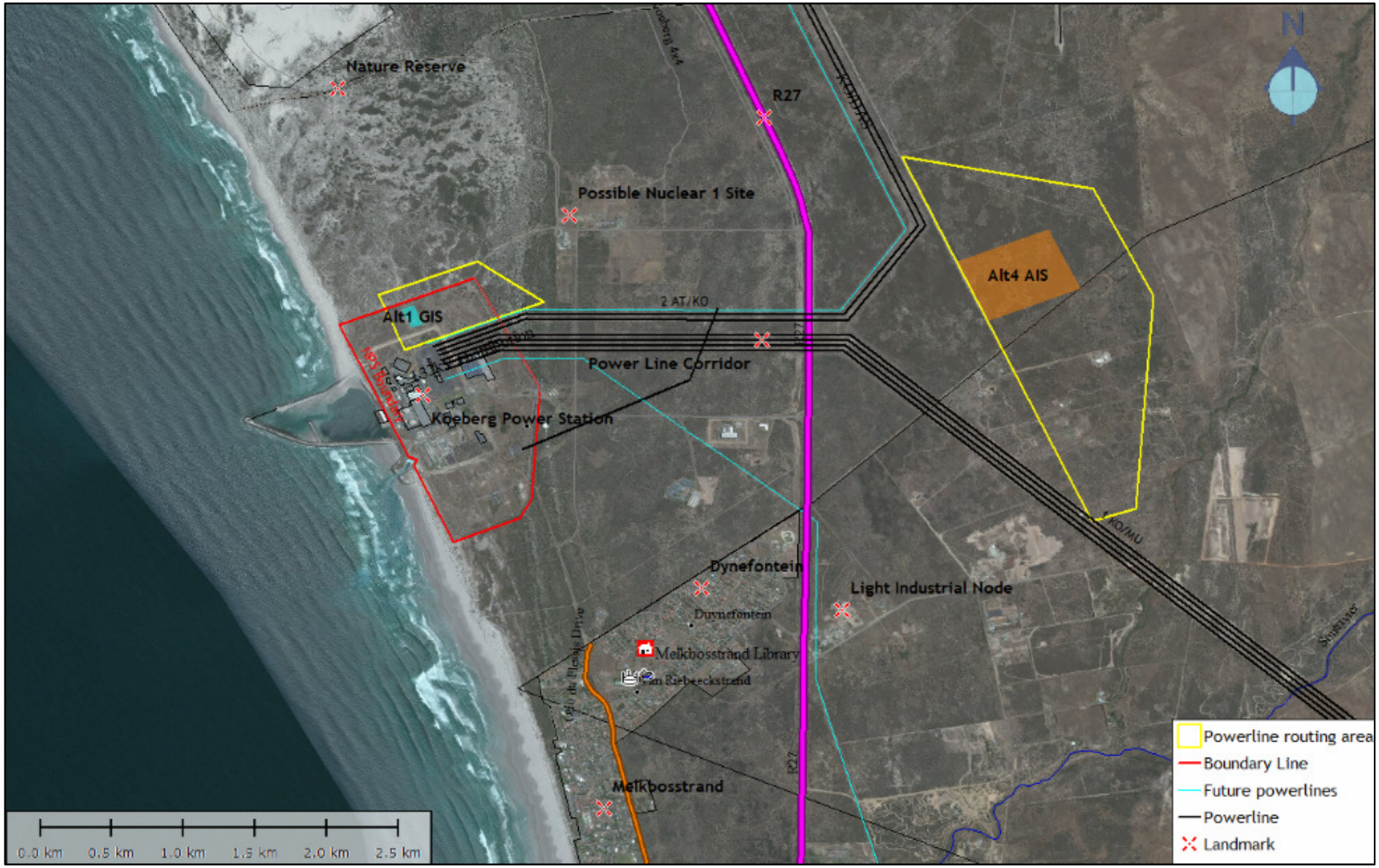

Figure 4: Landscape Character Map

Koeberg power station

Figure 5: Koeberg Nuclear Power Station as seen from the Melkbosstrand Beach

Koeberg Nuclear Power Station (Koeberg) is operated by Eskom, the South African National power utility. Koeberg, the only nuclear power station in Africa, has a pressurised water reactor (PWR) design. It boasts the largest turbine generators in the Southern Hemisphere and is the most southerly-situated nuclear power station in the world. There are approximately 1 200 employees involved at Koeberg. Koeberg supplies approximately 6,5 % of South Africa's total electricity needs. Koeberg ranks amongst the safest of the world's top ranking PWR's of its vintage and is the most reliable Eskom power station. In March 2001, Koeberg was awarded NOSCAR status for the 5th time by the National Occupational Safety Association (NOSA). The station is also vital for grid stability in the Cape. Geologically the land itself has remained virtually unchanged for millions of years. It is due to this geological stability that Koeberg Nuclear Power station was built in this region. (*http://www.route27sa.com)* The existing Koeberg Power Station has an average height offset of 50m as can be seen in the Viewshed Map seen below.

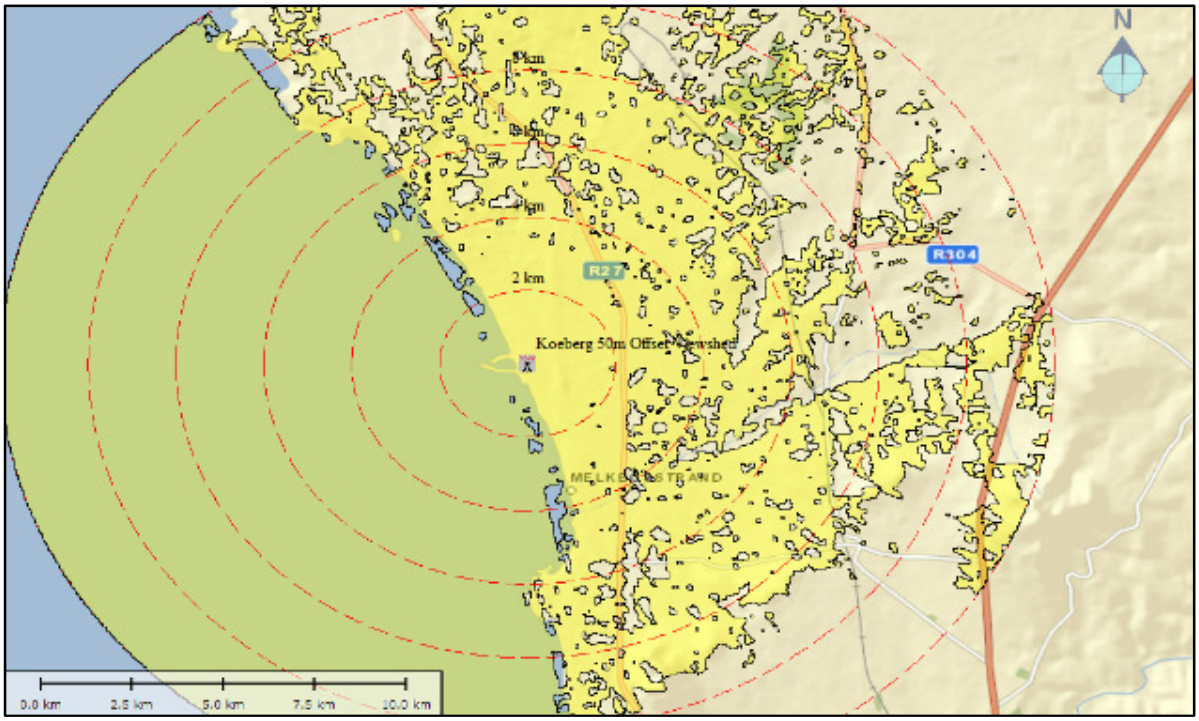

Figure 6: Koeberg 50m Offset Viewshed Map

Nuclear – 1

As part of its expansion programme Eskom is currently conducting a feasibility study of conventional nuclear generation in the greater Cape region, with one of the potential sites at Duynefontein adjacent to Koeberg. In order to integrate the proposed new nuclear power station into the electricity grid and to strengthen the existing Transmission network in the Western Cape Region, environmental authorisation was sought for servitudes for five 400kV transmission lines from the proposed site. It is anticipated that at some stage in the future a new nuclear power station will be established in the Koeberg region. *(Savannah. 2012)*

Melkbosstrand

Figure 7: View north from Melkbosstrand Beach

Melkbosstrand is a coastal beach and village located on the South West Coast, 35 km north of Cape Town. The town and its 7 km stretch of white sand beach is situated on the Atlantic coast with the Blouberg Mountain to the east. Melkbosstrand currently falls under the City of Cape Town Metropolitan Municipality and the nearest neighbouring towns are Bloubergstrand and Atlantis. The beach is popular with surfers and tourists travelling along the R27. It is notable for being one of the landing points for the Southern Africa-Far East and South Atlantic/West Africa submarine cable systems as well as the site of the Koeberg Nuclear Power Station.

Location and Routes

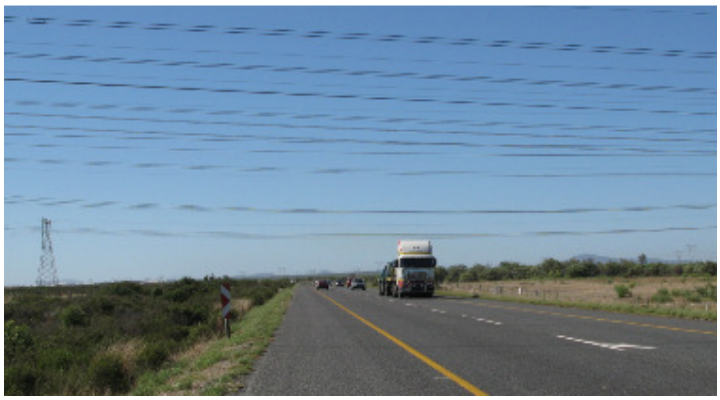

Figure 8: View north from R27 where the multitude of powerlines cross the road

The area is a well utilised tourist scenic corridor. Both the "Cape to Namibia" scenic N7 and the West Coast Route 27 start off at Melkbosstrand. The N7 National route runs all along the West Coast from Cape Town in the Western Cape to the border post of Namibia at Vioolsdrif in the Northern Cape. It is a favourite and extensively used route for viewing the Namaqualand daisies between the months of June to September, depending on the rains. The R27 is the primary connector between Cape Town and the West Coast.

Agriculture and Other Land Uses

There are surrounding rural communities such as Kleine Zouterivier small holdings and Vaatjie Farm. The sandy soils that predominate in the area have low to medium agriculatural potential due to the following:

- Excessive drainage due to sandy texture
- Low fertility due to low clay levels
- Susceptibility to wind erosion due to fine nature of the sand. *(Savannah. 2012. Koeberg-Omega)*

As depicted below, the area to the east of the R27 also includes a small light industrial node as well as a sand quarry.

Figure 9: Photographs depicting the small holdings (top), the sand quarry and the small industrial node (bottom)

Topography, Rivers and Climate

Making use the ASTGTM data set *(ASTER GDEM. METI / NASA. 2011)* a terrain model was generated for the area around the proposed project. (See Elevation Map below) The topography is described as predominantly *plains* and *moderately undulating plains and hills*, with a number of *low mountains* (e.g. Koeberg Hill adjacent to the N7 National Road) *(MetroGIS (Pty) Ltd. 2010)* As depicted in the map below, the terrain slopes gently from the north to the south, and has moderately undulating slopes from the west to the east.

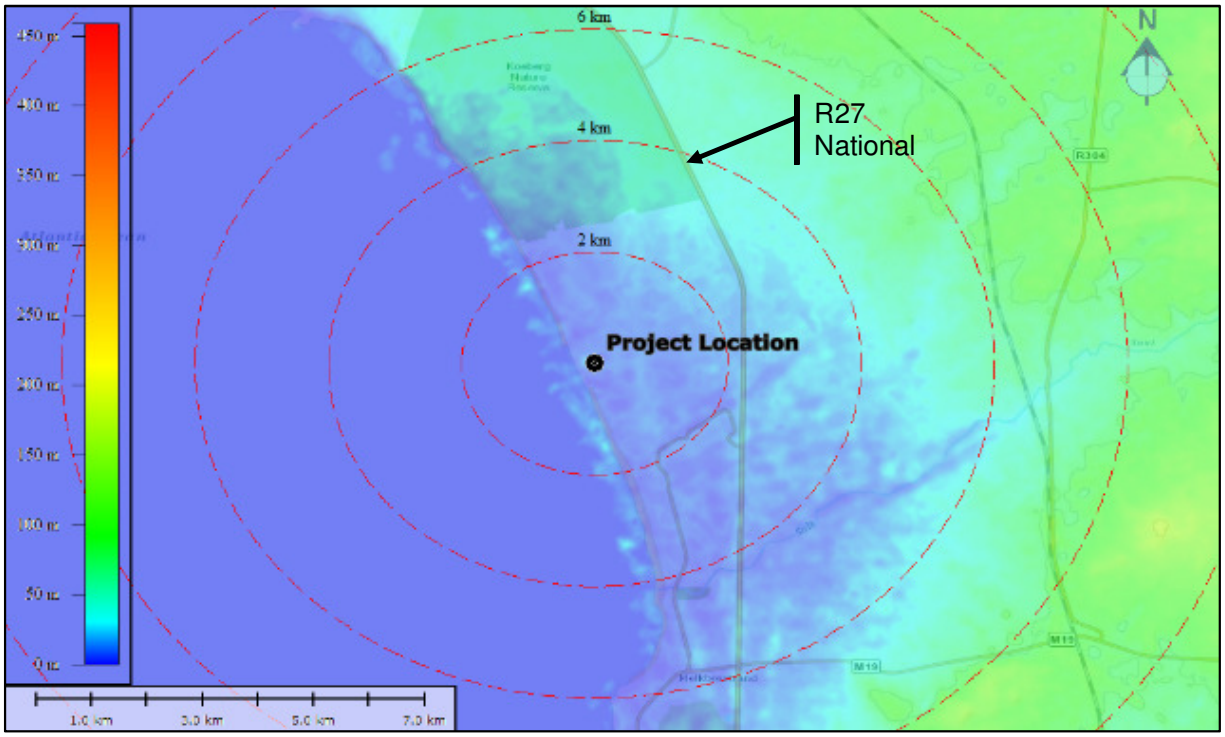

Figure 10: Surrounding area elevation overlay onto street map

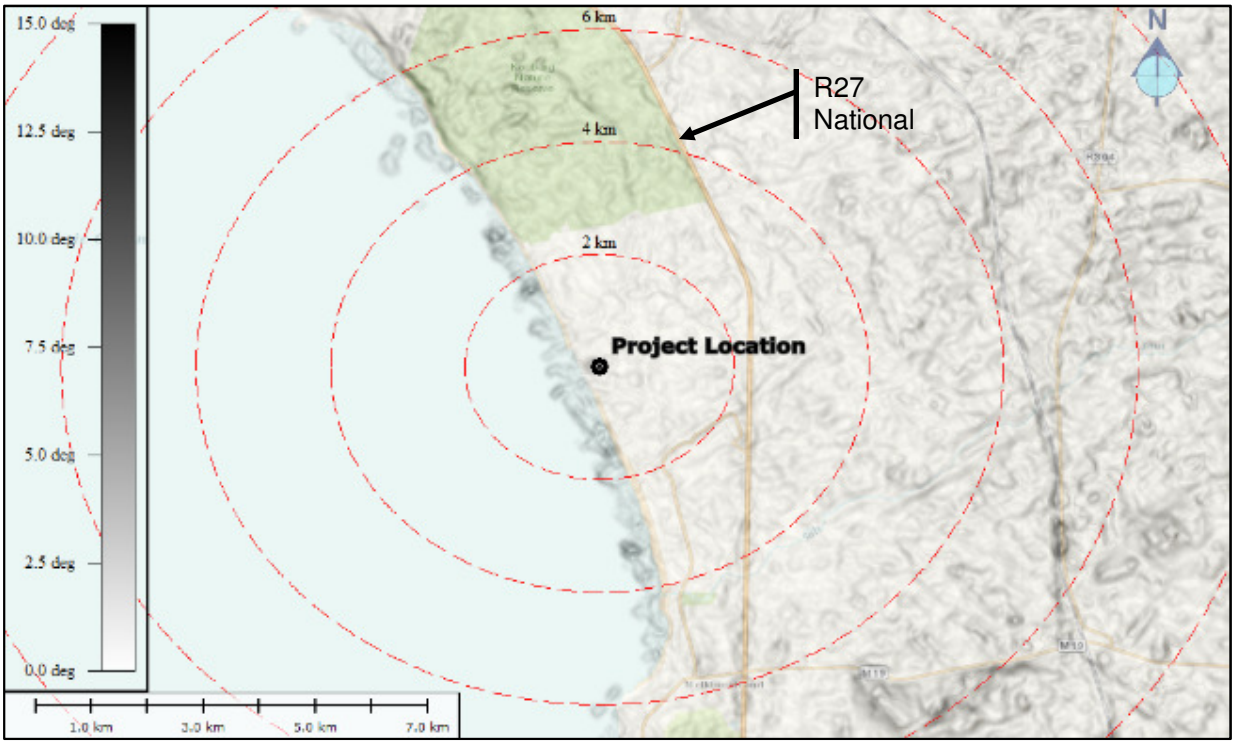

Figure 11: Surrounding areas slope gradient map overlay onto street map

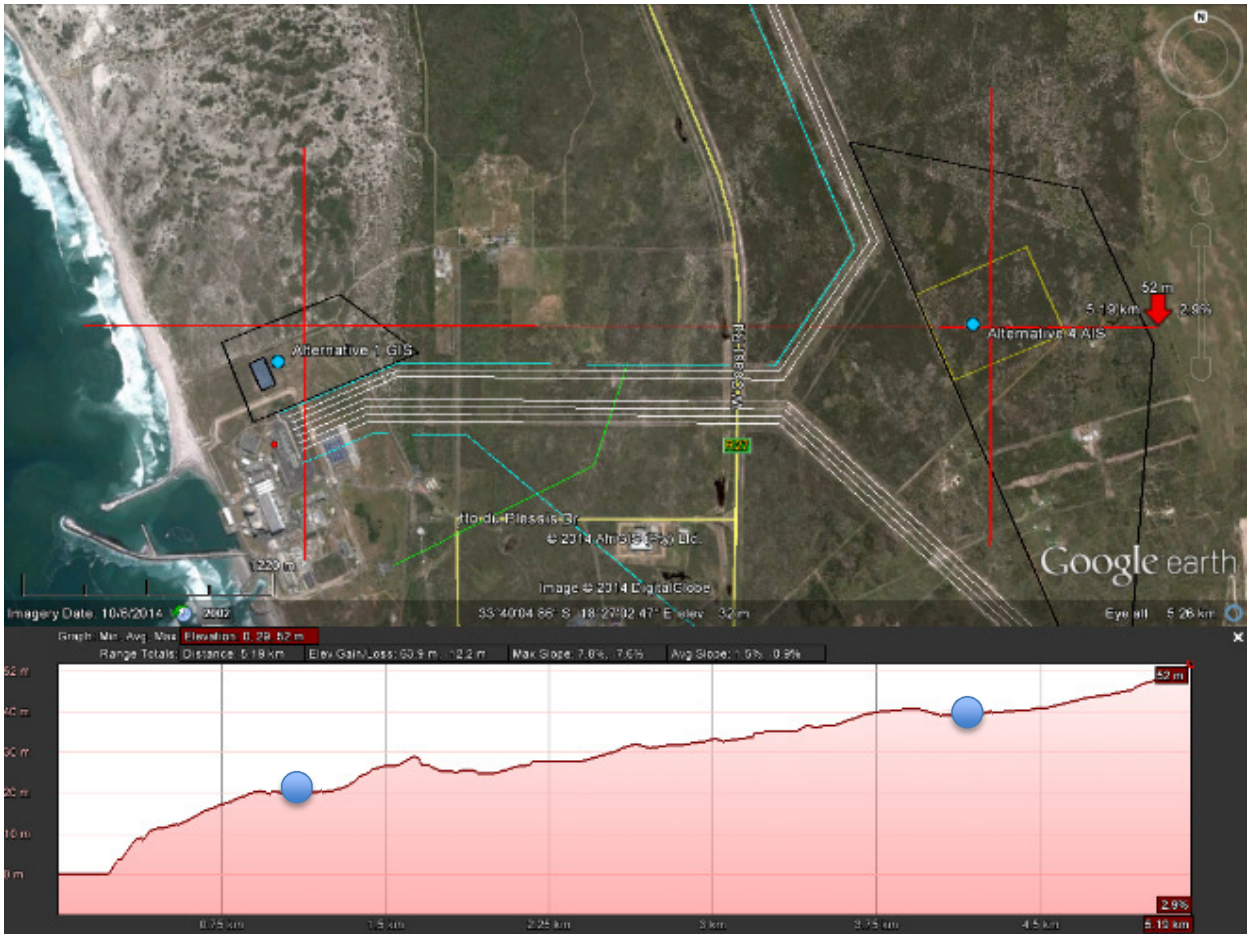

Figure 12: Google Earth West to East Elevation Profile Map

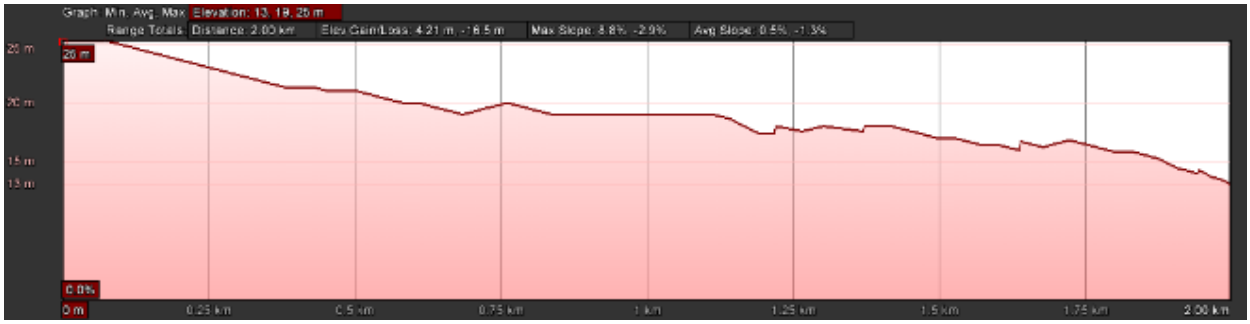

Figure 13: Alternative 1 Google Earth North to South Elevation Profile Map

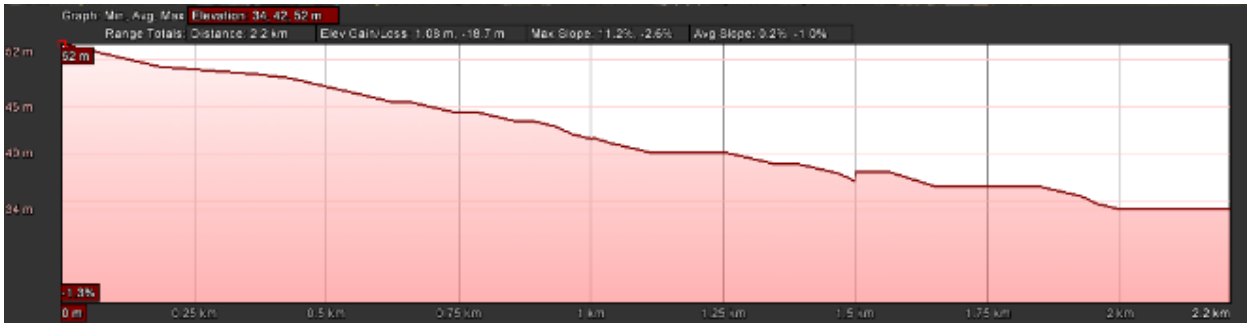

Figure 14: Alternative 4 Google Earth North to South Elevation Profile Map

Vegetation and Conservation Areas

The study area is part of the Cape Floristic Region with a very high percentage of endemic and threatened plant species. The vegetation in the area is classified by Rutherford and Mucina, 2005, as Cape Flats Dune Strandveld. This is regarded as an endangered vegetation type. Much of the area, however, has been heavily or moderately disturbed by agriculture, urbanisation, to frequent fires and alien vegetation. The largest expanse of High sensitivity vegetation occurs within the grounds of the Koeberg Nature Reserve (west of the R27). *(Savannah. 2012. Koeberg-Omega)*

The *Eskom Koeberg Nature Reserve*, which was proclaimed in 1991, is approximately 3000 ha in size and surrounds the Eskom Koeberg Nuclear Power Station. The reserve plays a pivotal role in the conservation of the area, especially since the development of industries and residential properties along the West Coast. A number of unique coastal landforms, wetlands and different vegetation communities are protected in the area. Strandveld is especially being threatened by the fast expanding Cape Town metropolitan area, poorly planned coastal developments, farming and mining. It is these factors that could ultimately lead to the decline and disappearance of the Strandveld. The vegetation is constantly under various pressures, such as salt spray from the sea, strong winds, wind blown sands and fluctuating temperatures. *(Eskom Koeberg Nature Reserve Information Package for Students)*

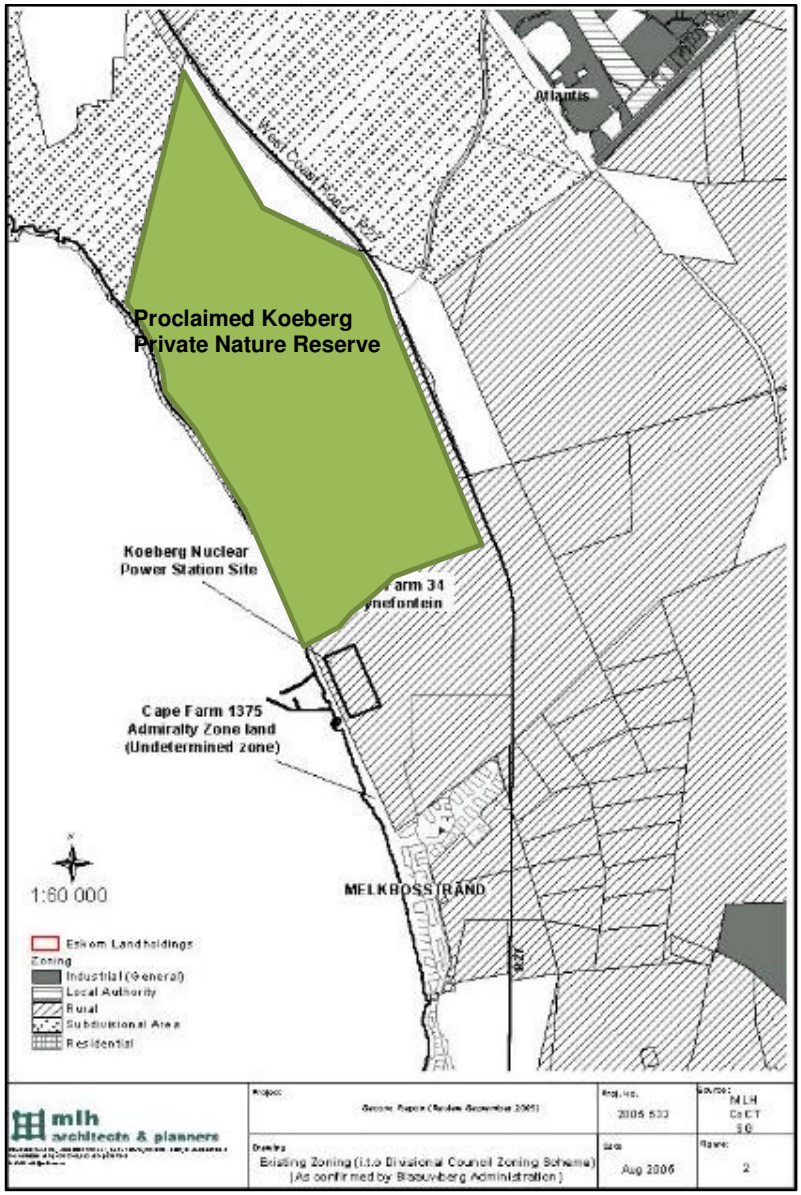

Figure 15: Locality Koeberg Private Nature Reserve

6 LANDSCAPE CHARACTER

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. The scenic quality is determined using seven key factors:

- **Land Form:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
- **Vegetation:** Primary consideration given to the variety of patterns, forms, and textures created by plant life.
- **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
- **Colour:** The overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) are considered as they appear during seasons or periods of high use.
- **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.
- **Adjacent Land Use:** Degree to which scenery and distance enhance, or start to influence, the overall impression of the scenery within the rating unit.
- **Cultural Modifications:** Cultural modifications should be considered, and may detract from the scenery, or complement or improve the scenic quality, of a unit.

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined using the following factors:

- **Type of Users:** Visual sensitivity will vary with the type of users, e.g. recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen or used by large numbers of people are potentially more sensitive.
- **Public Interest:** The visual quality of an area may be of concern to local, or regional, groups. Indicators of this concern are usually expressed via public controversy created in response to proposed activities.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent lands. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be as visually sensitive.
- **Special Areas:** Management objectives for special areas such as Natural Areas, Wilderness Areas or Wilderness Study Areas, Wild and Scenic Rivers, Scenic Areas, Scenic Roads or Trails, and Critical Biodiversity Areas frequently require special consideration for the protection of their visual values.
- **Other Factors:** Consider any other information such as research or studies that include indicators of visual sensitivity.

Assessment of the site scenic quality, receptor sensitivity and distance to nearest receptors was undertaken from nine survey points identified on the map below. The photograph of the site as well as the viewshed maps generated from the locality can be viewed in Appendix 1.

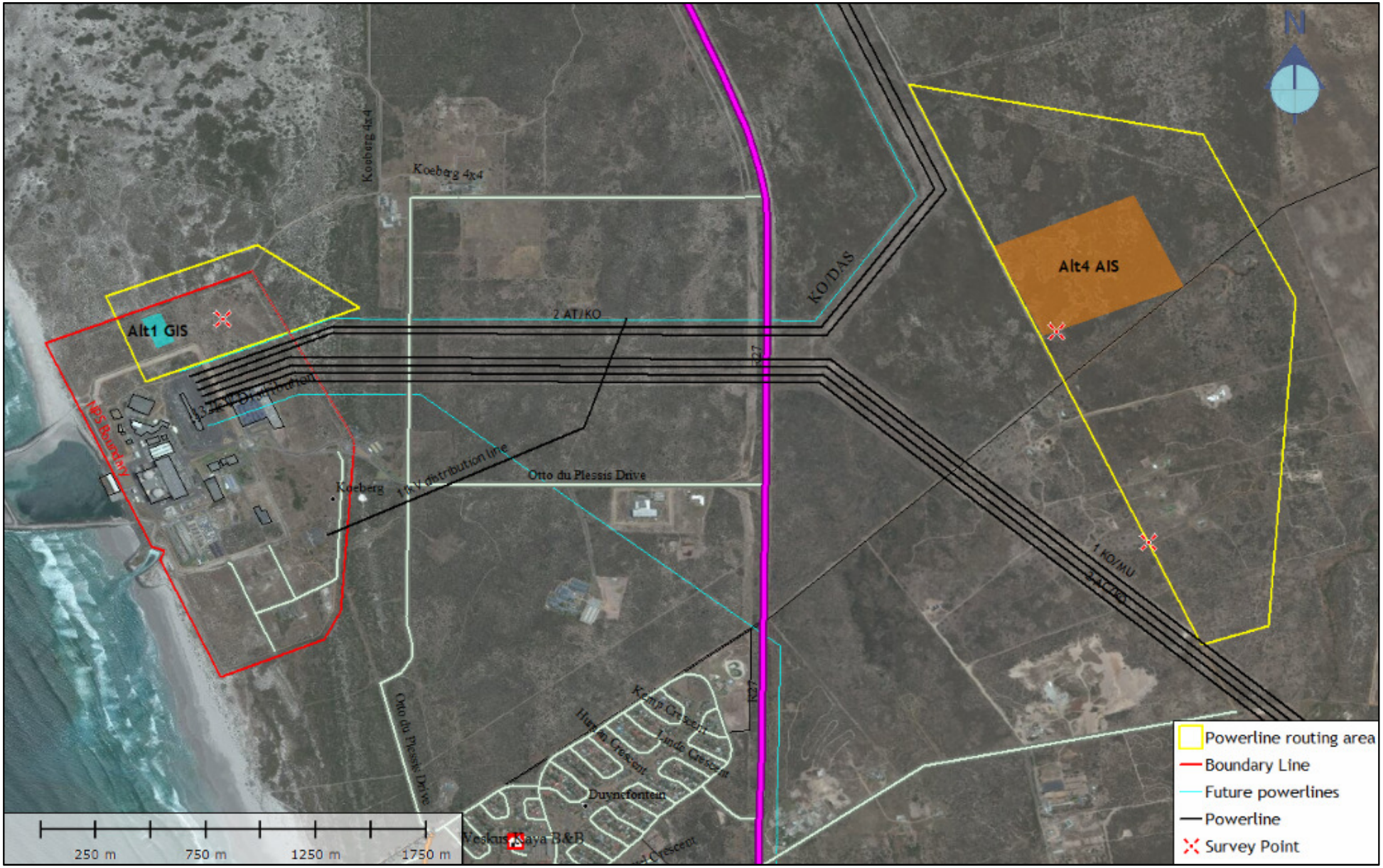

Figure 16: Alternatives 1 – 4 survey points Map

Table 1: Site Zone of Visual Influence Table

Project component	Landuse	VAC	VIZ	ZVI	Motivation
Alternative 1 GIS	Transformed	High	Low	Low	Close proximity to existing Koeberg power station visual context and relatively small in height and size.
Alternative 1 TX	Natural vegetation, dune fields	Low	Low	High	Conservation area
Alternative 4 AIS	Vacant land dominated by alien vegetation	Low	High	Medium	Limited contrast with flat terrain. Transmission lines pylon transparency moderates ZVI.
Alternative 4 TX	Transformed, alien vegetation	Low	High	Medium	Limited contrast with flat terrain. Transmission lines pylon transparency moderates ZVI.

Table 2: Site Scenic Quality Table

Project component	Landform	Vegetation	Water	Colour	Adj. Scenery	Scarcity	Cultural Modif.	Total	Scenic Quality	Motivation
Alternative 1 GIS	1	1	3	1	3	1	-4	6	C	The landscape is mainly flat but close proximity to the northern nature conservation area increases the overall value.
Alternative 1 TX	3	5	3	4	3	5	0	23	A	The dune fields have high botanical value and are incorporated into a conservation area.
Alternative 4 AIS	1	1	2	2	1	2	0	9	C	Flat landscape and alien vegetation as well as close proximity to transmission line corridor detract from scenic quality.
Alternative 4 TX	1	1	2	2	1	2	0	9	C	Flat landscape and alien vegetation as well as close proximity to transmission line corridor detract from scenic quality.

Table 3: Receptor Sensitivity Table

Project component	Exposure	Type Users	Amount of use	Public interest	Adj. land users	Special areas	Receptor sensitivity	Motivation
Alternative 1 GIS	Low	Medium	Low	Low	High	Low	Medium	Power station context.
Alternative 1 TX	Low	Medium	Low	Medium	Low	High	Medium to High	Although having low levels of visual exposure, the site falls within a conservation area.
Alternative 4 AIS	High	High	High	Medium	Low	Low	Medium	Residential with high exposure. Moderated by existing transmission line corridor in close proximity.
Alternative 4 TX	High	High	High	Medium	Low	Low	High	Residential with high exposure. Moderated by existing transmission line corridor in close proximity.

Table 4: VRM Class and Key Observation Point Table

Project component	Visual Inventory	Visual Resource	Motivation
Alternative 1 GIS	Class III	Class III	Maintains landscape status quo for most of the site but does intrude slightly into sensitive vegetation area.
Alternative 1 TX	Class II	Class II	The northern section of the proposed site has high scenic quality and sensitivity due to the dune field covered with indigenous vegetation and its locality within a greater conservation area.
Alternative 4 AIS	Class IV	Class III	Low scenic quality and moderate receptor sensitivity to landscape change results in Class IV visual inventory. Graded to Class III due to proximity to R510 view corridor.
Alternative 4 TX	Class III	Class III	Low scenic quality but high exposure to receptors with high sensitivity to landscape change.

7 FINDINGS

7.1 Landscape Context

As a result of the historic presence of the Koeberg Nuclear Power Station, the landscape context is strongly associated with large isolated structures and numerous powerlines. Tourism is important in the area and includes many accommodation services that cater for tourists looking for cultural or sporting experiences associated with the west coast. The R27 is also an important coastal access route that links the City of Cape Town in the south to the tourist nodes of the West Coast National Park and Langebaan.

7.2 Zone of Visual Influence (ZVI)

The ZVI for Alternative 1 was rated **low.** The viewsheds of Alternatives 1 mirrored the existing NPS viewshed, as a result of their its proximity to the plant. The area coverage was less than the existing NPS viewshed, and their proposed project zone of visual influence would not extend into new areas. The ZVI for Alternative 1 was rated **medium.**

Alternative 4 is located offsite and to the east of the R27. As a result, the viewshed patterning differs from that of the NPS viewshed. Hence, its zone of visual influence would expand to small pockets to the south of the site, but only should a large structure be constructed. The existing precedent for transmission lines on the Alt 4 site is strong. Hence, new powerlines in the area will not generate high levels of visual contrast. Due to the already high levels of visual contrast generated by the existing Koeberg Power Station, it is likely that visual intrusion from a similar type of electrical landscape modificaiton would not be percieved as visually intrusive.

7.3 Scenic Quality

Due to the higher ratings for the dune field landscape and the multi-coloured vegetation that covers the dunes, the northern and eastern section of Alternative 1 Transmission Line was rated **high** for scenic quality. Alternative 1 GIS site was rated **low** for scenic quality as the terrain has been strongly modified when it was flattered as part of the Nuclear Power Station security area.

Alternative 4 Site was rated **low** as, although covered with alien vegetation with limited colour variation, the site is bordered on two sides by transmission corridors and the landscape is common in the region. Alternative 4 Transmission Line area was rated **medium to low** for scenic quality due to the close proximity of the site to the existing power line corridor and the prevalence of alien vegetation.

7.4 Receptor Sensitivity

Alternative 1 GIS was rated **low** for receptor sensitivity towards landscape change. Its close proximity to the Koeberg plant ensure that any development here would be viewed as an extension of the greater power station complex. Alternative 1 transmission lines were rated **medium to high** for receptor sensitivity. Despite having low visual exposure, the site intrudes into the sensitive dune fields to the north of Koeberg in the Koeberg Private Nature Reserve.

Alternative 4 AIS was rated **medium** for receptor sensitivity. The site is in close proximity to the existing two transmission corridors, which have degraded the landscape character to some extent. Alternative 4 transmission line was rated **high.** Residents will have to be removed from the small holding area as the routing passes over, or is in very close proximity to, the dwellings.

7.5 Visual Resource Management

Due to the very close proximity of the site to well established plant or power line infrastructure, which already degrades the landscapes, no **Class I** areas were identified. The **Class II** visual objective, which requires low levels of landscape change in order to protect the visual resources of the area, was defined for Alternatives 1 transmission. This is due to the higher scenic quality of the indigenous plant covered dune fields and the visual linkages to the greater conservation area to the north. Alternative 4 AIS was defined as a **Class III** area and would allow for moderate levels of visual contrast as the area is zoned agricultural, has moderate levels of scenic quality but higher levels of receptor sensitivity to landscape change. Alternative 1 GIS was defined as a **Class IV** which allows for high levels of visual contrast. The proposed site is directly adjacent the existing power plant and is highly modified and incorporated into the NPS security zone.

8 IMPACT ASSESSMENT

8.1 Contrast Rating from Key Observation Points

In the VRM methodology, the magnitude is defined by means of a contrast rating. The assessment of the Degree of Contrast (DoC) is a systematic process undertaken from Key Observation Points (KOPs) surrounding the project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The degree of contrast generated by the proposed landscape modifications are measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible *(USA Bureau of Land Management, 2004).*

The following criteria are utilised in defining the DoC as seen from the Key Observation Points surrounding the proposed sites:

- **None**: The element contrast is not visible or perceived.
- **Weak**: The element contrast can be seen but does not attract attention.
- **Moderate**: The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong**: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

The assessment of the Degree of Contrast (DoC) is a systematic process undertaken from Key Observation Points (KOPs) surrounding the project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications.

A technical analysis of all the *alternatives* was undertaken during the same period when the scoping studies were undertaken. During the scoping public participation process I&APs have been allowed to comment on all the proposed *alternatives*. The preferred alternatives that will be taken into the EIA phase include **alternative 1 GIS** and **alternative 4 AIS**. (Lidwala Scoping Report 2014)

Making use of the VRM defined criteria, the following receptor locations were identified, as indicated in the maps below:

- Alt 1 GIS: R27
- Alt 4 AIS: Farmsteads and R27

R27 scenic route

The R27 is a national road linking Cape Town to the northern tourist and industrial area of Saldanha Port and Langebaan. It is a scenic route, used by tourists as well as being a main transport route for industry. Due to the undulating sand dunes between the receptor and site, the views of the substation as seen from this location would be screened. The views of the power lines would extend to the north but would not significantly alter the landscape character as the powerline presence is already strongly established.

Farmsteads

Located on the routing line for the proposed Alt 4 transmission lines are four dwellings which would be exposed to high levels of visual intrusion created by the new powerline routing.

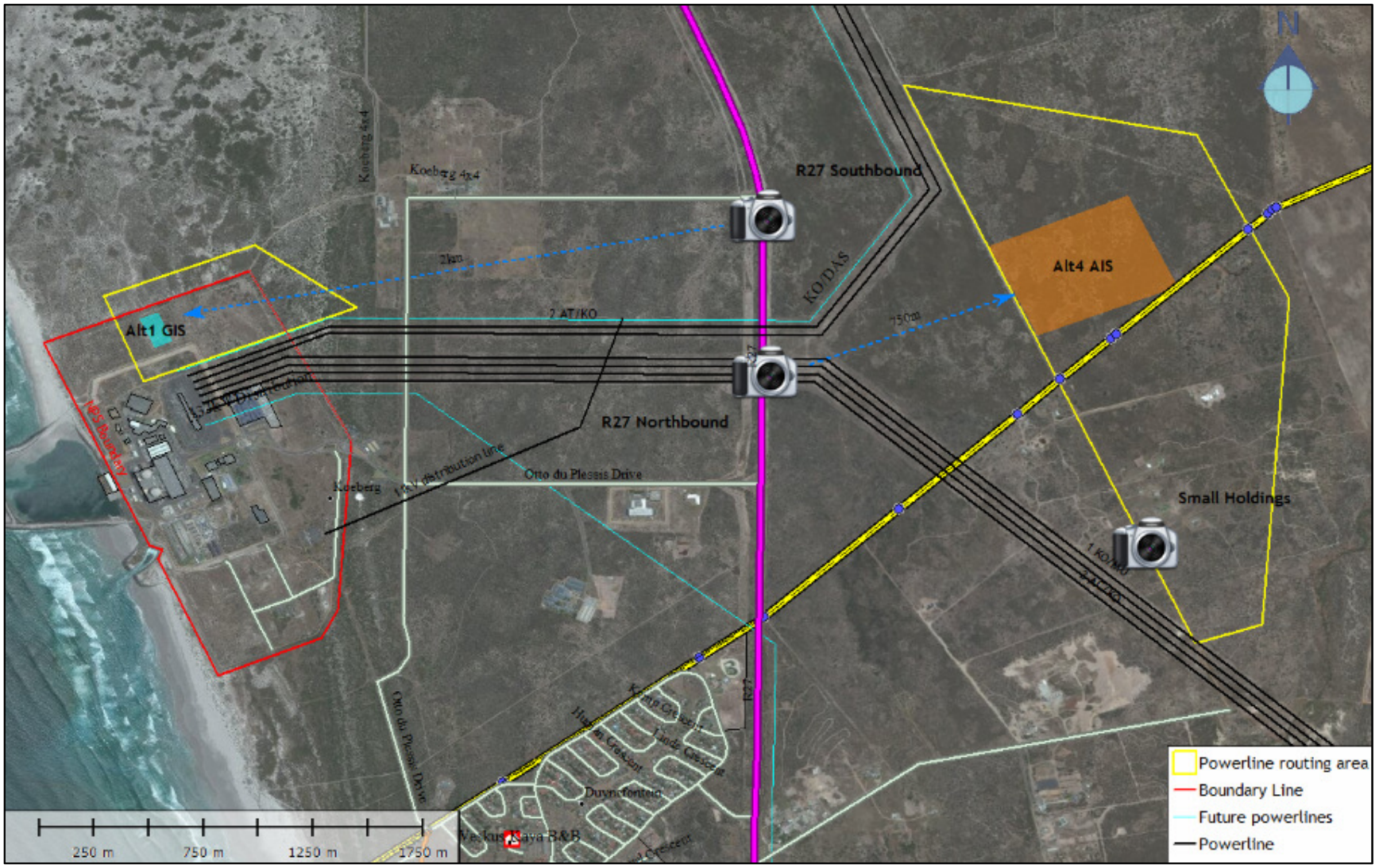

Figure 17: Receptor Alternatives 1 and 4 Map

Figure 18: R27 receptor view west towards Alt 1 where only the proposed powerline routing (red line) would be visible.

Figure 19: R27 receptor view east towards Alt 4 showing existing transmission lines and the approximate location of the Alternative 4 substation behind the pylons.

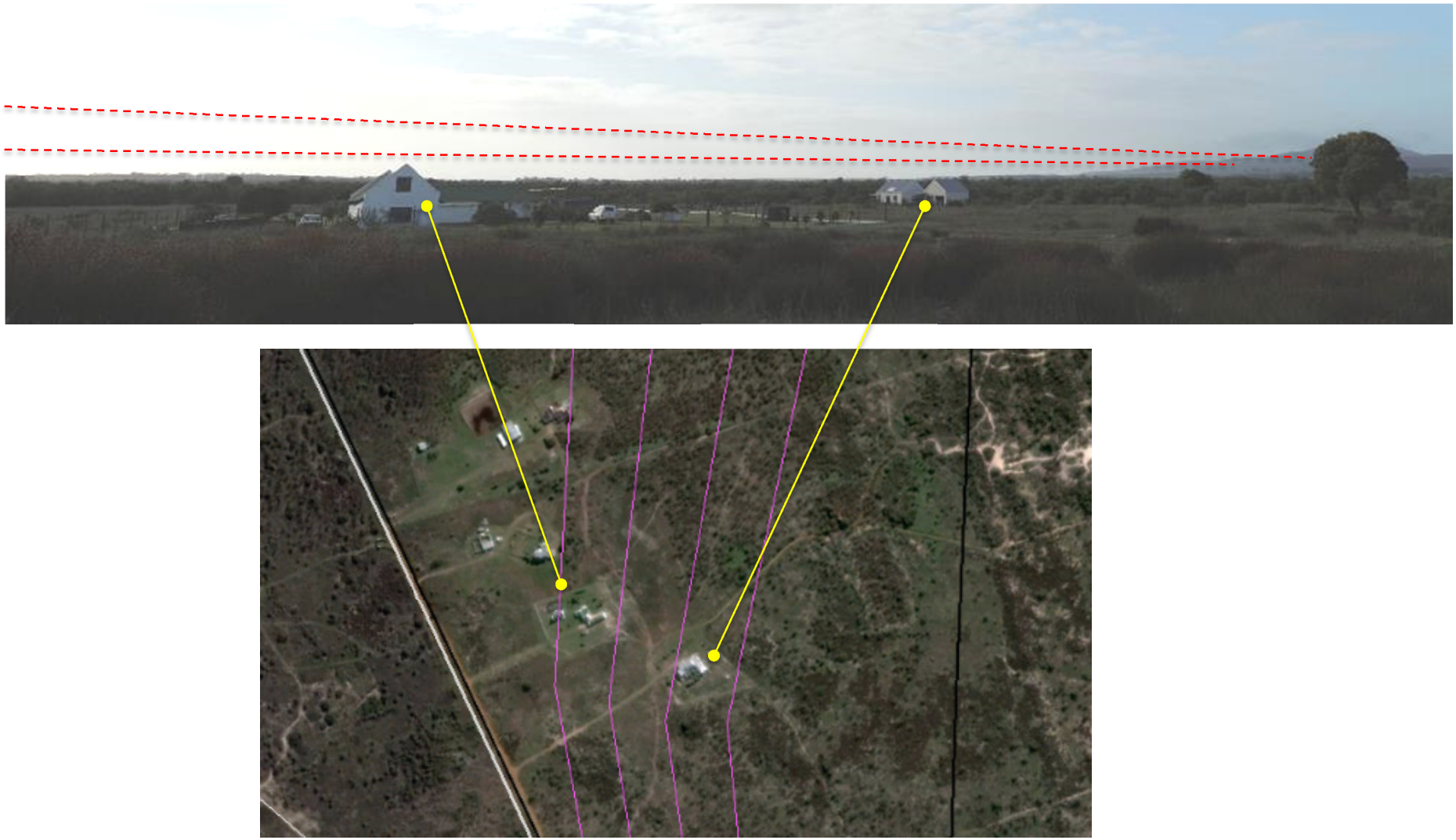

Figure 20: View from farm road toward Alt 4 transmission line corridor routed across the dwellings

Table 5: Key Observation Point Contrast Rating Table

KOP	Alternative	VRM Class	Distance (km)	Form	Line	Colour	Texture	DoC	Visual objectives met
R27	Alternative 1 GIS	Class II	2.2	None	Weak	Weak	Weak	Weak	With mitigation
R27	Alternative 4 AIS	Class III	1	Weak	Medium	Medium	Weak	Medium	With mitigation
Isolated farmsteads	Alternative 4 AIS	Class III	0	Medium	Strong	Strong	Strong	Strong	With mitigation

Table 6: Alternative 1 GIS and Transmission Visual Resources Impacts Summary Table

Site	Phase	Nature of impact:	Extent	Duration	Magnitude	Probability	Significance	Status	Confidence
			(E)	(D)	(M)	(P)	(S=(E+D+M)*P)	(+ve or -ve)	
Site 1 GIS	Construction	with	2	5	4	2	Low	-	Sure
		without	2	5	6	4	Medium	-	Sure
Site 1 GIS	Operation	with	2	5	2	2	Low	-	Sure
		without	2	5	6	4	Medium	-	Sure
Site 1 GIS	Decommissioning	with	1	5	2	1	Low	-	Sure
		without	4	5	6	4	Medium	-	Sure
Site 1 GIS	Cumulative	with	2	5	2	2	Low	-	Sure
		without	2	5	8	4	Medium	-	Sure
Site 1 TX	Construction	with	2	5	4	4	Medium	-	Sure
		without	5	5	8	5	High	-	Sure
Site 1 TX	Operation	with	2	5	4	4	Medium	-	Sure
		without	5	5	8	5	High	-	Sure
Site 1 TX	Decommissioning	with	2	5	4	4	Medium	-	Sure
		without	5	5	8	5	High	-	Sure
Site 1 TX	Cumulative	with	2	5	4	4	Medium	-	Sure
		without	5	5	8	5	High	-	Sure

(Key: +ve = Positive, -ve = Negative, Reg = Regional, Perm = Permanent,
VL = Very Low, L = Low, M = Medium, H = High, P = Probable, HP = Highly Probable)

Table 7: Alternative 4 AIS and Transmission Visual Resources Impacts Summary Table

Site	Phase	Nature of impact:	Extent	Duration	Magnitude	Probability	Significance	Status	Confidence
			(E)	(D)	(M)	(P)	(S=(E+D+M)*P)	(+ve or -ve)	
Site 4 AIG	Construction	with	2	5	4	5	Medium	-	Sure
		without	3	5	6	5	High	-	Sure
Site 4 AIG	Operation	with	2	5	6	3	Medium	-	Sure
		without	3	5	8	4	High	-	Sure
Site 4 AIG	Decommissioning	with	1	5	2	1	Low	-	Sure
		without	4	5	6	4	Medium	-	Sure
Site 4 AIG	Cumulative	with	1	5	4	2	Low	-	Sure
		without	4	5	6	5	Medium	-	Sure
Site 4 TX	Construction	with	1	5	2	2	Low	-	Sure
		without	2	5	10	5	High	-	Sure
Site 4 TX	Operation	with	1	5	2	2	Low	-	Sure
		without	2	5	10	5	High	-	Sure
Site 4 TX	Decommissioning	with	1	5	0	2	Low	-	Sure
		without	2	5	10	5	High	-	Sure
Site 4 TX	Cumulative	with	1	5	2	2	Low	-	Sure
		without	2	5	10	5	High	-	Sure

(Key: +ve = Positive, -ve = Negative, Reg = Regional, Perm = Permanent,
VL = Very Low, L = Low, M = Medium, H = High, P = Probable, HP = Highly Probable)

Table 8: Nogo Option Visual Resources Impacts Summary Table

Site	Phase	Nature of impact:	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
Sites 1 & 4 NoGo	Construction	with	2	5	2	2	Low	+	Sure
		without							
Sites 1 & 4 NoGo	Operation	with	2	5	2	2	Low	+	Sure
		without							
Sites 1 & 4 NoGo	Decommissioning	with	2	5	2	2	Low	+	Sure
		without							
Sites 1 & 4 NoGo	Cumulative	with	2	5	2	2	Low	+	Sure
		without							
TX 1 & 4 NoGo	Construction	with	2	5	8	4	Medium	+	Sure
		without							
TX 1 & 4 NoGo	Operation	with	2	5	8	4	Medium	+	Sure
		without							
TX 1 & 4 NoGo	Decommissioning	with	2	5	8	4	Medium	+	Sure
		without							
TX 1 & 4 NoGo	Cumulative	with	2	5	8	4	Medium	+	Sure
		without							

8.2 Visual Impact and Mitigation Descriptions

Lidwala Environmental Consultants method to determine the suitability of the site is based on a ranking system. In order to identify which of the alternative sites is deemed preferred the specialist are requested to rank the alternative sites according to a site ranking methodology.

The evaluation and nomination of a preferred site involves a highly interdisciplinary approach. The approach undertaken has involved a number of specialist studies which examine a number of different issues. In order to evaluate sites and determine a preferred site, the studies need to be comparative and therefore a site rating matrix was developed. The site preference rating system is applied to each discipline, and the rating of each site is conducted according to the following system:

1 = Not suitable for development / No-Go (impact of very high significance - negative)
2 = not preferred (impact of high significance - negative)
3 = acceptable (impact of moderate significance - negative)
4 = Preferred (impact of low or negligible significance - negative)

Extent	**Geographical area of influence.** **Site Related (S):***extending only as far as the activity* **Local (L):** limited to i*mmediate surroundings.* **Regional (R):** *affecting a larger metropolitan or regional area* **National (N):** *affecting large parts of the country* **International (I):** *affecting areas across international boundaries*
Duration	**Predicted lifespan** **Short term (S):** *duration of the construction phase.* **Medium term (M):** *duration for screening vegetation to mature.* **Long term (L):** *lifespan of the project.* **Permanent (P):** *where time will not mitigate the visual impact.*
Magnitude	**Magnitude of impact on views, scenic or cultural resources** **Low (L):** *where visual and scenic resources are not affected.* **Moderate (M)**: *where visual and scenic resources are affected* **High (H)**: *where scenic and cultural resources are significantly affected.*
Probability	**Degree of possible visual impact:** **Improbable (I):** *possibility of the impact occurring is very low.* **Probable (P):** *distinct possibility that the impact will occur.* **Highly probable (HP):** *most likely that the impact will occur.* **Definite (D):** *impact will occur regardless of any prevention measures.*
Significance	**A synthesis of nature, duration, intensity, extent and probability** **Low (L):** will not have an influence on the decision. **Moderate (M):** should have an influence on the decision unless it is mitigated. **High (H):** would influence the decision regardless of any possible mitigation.
Confidence	Key uncertainties and risks in the VIA process, which may influence the accuracy of, and confidence in, the VIA process.

Source: DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes

8.2.1 *Alternative 1*

GIS

The visual significance for Alternative 1 GIS was rated **medium** without mitigation and **low** with mitigation for all phases of development. Construction and operation phase visual intrusion would be reduced as the GIS structure is low in height, has low levels of visual exposure to receptors and be viewed as a smaller visual component of the existing power station complex. Higher visual intrusion could take place if the facility was painted a bright colour (blue or red) which would draw the attention of the casual observer to the proposed facility away from the interesting form of the Nuclear Power Station. Mitigation is recommended to ensure that further visual degradation does not take place to the Class IV type landscape.

Construction Phase

- The structure is to be painted a mid-grey colour
- Dust control during construction would also be required as the coastal region is prone to wind.

Operation Phase

- NA

Decommissioning Phase

- All structures and infrastructure are to be removed

Transmission

Without mitigation, **high** visual significance is possible due to the loss of the visual resources of the site by the intrusion of the transmission corridor into the conservation area to the north of the NPS. This could set a negative precedent for development in this conservation area which was defined as a NoGo area in the Nuclear One EIA. Mitigation is recommended in an attempt to meet the Class II visual objective defined to maintain the visual resources of the site. Mitigation would reduce the visual significance to **medium to high**.

Construction Phase

- Strict access restrictions to the area should be maintained with access via the southern existing NPS security road, with construction roads running north-south so as to not crest the north-south aligned sand dunes (subject to botanical specialist stipulations)
- Location of pylons should not be placed on prominent dune features which would increase the potential for disturbance of the surrounding soil structure, eroding the dune structure and impacting the vegetation
- The pylon corridor should not be fenced in and should be retained as a conservation area

Operation Phase

- Erosion prevention planning and monitoring should be undertaken
- Intensive rehabilitation and restoration of impact areas should be undertaken

Decommissioning Phase

- NA

Cumulative Effects

Cumulative Effects from the proposed GIS development were rated **low** as the site is already highly modified. It falls within the existing NPS security zone and any development would be viewed as an extension of the existing NPS complex. Cumulative Effects for the transmission line were rated **high**. The proposed extension of the pylon routings into the northern nature conservation area would not meet the Class II visual objectives requiring low levels of visual contrast, and could set a negative precedent for developing in the conservation area.

Construction Phase
- The powerline corridor area should not set a precedent for further development in the conservation area. To reduce the eventuality of this, the powerline corridor area should not be fenced off

Operation Phase
- NA

Decommissioning Phase
- NA

8.2.2 *Alternative 4*

AIS
The proposed AIS would be located to the east of the existing transmission line corridor located to the east of the R27. With four powerlines routed from the southeast and three (one proposed) to the northeast, the scenic quality of the site is already degraded. This is reinforced by the invasive alien vegetation. Without mitigation the visual significance for all phases is likely to be **high** for construction and operation phases and **medium** for decommissioning phase. Although the scenic quality or the area is low and there is sufficient distance from the R27 road users, the small holding residential area to the south would have high exposure views of the substation once the alien vegetation around the site was removed. Mitigation is recommended to meet the Class III visual objective defined for the site. With mitigation the visual significance for construction and operation phases would be **medium** and **low** for decommissioning phase.

Construction
- This would require a three metre high screening berm around the proposed site, built with a slope angle not exceeding 1 in 4 so as to facilitate vegetation growth and reduce erosion potential
- Dust control measures would be required to reduce wind-blown dust
- Location of the laydown to the north of the proposed site

Operation
- Fynbos plant species should be planted on the berm around the facility to reduce the visual intrusion to the adjacent small holding residential area.
- As the area currently does not have a bright light precedent, light management mitigations should be implemented (see appendix for examples)
- Erosion prevention planning and monitoring should be undertaken
- Ongoing rehabilitation and restoration as required

Decommissioning
- All structures and infrastructure are to be removed

Transmission
Without mitigation the visual significance of the proposed southern transmission line corridor would be **high** for the project life due to the routing of the powerlines over, or in very close proximity, to the small holding dwellings. This would significantly sterilise the scenic resources of this area resulting in a loss of revenue for the property owners. This is not recommended and an alternative routing should be implemented, or the properties should be purchased by Eskom. Rerouting would probably require the relocation of the substation, with further cost to route around the small holding area, which is likely to be unfeasible. The probable more viable alternative would be the purchase of the small holdings from the owners. Should this mitigation be implemented, the visual significance would be reduced to **low** as there would be no close proximity receptors. The other alternative, considering that suitable land would need to be purchased, is to purchase the small holdings area for the AIS substation. This scenario could be unviable in terms of engineering requirements.

Construction Phase
- The structures should be levelled to prevent illegal occupation
- The acquired land should be rehabilitated and effectively managed by Eskom

Operation
- Ongoing rehabilitation and restoration as required

Decommissioning
- NA (Permanent)

Cumulative Effects
Without mitigation it is likely that cumulative effects would be **high negative.** The routing of the transmission lines over the dwellings would increase the potential for negative cumulative effects in terms of landscape decay of the site and surrounds. With mitigation the cumulative effect would be reduced to **low**

Construction
- The properties in question would need to be purchased by Eskom and the dwellings flattened

Operation
- The acquired land should be rehabilitated and effectively managed by Eskom to ensure that the properties not falling beneath the powerlines would not result in landscape degradation.

Decommissioning
- NA (Permanent)

8.2.3 *NoGo Alternative*

The value of the current landscapes of both the proposed substation sites was rated **low**. Alt 1 is located on a transformed site adjacent the NPS and Alternative 4 is located in an area heavily invaded with alien vegetation (Port Jackson) and is adjacent to two multi-line transmission corridors. The value of the current landscapes for the transmission lines is rated **medium**. The proposed Alt 1 transmission line is partly located through a dune field located in a conservation area, with the corridor area intruding approximately 50m into the conservation area. Although this portion of the conservation area has high levels of landscape character due to the dune topography and the indigenous vegetation, the very close proximity of site to the NPS and the associated infrastructure does reduce the scenic quality of the area. The proposed Alt 4 transmission line is located through a small holding area which includes approximately five dwellings. Although local landscape character has been increased by the property owners, the overall scenic quality of the area is degraded by the adjacent multi-line transmission corridor as well as the invasive alien vegetation.

9 CONCLUSION

VRM Africa was appointed by Lidwala Environmental and Planning Services on behalf of Eskom Holdings to undertake a Visual Impact Assessment (VIA) for the proposed Weskusfleur Substation Project. The proposed sites are located at the Koeberg Nuclear Power Station (Koeberg) near Melkbosstrand, 30 km north of Cape Town on the West Coast. The proposed 400/132kV Weskusfleur Substation is proposed in the vicinity of the existing Koeberg Substation in order to:

- Improve the existing 400kV reliability
- Cater for load growth on the 132 kV network for the 20-year horizon.
- Prevent overloading of existing 400kV busbar
- Replace 30 year old technology/equipment.

The visual significance for Alternative 1 GIS was rated **medium** without mitigation and **low** with mitigation for all phases of development. Construction and operation phase visual intrusion would be reduced as the GIS structure is low in height, has low levels of visual exposure to receptors and be viewed as a smaller visual component of the existing power station complex. Without mitigation the visual significance for all phases of the proposed Alternative 4 AIS is likely to be **high** for construction and operation phases and **medium** for decommissioning phase. Although the scenic quality of the area is low and there is sufficient distance from the R27 road users, the small holding residential area to the south would have high exposure views of the substation once the alien vegetation around the site was removed. With mitigation the visual significance for construction and operation phases would be **medium** and **low** for decommissioning phase. Mitigation would entail the construction of a three metre high screening berm around the proposed site, dust control measures and the location of the laydown to the north of the proposed site.

Without mitigation, **high** visual significance of the Alternative 1 transmission line is possible due to the loss of the site visual resources of the site by the intrusion of the transmission corridor into the conservation area to the north of the NPS. This could set a negative precedent for development in this conservation area which was defined as a NoGo area in the Nuclear One EIA. Mitigation would reduce the visual significance to **medium to high** and would require strict access restrictions to the area, location of pylons off dune crests and retaining the existing conservation status of the area. Intensive rehabilitation and restoration of impact areas should be undertaken as soon as the site construction has been completed. Without mitigation the visual significance of the proposed Alternative 4 transmission line corridor would be **high** for the project life due to the routing of the powerlines over, or in very close proximity to the small holding dwellings. This is not recommended and an alternative routing should be implemented, or the properties should be purchased by Eskom. Should this mitigation be implemented, the visual significance would be reduced to **low** as there would be no close proximity receptors.

The findings of this study are that the Alternative 1 is the preferred visual alternate with mitigation. This is due to the smaller size of the GIS structure which is adjacent the existing NPS on already modified ground, and the complication of the Alternative 4 transmission line routing. Although the proposed Alternative 1 transmission lines do intrude into the conservation area, the intrusion is limited to the southern 100 metres where the landscape character is strongly dominated by the adjacent NPS plant and transmission line infrastructure.

10 REFERENCES

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11 ANNEXURE 1: SITE SURVEY AND VIEWSHED MAPS

11.1 Alternative 1 Site Survey Photographs and Viewshed

View north depicting Koeberg Nature Reserve

View east depicting Powerline corridor

View south depicting Koeberg car park

View west depicting Atlantic Ocean

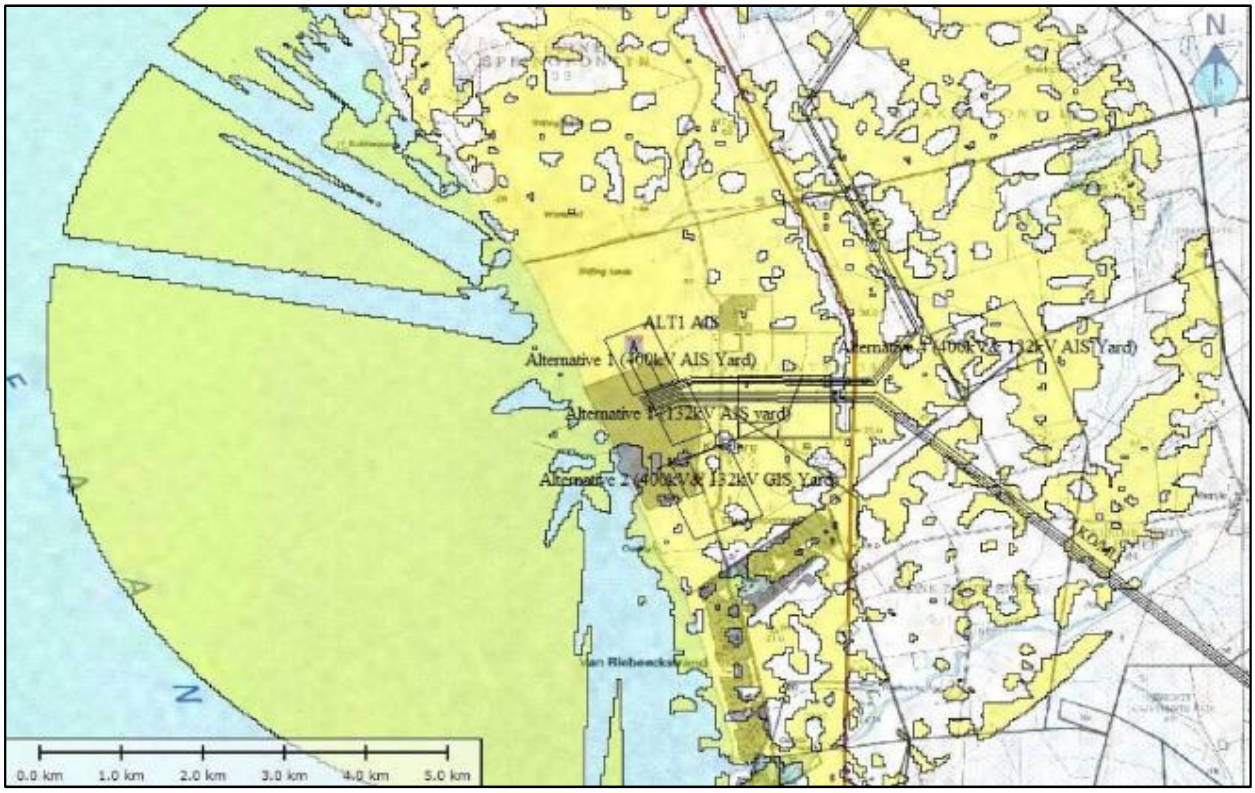


Figure 21: Alt 1 AIS Viewshed Map

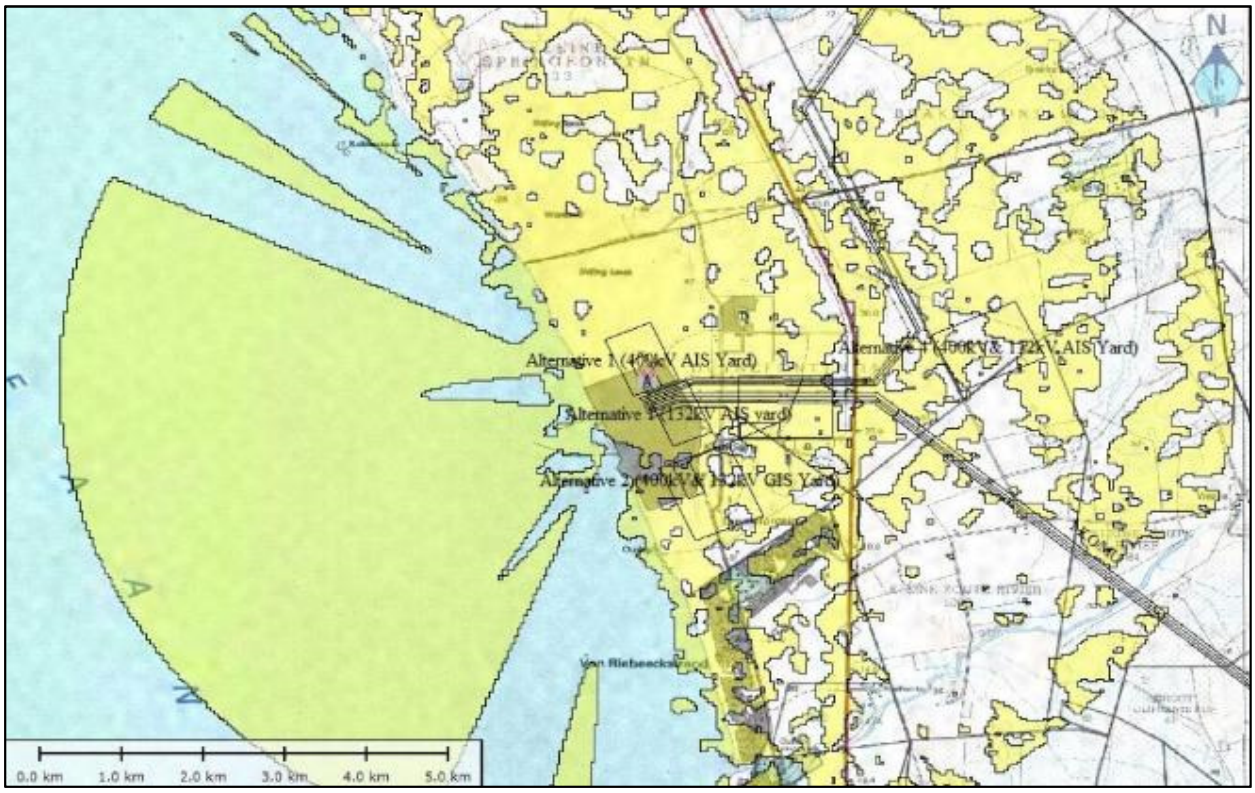


Figure 22: Alt 1 GIS Viewshed Map

11.2 Alternative 4: AIS Site Site Survey Photographs and Viewshed (Approximate location)

View north depicting alien vegetation and small access road.

View east depicting alien vegetation and small access road.

View south depicting alien vegetation and small access road

View west depicting alien vegetation in foreground and transmission line corridor in middleground

11.3 Alternative 4: Transmission Lines Site Survey Photographs

View north depicting alien vegetation and tracks.

View east depicting farmsteads and transformed lands.

View south depicting tracks through alien vegetation with transformed lands and transmission line corridor in middleground

View west depicting alien vegetation and transmission line in foreground

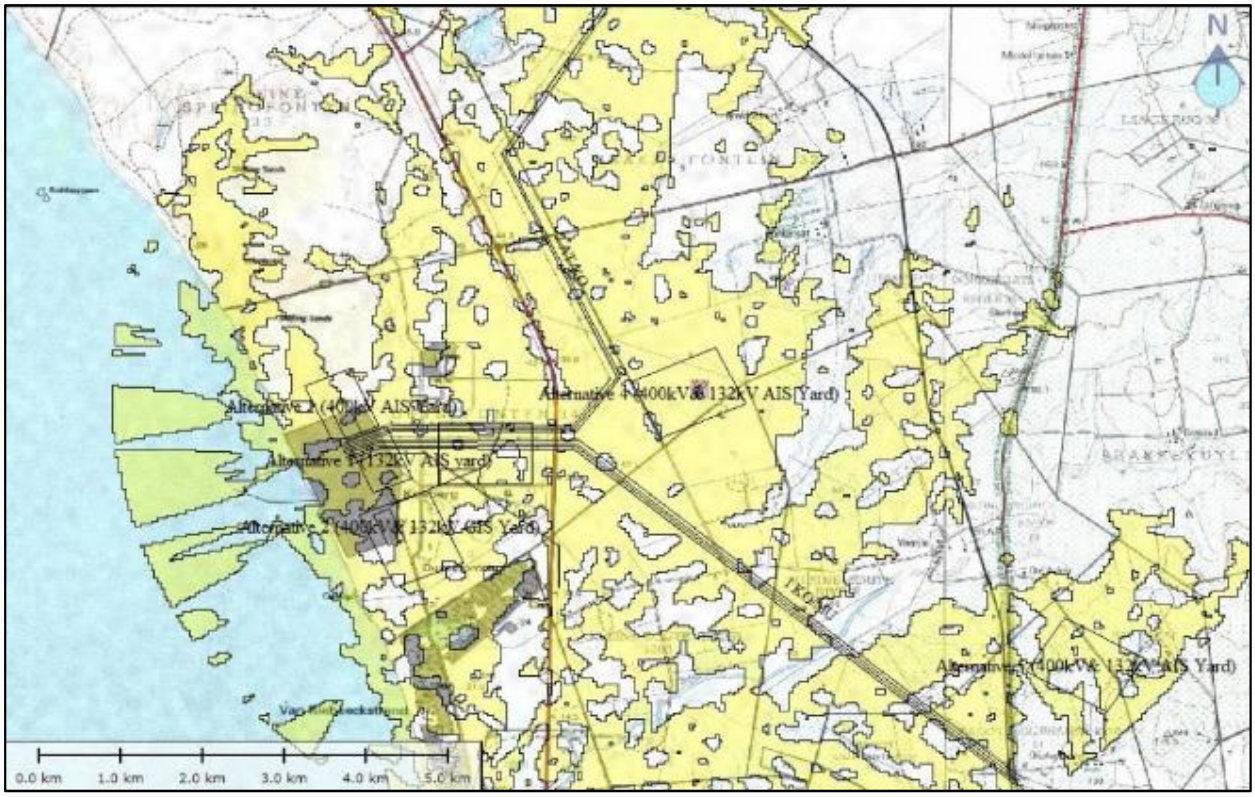


Figure 23: Alt 4 AIS Viewshed Map

12 ANNEXURE 2: SPECIALIST DETAILS

12.1 Declaration of Independence

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa (APHP)		

The specialist appointed in terms of the Regulations

I, **STEPHEN STEAD**, declare that ---

General declaration:

- I act as the independent specialist in this application
  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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- 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.

Signature of the specialist:

SILVER SOLUTIONS TRADING AS VRM AFRICA

Name of company (if applicable):

23 JANUARY 2013

Date:

12.2 Curriculum Vitae

Curriculum Vitae (CV)

1. **Position**: Owner / Director
2. **Name of Firm**: Visual Resource Management Africa cc *(www.vrma.co.za)*
3. **Name of Staff**: Stephen Stead
4. **Date of Birth**: 9 June 1967
5. **Nationality:** South African
6. **Contact Details:** **Tel: +27 (0) 44 876 0020**
   Cell: +27 (0) 83 560 9911
   Email: steve@vrma.co.za

7. **Educational qualifications**:
   - University of Natal (Pietermaritzburg):
   - Bachelor of Arts: Psychology and Geography
   - Bachelor of Arts (Hons): Human Geography and Geographic Information Management Systems

8. **Professional Accreditation**
   - Association of Professional Heritage Practitioners (APHP) Western Cape
     - Accredited VIA practitioner member of the Association (2011)

9. **Association involvement:** :
   - International Association of Impact Assessment (IAIA) South African Affiliate
     - Past President (2012 - 2013)
     - President (2012)
     - President-Elect (2011)
     - Conference Co-ordinator (2010)
     - National Executive Committee member (2009)
     - Southern Cape Chairperson (2008)

10. **Conferences Attended:**
    - IAIAsa 2012
    - IAIAsa 2011
    - IAIA International 2011 (Mexico)
    - IAIAsa 2010
    - IAIAsa 2009
    - IAIAsa 2007

11. **Continued Professional Development:**
    - Integrating Sustainability with Environment Assessment in South Africa (IAIAsa Conference, 1 day)
    - Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)
    - Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

12. **Countries of Work Experience**:
    - South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

13. **Relevant Experience:**
    Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa which specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. In association with ILASA qualified landscape architect Liesel Stokes, he has assessed of over 100 major landscape modifications through-out southern and eastern Africa. The

business has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

14. Languages:

- English – First Language
- Afrikaans – fair in speaking, reading and writing

15. Projects:

A list of ***some*** of the large scale projects that VRMA has assessed has been attached below with the client list indicated per project (Refer to www.vrma.co.za for a full list of projects undertaken).

YEAR	NAME	DESCRIPTION	CLIENT	LOCATION
2012	Afrisam Saldanha	Mine	AfriSAM	Saldana
2012	Ncondezi Power Station	Plant	Ncondezi Coal	Mozambique
2012	MET Housing Etosha Amended MCDM	Residential	Millennium Challenge	Namibia
2012	Kangnas Wind	Energy	Mainstream Renewable Power SA	N Cape
2012	Kangnas PV	Energy	Mainstream Renewable Power SA	N Cape
2012	Rossing Z20 Infrastructure Corridor	Infrastructure	Rio Tinto	Namibia
2012	MET Housing Etosha	Housing	MET	Namibia
2012	Qwale Mineral Sands	Mine	Base Resources	Kenya
2012	Houhoek Substation	Transmission	Eskom	Western Cape
2012	Bannerman Etango Mine Phase 2	Mining	Bannerman	Namibia
2012	Letseng Diamond Transmission Line Upgrade	Powerline	Gem Diaminds	Lesotho
2012	Letseng Diamond Mine Projet Kholo	Mine	Gem Diamonds	Lesotho
2012	Drennan PV	PV		Eastern Cape
2012	George Social Infrastructure	Analysis	George Municipal Area	George
2012	Lunsklip Windfarm	Windfarm	Bergwind	Stilbaai
2012	Hoodia Solar	PV expansion		Beaufort West
2012	Bitterfontein	Energy	WEPTEAM	N Cape
2012	Bitterfontein slopes	Slopes Analysis	WEPTEAM	N Cape
2012	Knysna Affordable Housing	Residential	Knysna Municipality	Knysna
2012	KAH Hornlee Project	Residential	Knysna Municipality	Knysna
2012	Kobong Hydro	Dam / Powerline	Lesotho Highlands Water	Lesotho
2012	Otjikoto Gold Mine	Mining	ASEC	Namibia
2012	Mozambique Gas Engine Power Plant	Plant	Sasol	Mozambique
2012	SAPPI Boiler Upgrade	Plant	SAPPI	Mpumalanga
2012	Upington CSP	solar Power	Sasol	Northern Cape
2012	Rossing Z20 Mine	Mining	Rio Tinto	Namibia
2012	Eastern Cape Mari-culture	Mari-culture	Department of Agriculture, forestry and Fisheries	Western Cape
2011	Vodacom Mast	Structure	Vodacom	Reichterbosch
2011	Weldon Kaya	Residential	Private	Plettenberg Bay
2011	Hornlee	Housing	ABSA	Knysna
2011	Erongo Uranium Rush SEA	SEA	SAIEA	Namibia
2011	Damkoppie	Residential	Private	Western Cape
2011	Moquini Hotel	Structure	Costa Zeerva Developments	Western Cape
2011	Bon Accord Nickel Mine	Mine	African Nickel	Barbeton
2011	Rossing Uranium Mine Phase 2	Mining	Rio Tinto	Namibia
2011	Rossing South Board Meeting	Mining	Rio Tinto	Namibia
2011	Floating Liquified Natural Gas Facility	Structure	PetroSA	Mossel Bay
2011	Khanyisa Power Station	Power Station	Anglo Coal	Western Cape
2011	PPC Rheebieck West Upgrade	Industrial	PPC	Western Cape
2011	Vale Moatize Railway 1	Mining_rail	VALE	Mozambique

2011	Vale Moatize Coal Mine	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 2	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 3	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 4	Mining_rail	VALE	Mozambique
2011	Olvyn Kolk PV	Solar Power		Northern Cape
2011	Beaufort West Urban Edge	Mapping	Willem de Kock Planners	Beaufort West
2011	ERF 7288 PV	PV		Beaufort West
2011	Erf 7288 Beaufort West	Slopes		Beaufort West
2011	N2 Herolds Bay Residental	Residential	MMS Developers	Herolds Bay
2011	Southern Arterial	Road	George Municipality	George
2011	De Bakke Cell Phone Mast	Mast	Vodacom	Western Cape
2011	Ruitesbosch	Mast	Vodacom	Western Cape
2011	Wadrif Dam	Dam	Plett Municipality	Western Cape
2011	George Western Bypass	Road	George Municipal Area	George
2011	Gecko Namibia	Industrial	Vision Industrial Park	
2011	Hartenbos Quarry Extension	Mining	Onifin(Pty) Ltd	Mossel Bay
2011	Wadrif Dam	Dam	Plettenberg Municipality	Beaufort West
2011	Kathu CSP	Solar Power		Northern Cape
2011	Sasolburg CSP	Solar Power		Free State
2010	George Open Spaces System	George SDF	George Municipal Area	George
2010	Sedgefield Water Works	Structure	Knysna Municipality	Sedgefield
2010	George Visual Resource Management	George SDF	George Municipal Area	George
2010	George Municipality SDF	George SDF	George Municipal Area	George
2010	Green View Estates	Residential		Mossel Bay
2010	Wolwe Eiland Access Route	Road	Theo Ciliers	Victoria Bay
2010	Asazani Zinyoka UISP Housing	Residential	Mossel Bay Municipality	Mossel Bay
2010	MTN Lattice Hub Tower	Structure	MTN	George
2010	Destiny Africa	Residential	KDFM	George
2010	Farm Dwarsweg 260	Residential	Hoogkwatier Landgoed	Great Brak
2010	Bantamsklip GIS Mapping	Mapping	Eskom	Western Cape
2010	Bantamsklip Transmission Revision	Transmission	Eskom	Eastern Cape
2010	Le Grand Golf and Residential Estate	Residenti	Private	George
2010	Ladywood Farm 437	Residential	Private	Plettenberg Bay
2010	Pezula Infill (Noetzie)	Residential	Pezula Golf Estate	Knysna
2010	Stonehouse Development	Residential	Private	Plettenberg Bay
2009	Eden Telecommunication Tower	Tower	Africon Engineering	George
2009	Walvis Bay Power Station	Structure	NamPower	Namibia.
2009	OCGT Power Plant Extension	Power Plant	Eskom	Mossel Bay
2009	Rossing Uranium Mine Phase 1	Mining	Rio Tinto	Namibia
2009	RUL Sulpher Handling Facility	Mining	Rio Tinto	Walvis Bay
2009	Boggomsbaai	Slopes	Private	Boggomsbaai
2009	Still Bay East	Mapping	DelPlan	SA, WC
2009	Bannerman Etango Uranium Mine	Mining	Bannerman	Namibia
2009	George Municipality Densification	George SDF	George Municipal Area	George
2009	Oudtshoorn Municipality SDF	Mapping	Oudtshoorn Municipality	Oudtshoorn
2009	Harmony Gold Mine	Mining	Harmony	Mpumalanga.
2009	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Turgis	Beaufort West
2009	Trekkopje Uranium Mine	Mining	Trekkopje Uranium Mine	Namibia
2009	Calitzdorp Retirement Village	Residential	Pretorius Family Trust	Calitzdorp
2009	Wilderness Erf 2278	Residential	Albert Hanekom	Wilderness
2009	Wolwe Eiland Eco & Nature Estate	Residential	Theo Ciliers	Victoria Bay
2009	Zebra Clay Mine	Mining	Private	Zebra
2009	Fancourt Visualisation Modelling	Visualisation	Fancourt Golf Estate	George
2009	Erf 251 Damage Assessment	Residential	Private	Great Brak
2009	Lagoon Bay Lifestyle Estate	Residential	Lagoon Bay Estate	Glentana
2009	Lagoon Garden Estate	Residential	Dreamveldt	Great Brak
2009	Moquini Beach Hotel	Resort	Kostas Zervas	Mossel Bay
2009	Knysna River Reserve	Residential	Private	Knysna
2009	Paradyskloof Residential Estate	Residential	Private	Stellenbosch
2008	Trekkopje Desalination Plant	Structure	Trekkopje Uranium Mine	Namibia
2008	Hartenbos Landgoed Phase 2	Residential	Willem van Rensburg	Hartenbos

2008	Hartenbos River Park	Residential	Adlequelle	Hartenbos
2008	Hersham Security Village	Residential	Private	Great Brak
2008	Kaaimans Project	Residential	Fritz Fenter	Wilderness
2008	Kloofsig Development	Residential	Muller Murray Trust	Vleesbaai
2008	Rheebok Development Erf 252 Apeal	Residential	Farm Searles	Great Brak
2008	Riverhill Residential Estate	Residential	Theo Cilliers	Wilderness
2008	Camdeboo Estate	Resort	Private	Graaff Reinet
2008	Oasis Development	Residential	Private	Plettenberg Bay
2008	Outeniquabosch Safari Park	Residential	Private	Mossel Bay
2008	George Airport Radar Tower	Tower	ACSA	George
2008	Lakes Eco and Golf Estate	Residential	Private	Sedgefield
2008	Pinnacle Point Golf Estate	Residential	Private	Mossel Bay
2008	Paradise Coast	Residential	Private	Mossel Bay
2008	Fynboskruin Extention	Residential	Ballabarn Three	Sedgefield
2008	Gansevallei	Residential	Pieter Badenhorst	Plettenberg Bay
2008	Hanglip Golf and Residential Estate	Residential	Pieter Badenhorst	Plettenberg Bay
2008	Proposed Hotel Farm Gansevallei	Resort	Wendy Floyd Planners	Plettenberg Bay
2008	Uitzicht Development	Residential	Private	Knysna
2008	Hansmoeskraal	Slopes Analysis	Private	George
2008	Kruisfontein Infill	Mapping	SetPlan George	Knysna
2008	Mount View Tourist Distination	Mapping	SetPlan	Western Cape
2008	Welgevonden	Visualisation	SetPlan George	De Rust
2008	Pierpoint Nature Reserve	Residential	Private	Knysna
2008	West Dunes	Residential	Private	Knysna
1998	Greater Durban Informal Housing Analysis	GIS	Durban Municipality	Durban

Certification:
I confirm that the above CV is an accurate description of my experience and qualifications and that I am available to serve in the position indicated for me in the proposal for this project.

Yours faithfully,

_____
Stephen Stead, Director

13 ANNEXURE 3: METHODOLOGY

Visual impact is defined as 'the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.' *(Oberholzer, B., 2005)*. As identified in this definition, 'landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, as they embody the history, landuse, human culture, wildlife and seasonal changes to an area.' *(U.K IEMA, 2002)*. These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

VRM Africa's objective is to provide Interested and Affected Parties (I&APs) and decision-makers with sufficient information to take "early opportunities for avoidance of negative visual effects." This is based on the U.K. Institute of Environmental Management and Assessment's (IEMA), and South Africa's Western Cape Department of Environmental Affairs and Development Planning's (DEA&DP), guidelines:

- "The ideal strategy for each identifiable, negative effect is one of avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation may be explored. If the consideration of mitigation measures is left to the later stages of scheme design, this can result in increased mitigation costs because early opportunities for avoidance of negative visual effects are missed."*(U.K IEMA, 2002)*.
- "In order to retain the visual quality and landscape character, management actions must become an essential part of the guidelines throughout construction and operation...Proper management actions ensure that the lowest possible impact is created by the project...
- Ongoing monitoring programmes, with regard to the control of aesthetic aspects, for all stages of the project, are a vital component, ensuring that the long-term visual management objectives are met."*(Oberholzer, B., 2005)*.

The impact assessment methodology that VRM Africa uses is based on the VRM methodology developed by the United States Bureau of Land Management (BLM) in that the study involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification, against the same elements found in the natural landscape. The contrast rating is a systematic process undertaken from KOPs surrounding the project site, and the assessment of the degree of contrast (DoC) is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The method is based on the premise that the degree to which a proposed landscape modification affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape *(USA Bureau of Land Management, 2004)*.

Landscape Significance

Landscape significance is assessed in order to highlight the nature and degree of significance of the landscape context by differentiating between those landscapes of recognized or potential significance or sensitivity to modification to those landscape contexts that have low sensitivity and scenic value. 'Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.' *(USA Bureau of Land Management,2004)*.

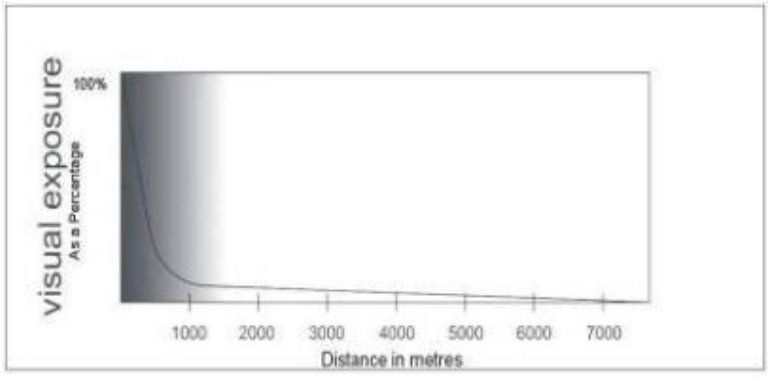
Viewshed Analysis

A viewshed is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, B., 2005)*. This reflects the area within which, or the extent to which, the landscape modification is likely to be seen. It is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape, as a point of departure for defining the shared landscape context, and to identify the receptors making use of the common views. Viewshed analyses are not absolute indicators of the level of significance, but an indication of potential visibility *(Centre for Advanced Spatial Analysis, 2002)*. Once the sites and heights of the proposed activities have been finalised, the viewshed analysis will be undertaken.

Receptor Exposure

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. Institute of Environmental Management and Assessment's (IEMA) *'Guidelines for Landscape and Visual Impact Assessment'* as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature *(Hull, R.B. and Bishop, I.E., 1988)*. According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2 km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.



13.1 Distance Zones

The VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management. The distance zones are:

1. ***Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
2. ***Background areas***, from 6km to 24km, where there is some potential for change in the sense of place, but where change would only occur in the case of very large landscape modifications; and
3. ***Seldom seen areas***, which fall within the Foreground / Middle ground area but, as a result of no receptors, are not viewed or are seldom viewed.

13.2 Scenic Quality

In the VRM methodology, scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors. During the rating process, each of these factors is ranked on a comparative basis with similar features in the region *(USA Bureau of Land Management, 2004)*. These seven elements are:

1. **Landform:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
2. **Vegetation:** 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. Also consider smaller-scale vegetation features which add striking and intriguing detail elements to the land.
3. **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.

4. **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.
5. **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.
6. **Adjacent Land Use:** Degree to which scenery, outside the scenery unit being rated, enhances the overall impression of the scenery within the rating unit. The distance at which adjacent scenery will start to influence scenery within the rating unit ranges, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
7. **Cultural Modifications:** Cultural modifications in the landform, water, and 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.

Receptor Sensitivity Rating Criteria
A= scenic quality rating of ≥19;
B = rating of 12 – 18,
C= rating of ≤11

Scenic Quality Rating Questionnaire

KEY FACTORS	**RATING CRITERIA AND SCORE**		
SCORE	**5**	**3**	**1**
Land Form	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including dune systems: or detail features that are dominating and exceptionally striking and intriguing.	Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.

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

13.3 Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium or low sensitivity levels by analysing the various indicators of public concern. The following criteria were used to assess the sensitivity of each of the communities:

- **Public Interest:** The visual quality of an area may be of concern to local, state, or national groups. Indicators of this concern are usually expressed in public meetings, letters, newspaper or magazine articles, newsletters, landuse plans, etc. Public controversy, created in response to proposed activities that would change the landscape character, should also be considered.
- **Special Areas:** Management objectives for special areas such as natural areas, wilderness areas or wilderness study areas, wild and scenic rivers, scenic areas, scenic roads or trails, and Areas of Critical Environmental Concern (ACEC), frequently require special consideration for the protection of visual values. This does not necessarily mean that these areas are scenic, but rather that one of the management objectives may be to preserve the natural landscape setting. The management objectives for these areas may be used as a basis for assigning sensitivity levels.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent land can affect the visual sensitivity of an area. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be visually sensitive.
- **Type of User:** Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen and used by large numbers of people are potentially more sensitive. Protection of visual values usually becomes more important as the number of viewers increase *(USA Bureau of Land Management, 2004)*.

Receptor Sensitivity Rating Criteria

The level of visual impact considered acceptable is dependent on the types of receptors.

- *High sensitivity : e.g. residential areas, nature reserves and scenic routes or trails*
- *Moderate sensitivity : e.g. sporting or recreational areas, or places of work*
- *Low sensitivity : e.g. industrial, mining or degraded areas*

Sensitivity Level Rating Questionnaire

FACTORS	QUESTIONS	
Type of Users	**Maintenance of visual quality is:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Amount of use	**Maintenance of visual quality becomes more important as the level of use increases:**	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low

Public interest	**Maintenance of visual quality:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Adjacent land Users	**Maintenance of visual quality to sustain adjacent land use objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
Special Areas	**Maintenance of visual quality to sustain Special Area management objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

13.4 Key Observation Points (KOPs)

KOPs are defined by the BLM Visual Resource Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are used to assess the suitability of the proposed landscape modifications by means of assessing the degree of contrast of the proposed landscape modifications to the existing landscape, taking into consideration the visual management objectives defined for the area. The following selection criteria were utilised in defining the KOPs:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size
- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

13.5 VRM Classes

The landscape character of the proposed project site is surveyed to identify areas of common landuse and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be "absorbed" or "disappear" into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method as seen below, which is then represented in a visual sensitivity map

The BLM has defined four Classes that represent the relative value of the visual resources of an area:

i. **Classes I and II** are the most valued
ii. **Class III** represents a moderate value
iii. **Class IV** is of least value

		VISUAL SENSITIVITY LEVELS								
		High			Medium			Low		
SCENIC QUALITY	A (High)	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		fore/middle ground	Background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The VRM class objectives are defined as follows:

1. The **Class I** objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. **Class I** is assigned to those areas where a ***specialist decision*** has been made to maintain a natural landscape.
2. The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
3. The **Class III** objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
4. The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

13.6 Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003)*(Sheppard, S.R.J., 2005)*. This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity

- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, 'sales' techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken. *(Sheppard, S.R.J., 2005)*.

13.7 Contrast Rating Stage

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed and the proposed landscape modification is assessed from the Key Observation Point. The suitability of landscape modification is assessed by measuring the Degree of Contrast (DoC) of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- **None** :The element contrast is not visible or perceived.
- **Weak** :The element contrast can be seen but does not attract attention.
- **Moderate** :The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** :The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

13.8 VRM Terminology

The following terms were used in the Contrast Rating Tables to help define Form, Line, Colour, and Texture. The definitions were a combination of Microsoft Word Dictionary and simple description.

FORM	LINE	COLOUR	TEXTURE
Simple	Horizontal		Smooth
Weak	Vertical		Rough
Strong	Geometric		Fine
Dominant	Angular		Coarse
Flat	Acute		Patchy
Rolling	Parallel		Even
Undulating	Curved	Dark	Uneven
Complex	Wavy	Light	Complex
Plateau	Strong	Mottled	Simple
Ridge	Weak		Stark
Valley	Crisp		Clustered
Plain	Feathered		Diffuse
Steep	Indistinct		Dense
Shallow	Clean		Scattered
Organic	Prominent		Sporadic
Structured	Solid		Consistent

Simple	Basic, composed of few elements	**Organic**	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	**Structure**	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	**Regular**	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	**Horizontal**	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	**Vertical**	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	**Geometric**	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	**Angular**	Sharply defined; used to describe an object identified by angles
Undulating	Moving sinuously like waves; wavy in appearance	**Acute**	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	**Parallel**	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	**Curved**	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	**Wavy**	Repeatedly curving forming a series of smooth curves that go in one direction and then another
Plain	A flat expanse of land; fairly flat dry land, usually with few trees	**Feathered**	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	**Indistinct**	Vague; lacking clarity or form
Prominent	Noticeable; distinguished, eminent, or well-known	**Patchy**	Irregular and inconsistent;
Solid	Unadulterated or unmixed; made of the same material throughout; uninterrupted	**Even**	Consistent and equal; lacking slope, roughness, and irregularity
Broken	Lacking continuity; having an uneven surface	**Uneven**	Inconsistent and unequal in measurement irregular
Smooth	Consistent in line and form; even textured	**Stark**	Bare and plain; lacking ornament or relieving features
Rough	Bumpy; knobbly; or uneven, coarse in texture	**Clustered**	Densely grouped
Fine	Intricate and refined in nature	**Diffuse**	Spread through; scattered over an area
Coarse	Harsh or rough to the touch; lacking detail	**Diffuse**	To make something less bright or intense

14 ANNEXURE 3: GENERAL LIGHTS AT NIGHT MITIGATIONS

Mitigation:

- Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising mine operational safety and security (See lighting mitigations by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp in 14.2).
- Utilisation of specific frequency LED lighting with a green hue on perimeter security fencing.
- Directional lighting on the more exposed areas of operation, where point light source is an issue.
- No use of overhead lighting and, if possible, locate the light source closer to the operation.
- If possible, the existing overhead lighting method utilised at the mine should be phased out and replaced with an alternative lighting using closer to source, directed LED technology.

Mesopic Lighting

Mesopic vision is a combination of photopic vision and scotopic vision in low, but not quite dark, lighting situations. The traditional method of measuring light assumes photopic vision and is often a poor predictor of how a person sees at night. The light spectrum optimized for mesopic vision contains a relatively high amount of bluish light and is therefore effective for peripheral visual tasks at mesopic light levels. *(CIE, 2012)*

The Mesopic Street Lighting Demonstration and Evaluation Report by the Lighting Research Centre (LRC) in New York found that the 'replacement of white light sources (induction and ceramic metal halide) were tuned to optimize human vision under low light levels while remaining in the white light spectrum. Therefore, outdoor electric light sources that are tuned to how humans see under mesopic lighting conditions can be used to reduce the luminance of the road surface while providing the same, or better, visibility. Light sources with shorter wavelengths, which produce a "cooler" (more blue and green) light, are needed to produce better mesopic vision. Based on this understanding, the LRC developed a means of predicting visual performance under low light conditions. This system is called the unified photometry system. Responses to surveys conducted on new installations revealed that area residents perceived higher levels of visibility, safety, security, brightness, and colour rendering with the new lighting systems than with the standard *High-Purity Standards* (HPS) systems. The new lighting systems used 30% to 50% less energy than the HPS systems. These positive results were achieved through tuning the light source to optimize mesopic vision. Using less wattage and photopic luminance also reduces the reflectance of the light off the road surface. Light reflectance is a major contributor to light pollution (sky glow).' *(Lighting Research Center. New York. 2008)*

‘Good Neighbour – Outdoor Lighting’

Presented by the New England Light Pollution Advisory Group (NELPAG) http://cfa/ www.harvard .edu /cfa/ps/nelpag.html) and Sky & Telescope http://SkyandTelescope.com/). NELPAG and Sky & Telescope support the International Dark-Sky Association (IDA) *(http://www.darksky.org/).*

What is good lighting? Good outdoor lights improve visibility, safety, and a sense of security, while minimizing energy use, operating costs, and ugly, dazzling glare.

Why should we be concerned? Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the night-time environment and neighbours’ property values. Light directed uselessly above the horizon creates murky skyglow — the “light pollution” that washes out our view of the stars.

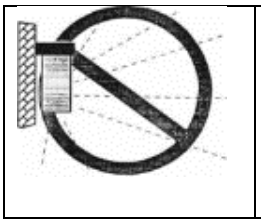
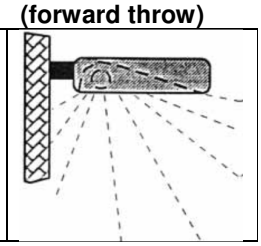
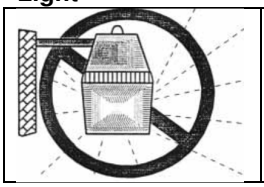
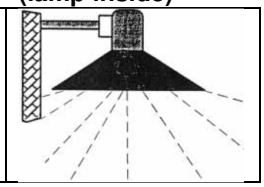
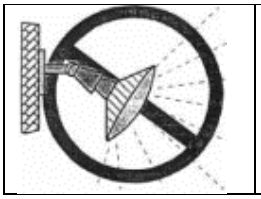
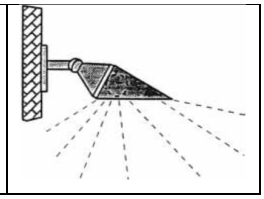
Glare Here’s the basic rule of thumb: If you can see the bright bulb from a distance, it’s a bad light. With a good light, you see lit ground instead of the dazzling bulb. “Glare” is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

Excess Lighting Some homes and businesses are flooded with much stronger light than is necessary for safety or security.

Good and Bad Light Fixtures

Typical “Wall Pack”	**Typical “Shoe Box” (forward throw)**
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down
Typical “Yard Light”	**Opaque Reflector (lamp inside)**
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down
Area Flood Light	**Area Flood Light with Hood**
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down

How do I switch to good lighting?
Provide only enough light for the task at hand; don’t over-light, and don’t spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbours or polluting the sky.

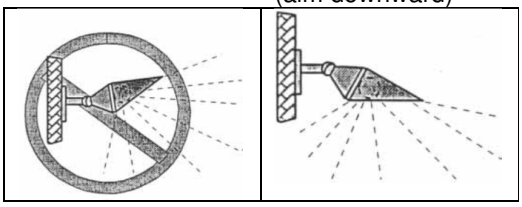
1. Aim lights down. Choose “full-cutoff shielded” fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.

2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.

3. If colour discrimination is not important, choose energy-efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact fluorescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.

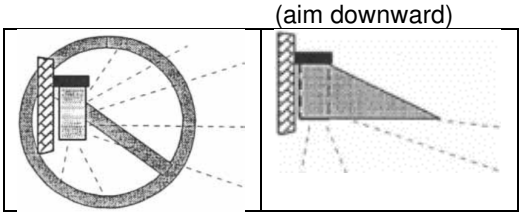
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



Floodlight:

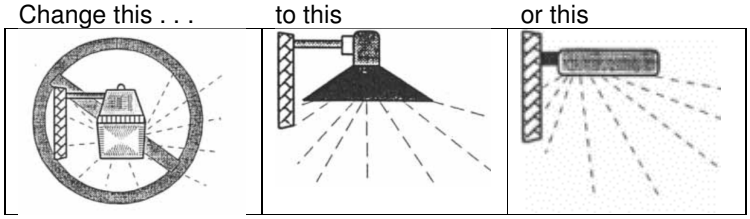
Change this . . . to this (aim downward)



Wall Pack

4. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

Change this . . . to this or this



Yard Light Opaque Reflecter Show Box

Replace bad lights with good lights.
You’ll save energy and money. You’ll be a good neighbour. And you’ll help preserve our view of the stars.