ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED AMDA KLONDIKE DELTA PV, NORTHERN CAPE PROVINCE.

VISUAL IMPACT ASSESSMENT: SPECIALIST REPORT

DRAFT: 4 May 2016

Document prepared for Cape EAPrac (Pty) Ltd;
On behalf of AMDA DELTA (Pty) Ltd.

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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, which 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.

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.'

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
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
SAHRA	South African National Heritage Resources Agency
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

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This document was undertaken by the following team:

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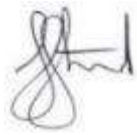
Lisa Schultz	Editing and Contrast Rating	Bachelor of Arts, Fine Art



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1 EXECUTIVE SUMMARY

Conclusion
It is the recommendation of this visual assessment that the proposed Klondike Delta PV development should be authorised. The proposed development is also located within the Renewable Energy Development Zones (REDZs) Area 6 that has been identified as a strategic growth point for renewable energy development. Three other solar energy facilities have been proposed for the area, but will not be within the proposed development's visual context, reducing cumulative massing effects.

Without mitigation, the Visual Significance for all phases of the proposed PV development is likely to be ***Medium to High***. This is due to the closer proximity of the tourist receptors located to the north of the proposed site. With mitigation, and the rehabilitation of the open field (or screening trees planted in front of the tourist areas), the Visual Significance for all phases is likely to be ***Medium to low***.

Without mitigation, the Visual Significance for all phases of the proposed Power Line is likely to be ***Low*** due to the routing adjacent either a 88kV or a 400kV Eskom power lines. With mitigation, the Visual Significance for all phases is likely to be ***Very Low***.

Visual Absorption Capacity
The VAC of the site is rated ***Medium***. There is some undulation of the landscape, but the main feature increasing the VAC levels is the treed bushveld landscape. Cultural modifications also include the Naledi residential areas to the east, the Eskom distribution power lines to the south, distribution power lines on the site and surrounding the site, as well as numerous farmsteads around the site. The proposed power line is also aligned along two existing Eskom servitudes which increases the vertical visual element in the landscape.

Project Visibility
The proposed PV structures have a constrained viewshed extent and as such is rated ***Local***. Even within the 2km buffer distance area, fragmentation of the viewshed is starting to take place. Beyond the 6km distance, a visual incidence is very unlikely. It is likely that the PV project zone of visual influence would not extend beyond the foreground / middle ground buffer of 4 kilometres from the site. This is mostly due to the surrounding vaalbosveld, which in most instances will be higher than the proposed PV structures that would significantly fragment most views.

The proposed power line routing has a constrained viewshed extent and as such is rated ***Local***. The 2km high exposure area depicts full coverage, but views start to fragment in the 2km to 6km distance zone, limiting visual extent to the northeast areas. It is likely that the power line zone of visual influence would not extend beyond two kilometres from the site, due to the small visual footprint of the monopoles.

Project Exposure
The overall visual exposure of the proposed landscape modification to the surrounding receptors is defined as ***high***. The N14 and the three tourist facilities located adjacent the proposed site, are located in close proximity.

Scenic Quality

The Scenic Quality rating for the modified Vaalbosveld landscape is rated ***Medium to Low***. Landform is rated low due to the flat terrain that has no outstanding landscape features. Vegetation is rated medium due to the Vaalbosveld type trees that offer some variety and colour to the landscape. Water is absent on the site and rated low. Colours are shades of greens from the trees and the yellows from the grasses. Adjacent dwellings are well screening by local trees that hide the house colours. Adjacent scenery is rated medium to low. The existing adjacent residential areas, the power lines and the road infrastructure increase the local VAC levels. Scarcity is rated low as the land is zoned agriculture and is interesting within it's setting but is fairly common within the region.

Receptor Sensitivity

The overall receptor sensitivity to the landscape change is likely to be ***low***. The type of users do include tourist who could be more sensitive to landscape change, however the higher VAC of the area and close proximity of the site to the Naledi residential development are likely to reduce receptor sensitivity to low. The area is buffered from the N14 and would be mainly screened from these receptors. Other receptors include adjacent tourism accommodation and conference activities and the amount of use is rated medium. The partial screening and higher VAC from the remaining Vaalbosveld trees in the buffer zone, would reduce public interest and is rated low. Adjacent land users include tourists that use the site as part of their tourism based sense of place and as such is rated high. The area is zoned agricultural and rated low for special zonings.

2 INTRODUCTION

VRM Africa was appointed by Cape EAPrac (PTY) Ltd to undertake a Level 3 Visual Impact Assessment for the proposed Klondike Delta PV Project on behalf of AMDA Delta (PTY) Ltd. The site is located near the town of Vryburg in the North West Province. A site visit was undertaken on the 22th of February 2016.

2.1 Terms of Reference

According to the Bureau of Land Management, U.S. Department of Interior, landscape significance is assessed by differentiating between those landscapes of recognized or potential significance or sensitivity to modification and landscapes that have low sensitivity and scenic value. 'Different levels of scenic values require different degrees 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. 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.'
(USDI., 2004)

The scope of the study is to cover the entire proposed project area, and the terms of reference for the study are as follows:

- Collate and analyse all available secondary data relevant to the affected proposed project area. This includes a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
- Consider all cumulative effects in all impact reports.
- Specific attention is to be given to the following:
  - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
  - Evaluation and classification of the landscape in terms of sensitivity to a changing land use.
  - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Determining visual issues, including those identified in the public participation process.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operation and decommissioning phases of the proposed project.
  - Assessing the potential cumulative impacts associated with the visual impact.
  - Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Plan (EMP).

2.2 Assumptions and Limitations

- Information pertaining to the specific heights of activities proposed for the development was limited and, where required, generic heights will be used to define the visibility of the project.
- 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 open source satellite imagery was utilised for base maps in the report.
- The viewsheds were generated using ASTER elevation data. (NASA, 2009)
- 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 Enterprise framework.
- 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. This 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.

2.3 Methodology Summary

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 (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria.

The VRM process involves the systematic classification of the broad-brush landscape types within the receiving environment into one of four VRM Classes. Each VRM Class is associated with management objectives that serve to guide the degree of modification of the proposed site. The Classes are derived by means of a simple matrix with the three variables being the scenic quality, the expected receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points. The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity, where they represent the relative value of the visual resources of an area. Classes I and II are the most valued, Class III represents a moderate value; and Class IV is of least value.
To determine impacts, a degree of contrast exercise is required. This is an assessment of the expected change to the receiving environment in terms of the form, line, colour and texture, as seen from the surrounding Key Observation Points. This is to determine if the proposed project meets the visual objectives defined for each of the Classes. If the expected visual contrast is strong, mitigations and recommendations are be made to assist in meeting the visual objectives. To assist in the understanding of the proposed landscape modifications, visual representation, such as photomontages or photos depicting the impacted areas, can be generated. There is an ethical obligation in the visualisation process, as visualisation can be misleading if not undertaken ethically.

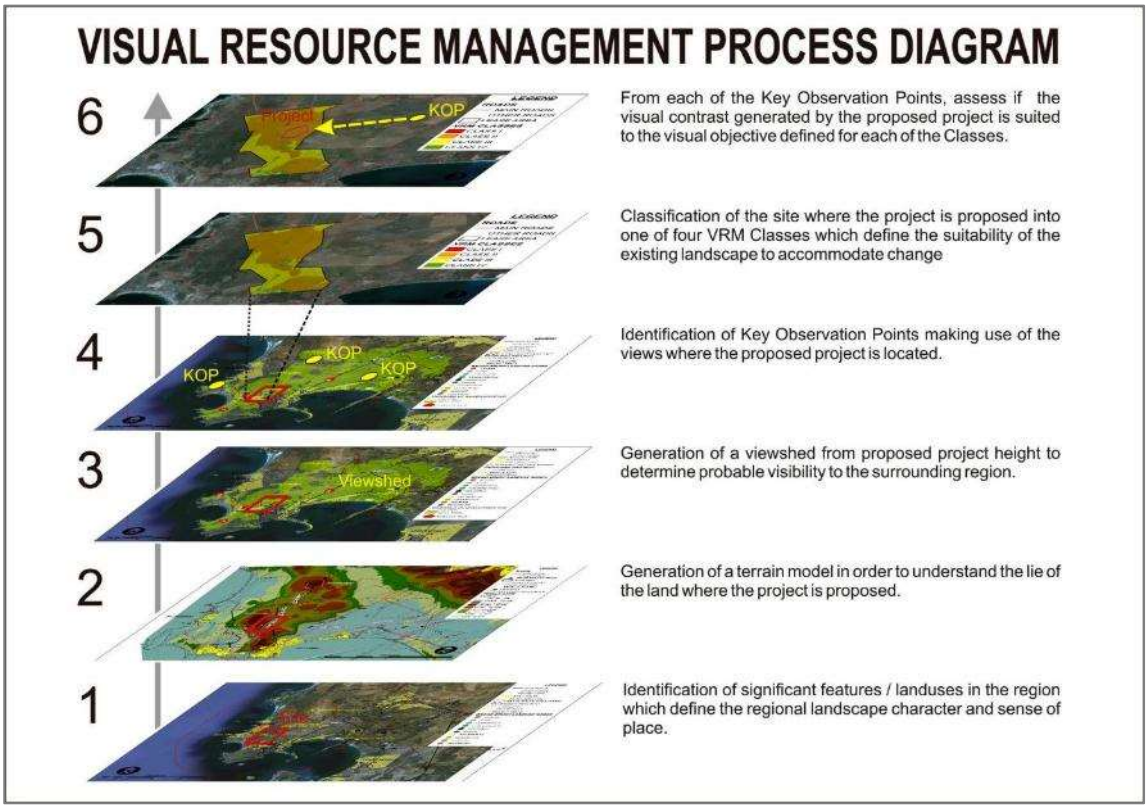

Figure 1: VRM process diagram

3 PROJECT DESCRIPTION

The proposed project is located approximately 5km west of the town of Vryburg in the North West Province, within the Naledi Local Municipality.

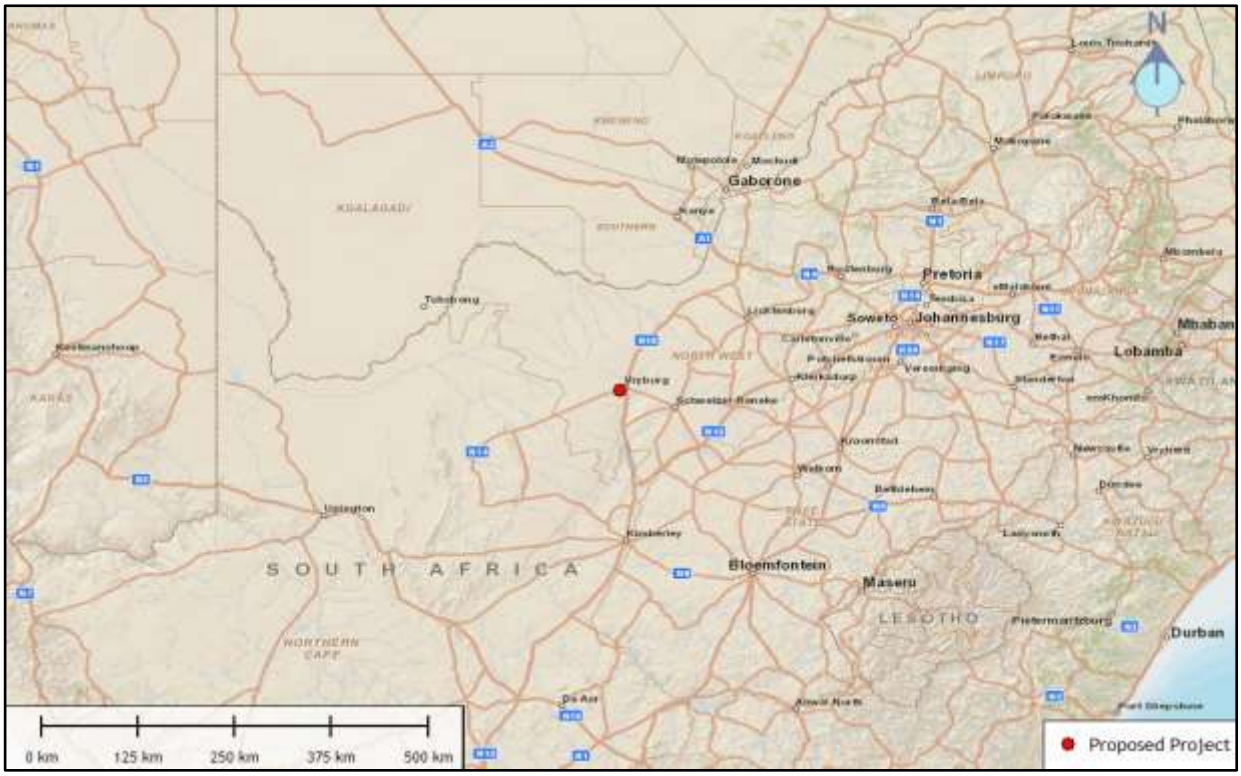

Figure 2: Project regional locality map.

Figure 3: Photographic example of a similar PV technology (Solar Professional)

The following table of information was provided by the developer.

Table 1: Project Information Table

Company Details		
Company profile	Name and details of Developer	**AMDA Delta (Pty) Ltd** Co Reg No 2015/300643/07
Site Details		
Project Property	Description and Size in hectares of the affected property.	Farm name and number: Remaining Extent Klondike No 670, IN Registration Division, North West Province Total Property Size: 1142.4853Ha
Development Site	Approximate EIA and development areas	Initial EIA Study Area size: Approx 900Ha Development lease area : Approx 250Ha
Technology Details		
Capacity of the facility	Capacity of facility (in MW)	Net generating capacity (AC): 75MWac Installed capacity (DC): 85MWp
Solar Technology selection	Type of technology	Solar PV on fixed tilt structures or single axis tracking technology.
	Structure orientation	Fixed-tilt in north-facing orientation, or mounted on horizontal axis trackers, tracking from east to west.
	Development component dimensions: Solar PV field footprint Project sub-station Collector sub-station Buildings Roads Permanent laydown areas Construction laydown areas	Approximate dimensions 185Ha 1Ha 1Ha 1.5Ha 22km long @6m wide = 13.2Ha 7Ha 12Ha
	Solar field tracker structure height	Approx.: 3.5m
	Perimeter fence	2.4m high multi-strand electric security fence
Connection to National Grid		
Grid connection	Substation to which project will connect.	Eskom Mookodi MTS near Vryburg, North West Province 27° 0'34.63"S and 24°44'40.81"E
	Capacity of substation to connect facility	Confirmed capacity 485MW – Eskom letter for REIPPPP Bid Window 4 Accelerated Programme & 907MW in GCCA 2022 June 2015
Power line/s	Project sub-station to collector sub-station Collector sub-station to Mookodi	A single 132kV overhead line A double 132kV overhead line
	Route/s of power lines	Approx 5.88km from collector sub-station on east of Klondike 670 property, across district road and over Municipal land to Mookodi MTS

	Height of the Power Line	25m
	Servitude Width	50m
Auxiliary Infrastructure		
Other infrastructure	Additional Infrastructure	Water from Municipality or borehole. Auxiliary electricity supply from Eskom Sewerage by conservancy tank
	Details of access roads	Existing access from N14 or new access off Vryburg - Reivilo district road

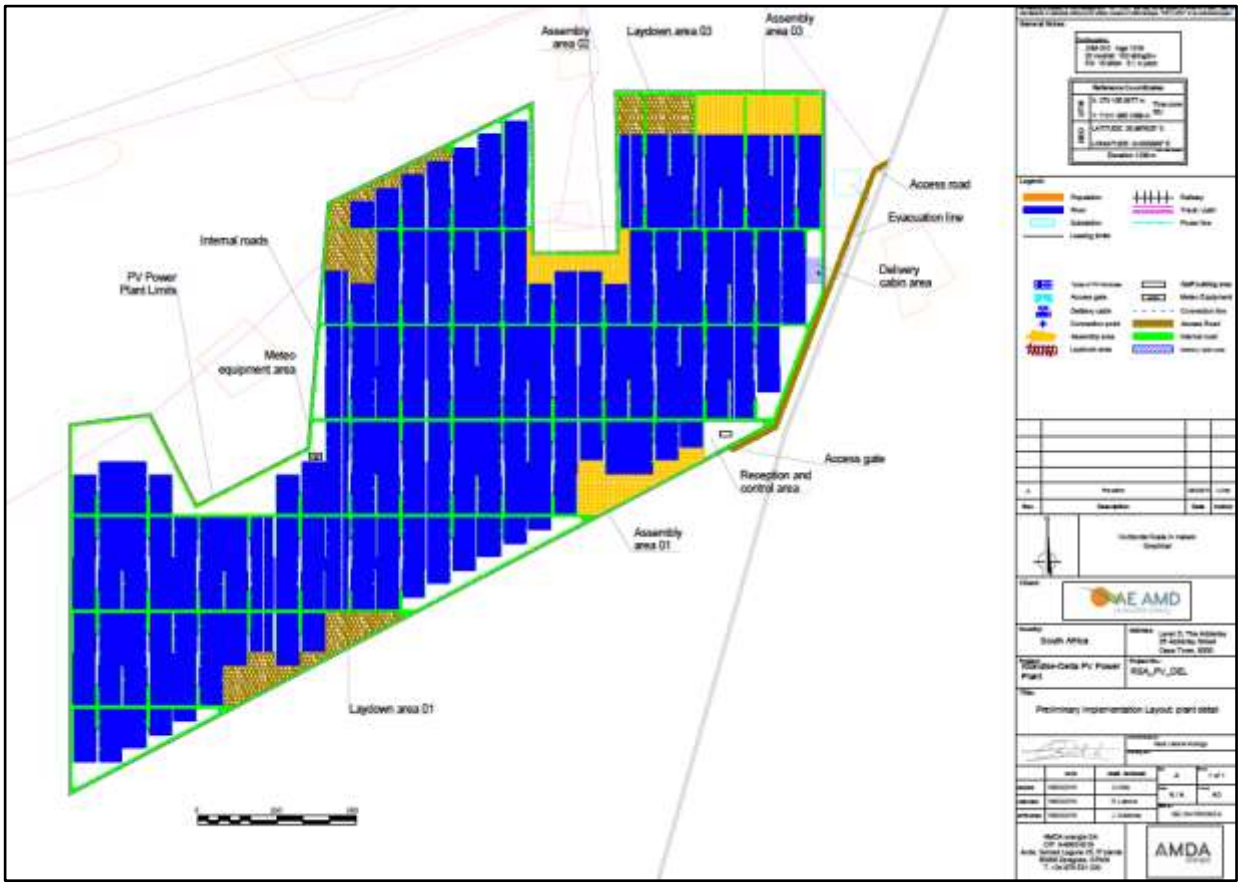

Figure 4: Proposed project layout plan.

3.1 Legislative Context

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the proposed 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 organization guidelines:

3.1.1 *The Draft Strategic Environmental Assessment Department of Environmental Affairs Guidelines for Solar and Wind Energy Negative Mapping Document*

According to the draft negative mapping undertaken for the Solar and Wind Energy SEA conducted by the CSIR for the Department of Environment Affairs, the following distance criteria were recommended as road buffers for proposed wind and solar projects. (Department of Environment Affairs, 2013).

Roads

Attributes	Wind Buffer	Solar Buffer
Major Roads (national, arterial, main)	500m	500m
Secondary Roads (secondary)	500m	500m
Tourist Routes (WC)	2km	2km

Source: DRDLR 50k Topo, 2006

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

As specific Visual Guidelines are not provided for the area we propose to refer to the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in EIA processes. This states that the Best Practicable Environmental Option (BPEO) should address the following:

- 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 BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e. to retain open views and vistas).
- “Long term protection of important scenic resources and heritage sites.
- Minimisation of visual intrusion in scenic areas.
- Retention of wilderness or special areas intact as far as possible.
- Responsiveness to the area's uniqueness, or sense of place.” (Oberholzer, 2005)

3.1.3 *Renewable Energy Development Zones (REDZs)*

A Strategic Environmental Assessment commissioned by the Department of Environmental Affairs, undertaken by the CSIR, identified Renewable Energy Development Zones (REDZs). These are gazetted geographical areas in which several wind and solar PV development projects will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country. The Site falls into the Area 6 around Vryburg (Department of Environment Affairs, 2013).

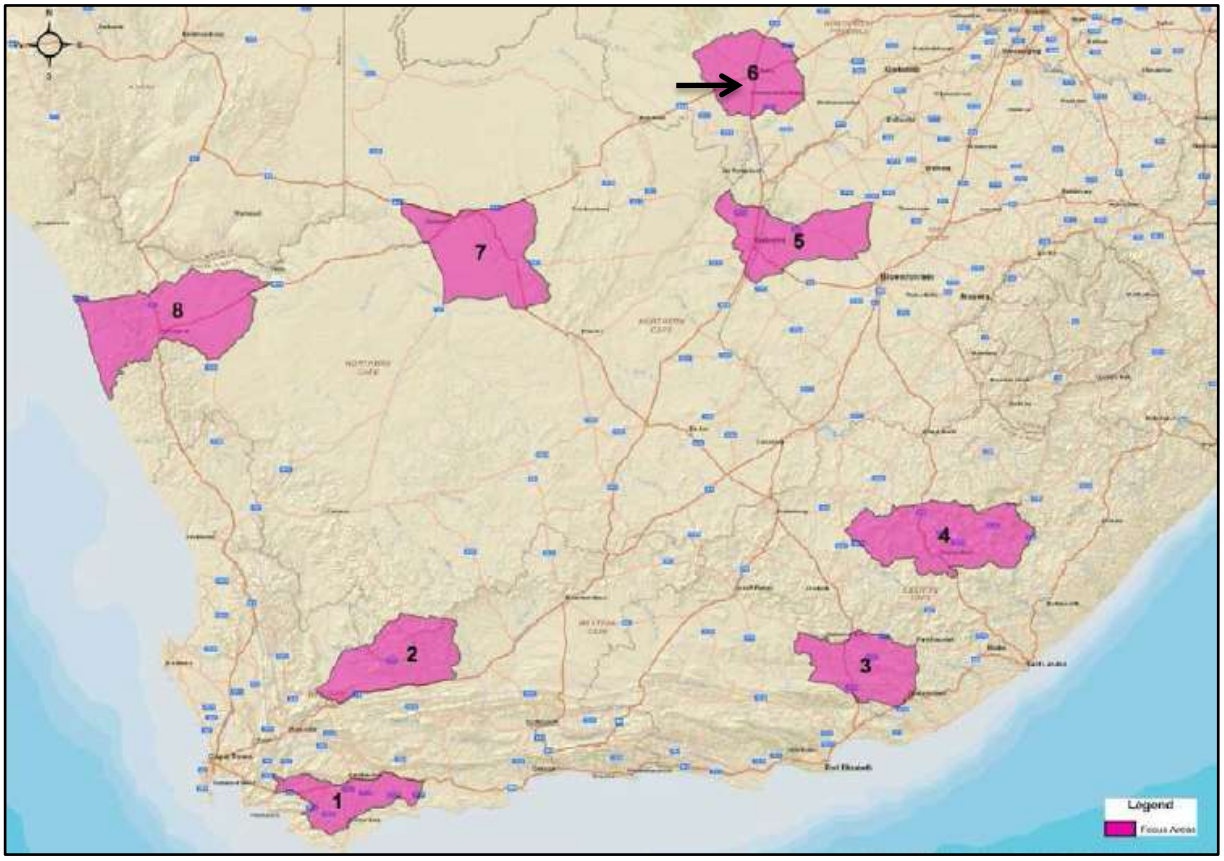

Figure 5: Renewable Energy Development Zones (REDZs) map with the approximate location of the proposed project indicated.

4 BASELINE ASSESSMENT

The baseline section serves to provide an understanding of the extent of the influence of the proposed landscape change, the degree of the change that will take place to the landscape, and the expected intensity by which the proposed landscape change is likely to be experienced by people around the site making use of the common landscape.

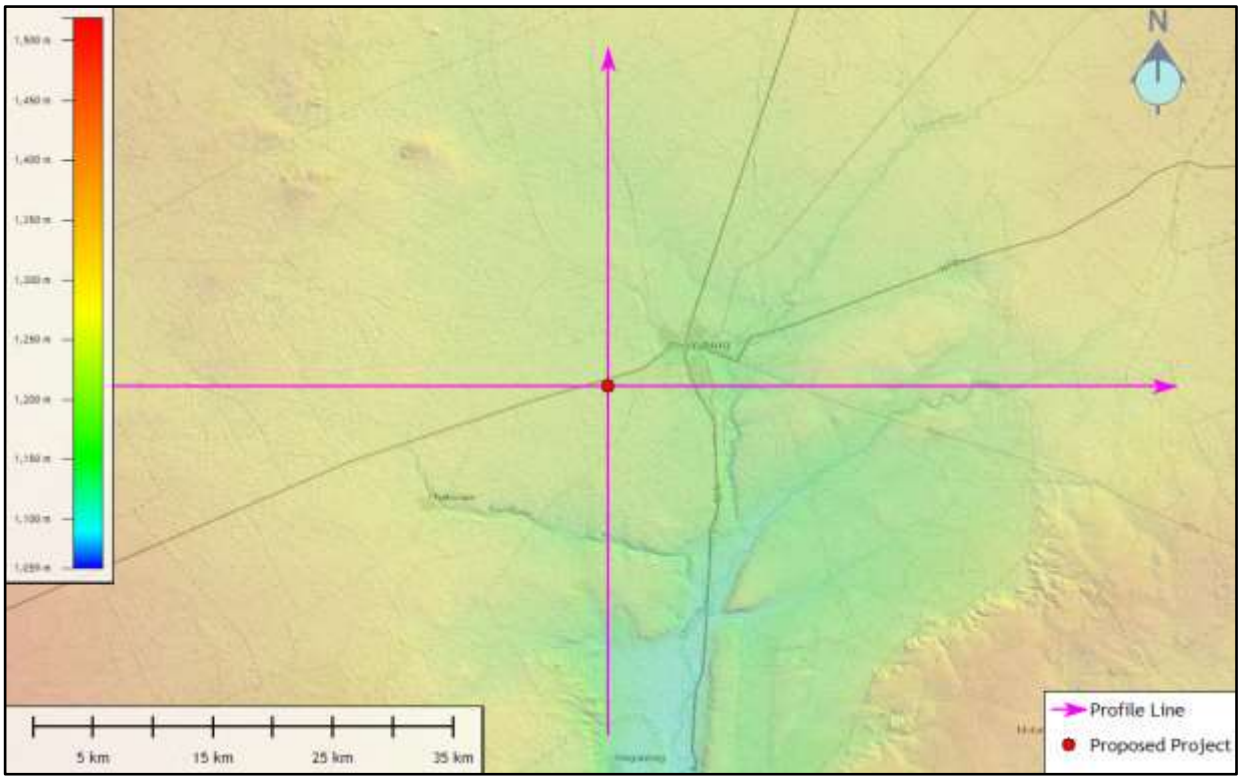

Figure 6: Regional topographic and profile locality map.

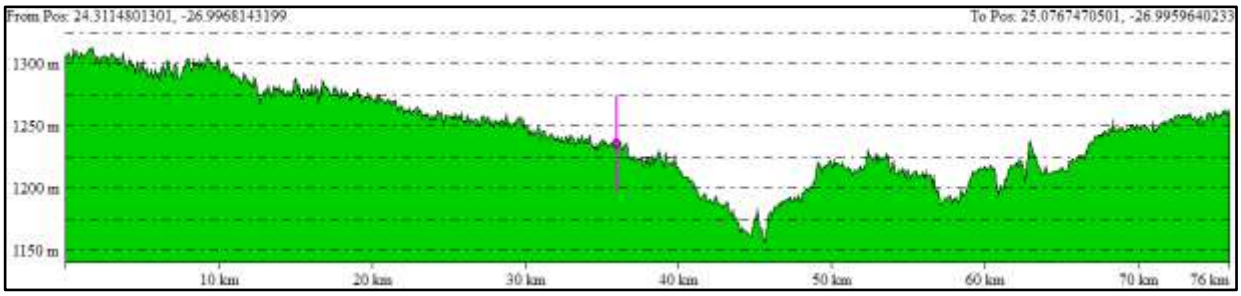

Figure 7: West to East topographic profile.

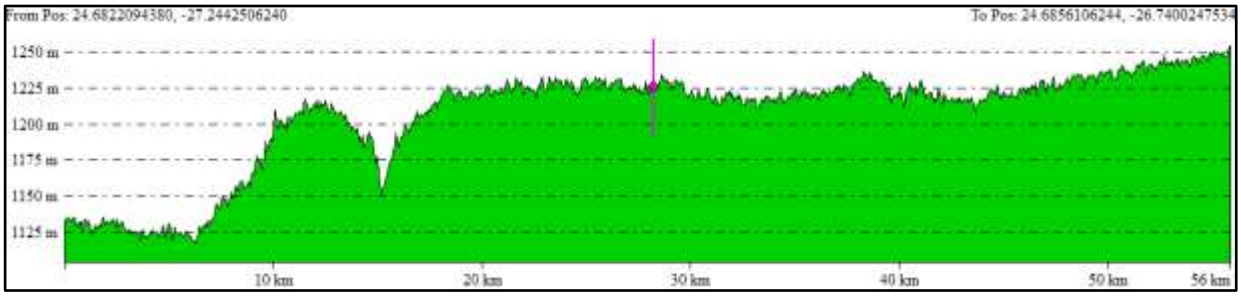

Figure 8: South to North topographic profile.

The terrain in which the proposed project is to be sited, is predominantly flat, with drainage to the south into the Droe Hartrivier. Some low hill features are located to the northwest of the proposed site but at a distance of approximately 25km and outside of the proposed project landscape context. As depicted in the West to East profile, the elevation fall is to the centre with the proposed site located at approximate elevation 1230 mamsl from a high point of 1300 mamsl to the west. The drop in elevation to the east, and the gradual rise in elevation to the west are likely to reduce the viewshed extent. The south to north profile depicts some variation across the terrain, draining to the south. As with the West to East profile, the slight undulation of the terrain in combination with the lower visual profile of the proposed PV project, is likely to contain the visual extent of the proposed project to within a local extent.

4.1 Project Visibility and Exposure

The visible extent, or viewshed, is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis is undertaken from the proposed sites at a specified height above ground level as indicated in the below table making use of open source NASA ASTER Digital Elevation Model data (NASA, 2009). The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988).

Table 2: Proposed Project Heights and Viewshed Constraints Table

Project Phase	Proposed Activity	Approx. Max. Height (m)	Approx. ZVI (km)
Construction	PV	5	12
Operation	Monopoles	25	6

As depicted in Figure 9 below, the (4) viewsheds generated from the proposed site corner points, have a constrained extent and as such the visible extent is rated ***Local***. Even within the 2km buffer distance area, fragmentation is starting to take place. Beyond the 6km distance, a visual incidence is very unlikely due to the medium sized bushveld vegetation.

As depicted in Figure 10 below, the (3) viewsheds generated along the proposed power line routing is rated ***Local***. The 2km high exposure area depicts full coverage, but views start to fragment in the 2km to 6km distance zone, limiting visual extent to the northeast areas. The route is also proposed to follow existing Eskom power servitude which would increase the visual absorption capacity of the area.

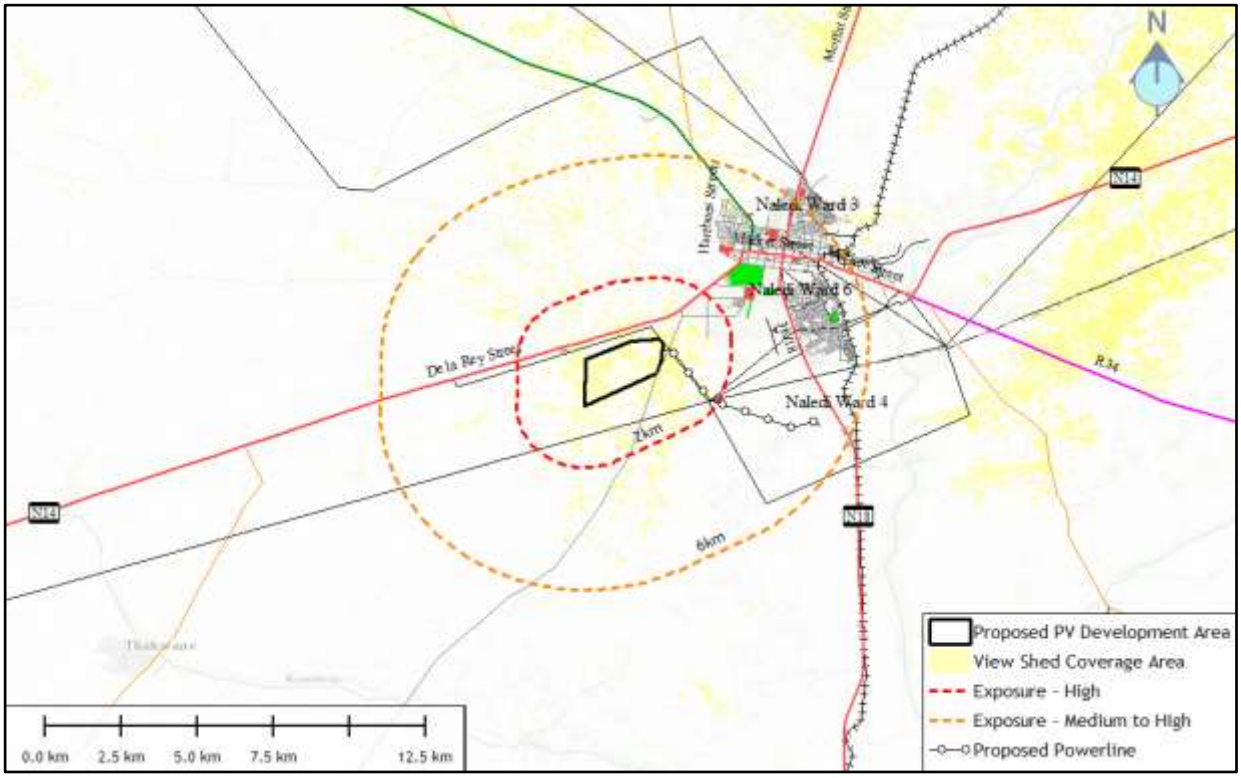

Figure 9: Viewshed for the PV structures at the high points generated from a 5m offset overlaid onto OS terrain Image.

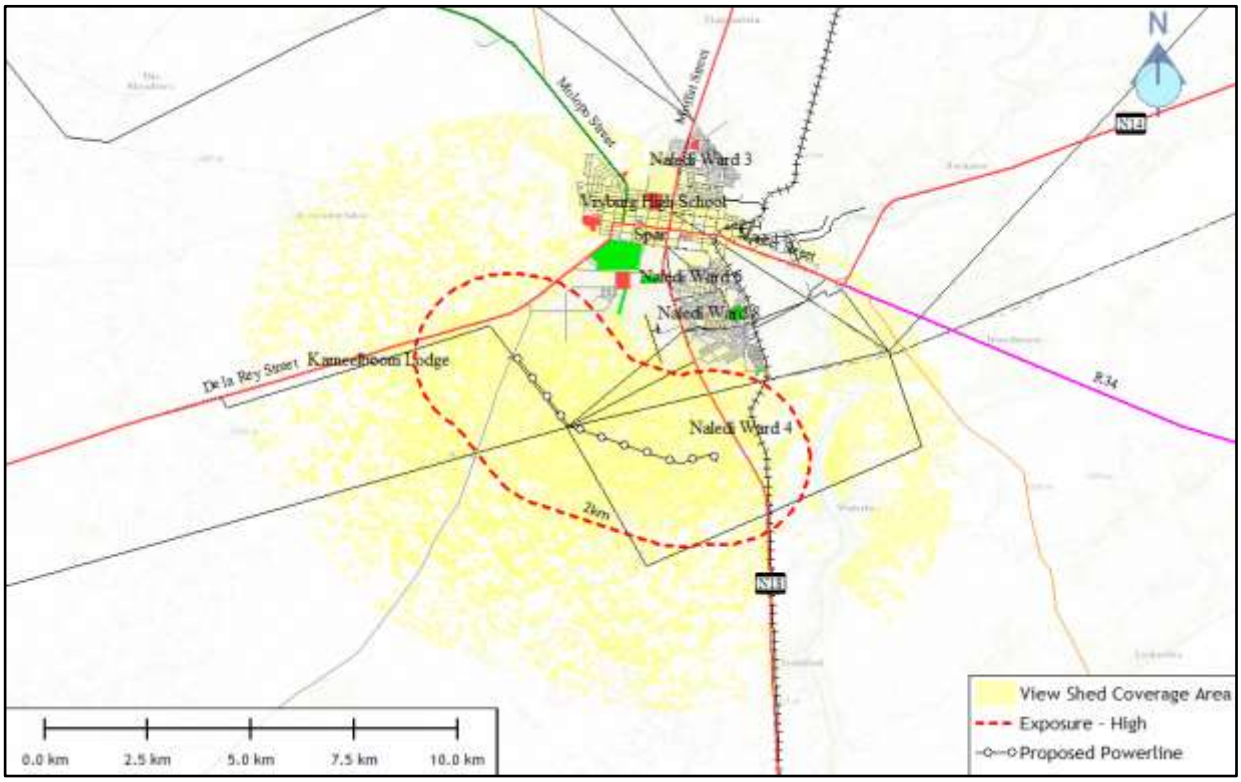

Figure 10: Viewshed for the power line structures at the high points generated from a 25m offset overlaid onto OS terrain Image.

Receptors and key landmarks located within the defined viewshed include:

High Exposure

- N14 National Road
- Klondike Conference Centre
- Mata Hara B&B
- Kameelboom Lodge
- Isolated farmsteads.

The overall visual exposure of the proposed landscape modification to the surrounding high exposure receptors is defined as ***high***. The N14 and the three tourist facilities located adjacent the proposed site, are located in close proximity.

4.2 Regional Landscape Character

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, landform, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place'. (IEMA, 2002)

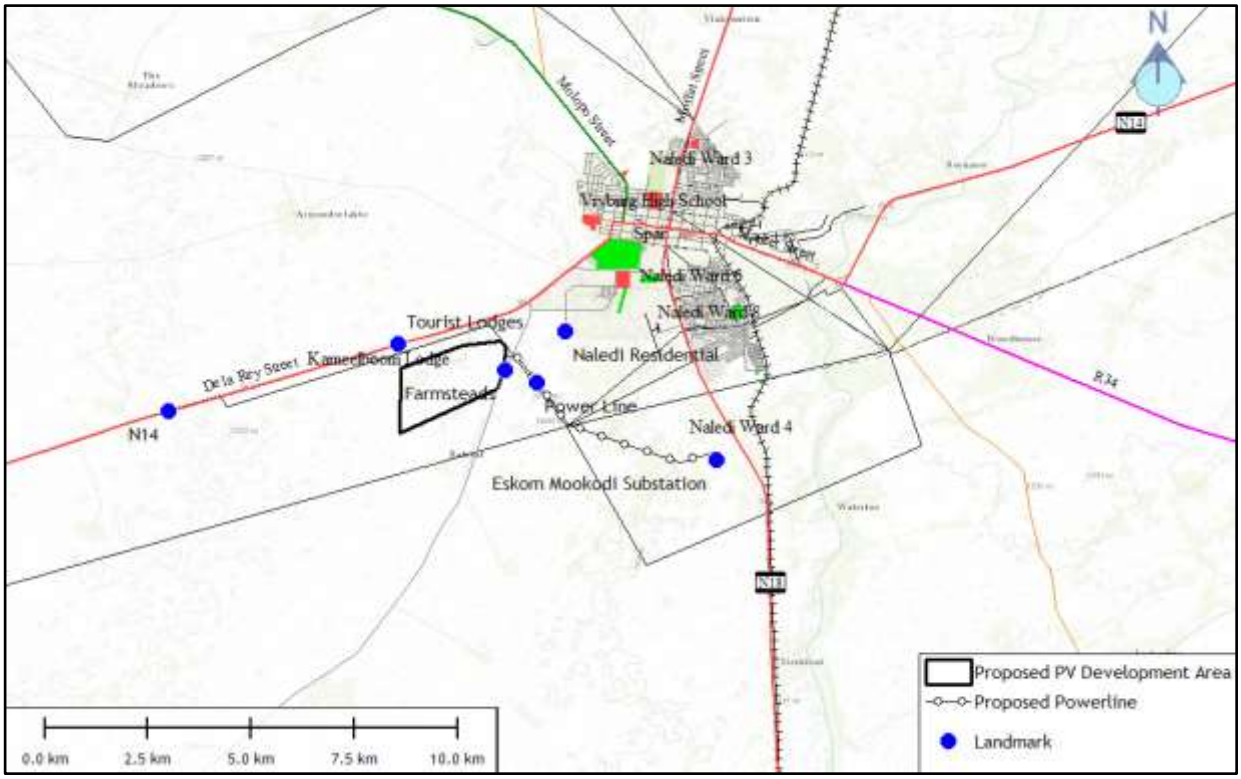

Figure 11: Surrounding landmark photograph location point and profile lines map.

Figure 12: Photograph of the N14 National Road

Figure 13: Photograph of one of the three tourist lodges located along the N14 National Road.

Figure 14: Photograph of the existing Eskom line along which the proposed power line is to be routed.

Figure 15: Photograph of the existing Eskom Mookodi Substation

Figure 16: Photograph of the Naledi residential areas to the east of the proposed development.

4.2.1 *Vegetation*

According to Mucina & Rutherford the general vegetation in the Vryburg area falls into the Savanna Biome and more specifically in the Ghaap Plateau Vaalbosveld group. The vegetation and landscape features are described as "a flat plateau with well-developed shrub layer with Tarcho camphoraturs and Acacia karroo. Common species include Namaqua Fig Ficus chordata, White Stinkwood Celtis africana and False Olive Buddleja saligna". (Macina & Rutherford, 2006)

The Plantzafrica website defines the "Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third the area of South Africa. It is well developed over the lowveld and Kalahari region of South Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense as Woodland, and the intermediate stages are locally known as Bushveld."

The website indicates that "the environmental factors delimiting the biome are complex: altitude ranges from sea level to 2 000 m; rainfall varies from 235 to 1 000 mm per year; frost may occur from 0 to 120 days per year; and almost every major geological and soil type occurs within the biome. A major factor delimiting the biome is the lack of sufficient rainfall that prevents the upper layer from dominating, coupled with fires and grazing, which keep the grass layer dominant. Summer rainfall is essential for the grass dominance, which, with its fine material, fuels near-annual fires. In fact, almost all species are adapted to survive fires, usually with less than 10% of plants, both in the grass and tree layer, killed by fire. Even with severe burning, most species can resprout from the stem bases."

Relating to the site, the website indicates that "the shrub-tree layer may vary from 1 to 20 m in height, but in Bushveld typically varies from 3 to 7 m. The shrub-tree element may come to dominate the vegetation in areas that are being overgrazed. Most of the savanna vegetation types are used for grazing, mainly by cattle or game. In the southernmost savanna types, goats are the major stock". (Plantzafrica)

4.2.2 *Other Projects*

As depicted in Figure 16 below, due to the location of the proposed site within the Renewable Energy Development Zones (REDZs) Area 6, other renewable projects are also located within the vicinity. Located due east of the proposed project site are a Mainstream, Kabi Solar and DPS79 Solar projects. They each have a 75MW capacity. The location of many renewable projects around the Eskom substation is likely to create a strong cumulative change to the landscape character.

Figure 17: Google Earth map depicting the Department of Environmental Affairs Renewable Energy projects in relation to the proposed three AMDA PV projects (western purple areas).

4.2.3 *Landuses*

The closest town is Vryburg and is located approximately 5km to the east of the site. The town is medium in size and is expanding to the south. As indicated in Figure 16, expansion of the formal residential areas of Naledi does extend to just east of the proposed site.

The predominant land use around the area is agriculture, with all property zoned agricultural. The Vryburg area is well known as a beef cattle farming area. The farms are large in size and, with the bushveld treed landscape, the isolated farmhouses do not dominate the landscape, with the natural vegetation dominating the local sense of place.

4.2.4 *Infrastructure and Settlement*

The main linear infrastructure elements identified within the surrounding areas are the N14 National Road and a 400kV Eskom Power Line to the south of the proposed site. The N14 National Road starts in the Gauteng area, routing through the town of Vryburg in the east to the town of Springbok in the west. Being the main westerly route road from the eastern interior to the west, it is well utilised and would carry tourist traffic visiting the tourist areas around Upington, and in addition, offer road access into Namibia from Gauteng.

4.2.5 *Tourism*

Three tourist facilities were identified in close proximity to the proposed project. These are all to the north of the proposed site, and are located on a narrow strip of land between the site and the N14. The properties are small in size, due to the realignment of the N14 further to the north to straighten out a short section of the road. The larger narrow section of subdivided land was then further subdivided into four portions, three of which are utilising the adjacent N14 National Road to attract overnight accommodation. The Klondike Conference centre is located to the east, with the Mata Hara and Kameelboom Lodge further to the west. The Klondike Conference centre is the most established, comprising of ten chalets, a conference centre and a chapel.

Figure 18: Klondike Conference Centre chalets

4.3 Site Landscape Character

Topographic statistics indicate that the site covers an area of 3 sq. km. The minimum elevation is 1210 mamsl and the maximum elevation is 1243 mamsl, with the average elevation set as 1226 mamsl. The maximum slope is indicated as 12 degrees and the average slope is a gradual 3.7 degrees. The dominant aspect, and drainage, is to the east. According to the botanical specialist, the vegetation is mainly comprised of modified vaalbosveld.

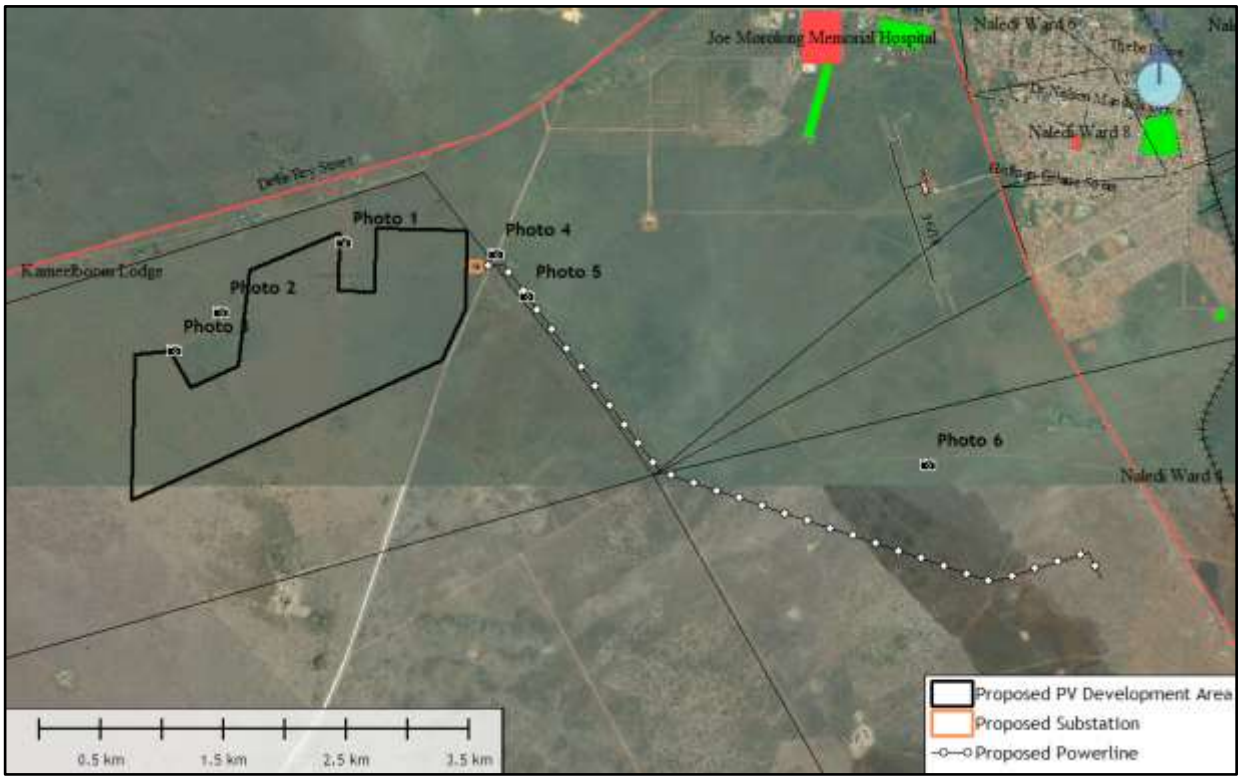

Figure 19: Site photograph locality overlay only OS satellite image map.

Figure 20: Photograph 1 in a northerly direction showing the Klondike chalet roofs in the background as seen from the proposed PV site.

Figure 21: Photograph 2 in a southerly direction of some of the existing agricultural buildings found on the proposed site (non development area).

Figure 22: Photograph 3 taken in a westerly direction of the medium sized vegetation and the farm roads on the proposed site.

Figure 23: Photograph 4 taken in a westerly direction of the proposed substation area as seen from the adjacent district road.

Figure 24: Photograph 5 taken in a easterly direction of the proposed power line routing along the existing Eskom power line.

Figure 25: Photograph 6 taken in a southerly direction of the existing Eskom 400kV power line along which the proposed project power line is proposed.

4.4 Visual Resource Management (VRM) Classes

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. These three criteria are rated in terms of the VRM scenic quality and receptor sensitivity questionnaires that are appended to the addendum. The Classes are not prescriptive and are utilised as a guideline to determine the carrying capacity of a visually preferred landscape that is utilised to assess the suitability of the landscape change associated with the proposed project. Due to the uniformity of the proposed site, only a single landscape was defined for the modified vaalbosveld landscape.

4.4.1 *Scenic Quality*

The scenic quality is determined making use of the VRM scenic quality questionnaire (refer to addendum). Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale. The scores are totalled and assigned a A (High), B (Moderate) or C (low) based on the following split:

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

Table 3: Landscape Scenic Quality rating table.

Landscape	Modified Vaalbosveld
Landform	1
Vegetation	3
Water	0
Colour	2
Adjacent scenery	2
Scarcity	1
Cultural modifications	-2
Score	7
Category	C

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

4.4.2 *Receptor Sensitivity*

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

Table 4: Landscape Receptor Sensitivity rating table.

Landscape	Modified Vaalbosveld
Type of user	L
Amount of use	M
Public interest	L
Adjacent land users	H
Special areas	L
Score	L

(H = High, M = Moderate, L = Low sensitivity)

4.4.3 *VRM Class Objectives*

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined making use of the VRM Matrix below:

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

Table 5: VRM Class Matrix Table

		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

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

Table 6: VRM Class Summary Table

Landscape Area	**ZVI**	**Scenic Quality**	**Receptor sensitivity**	**Visual Inventory**	**Visual Resource Management**
Significant vegetation	NA				Class I
Modified Vaalbosveld	FG/MG	C	Low	Class IV	Class III

(Key: FG = Foreground, MG = Middle ground, BG = Background)

Class I

Class I is assigned when legislation restricts development in certain areas. The visual objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- Any river / streams and associated flood lines buffers identified as significant in terms of the WULA process.
- Any wetlands identified as significant in terms of the WULA process.
- Any ecological areas (or plant species) identified as having a high significance.

Class II

Class II visual objectives were assigned to the following features:

- No Class II landscape were defined.

Class III

Class III visual objectives were assigned to the following landscapes:

- Modified Vaalbosveld

Based on the VRM matrix, the inventory landscape was rated Class IV due to the low scenic quality and the low receptor sensitivity. However, due to the close proximity to the three tourist related activities to the north of the proposed site, this inventory class was changed to Class III to protect the surrounding agricultural sense of place, which is used to some degree by the receptors making use of the tourist facilities. The Class III visual objective is to partially retain the existing character of these rural landscapes, 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.

Class IV

Class IV visual objectives were assigned to the following features:

- No Class IV landscape were defined.

4.5 Key Observation Points

Key Observation Points (KOPs) are defined by the Bureau of Land Management as the people (receptors) 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 important in terms of the VRM methodology, which requires that the degree of contrast that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property.

The main receptors for this site, where clear views of the proposed project could result in a change to local visual resources, are:

- N14 Westbound
- Klondike Conference Centre
- Kameelboom Lodge / Mata Hara B&B
- Rural residential

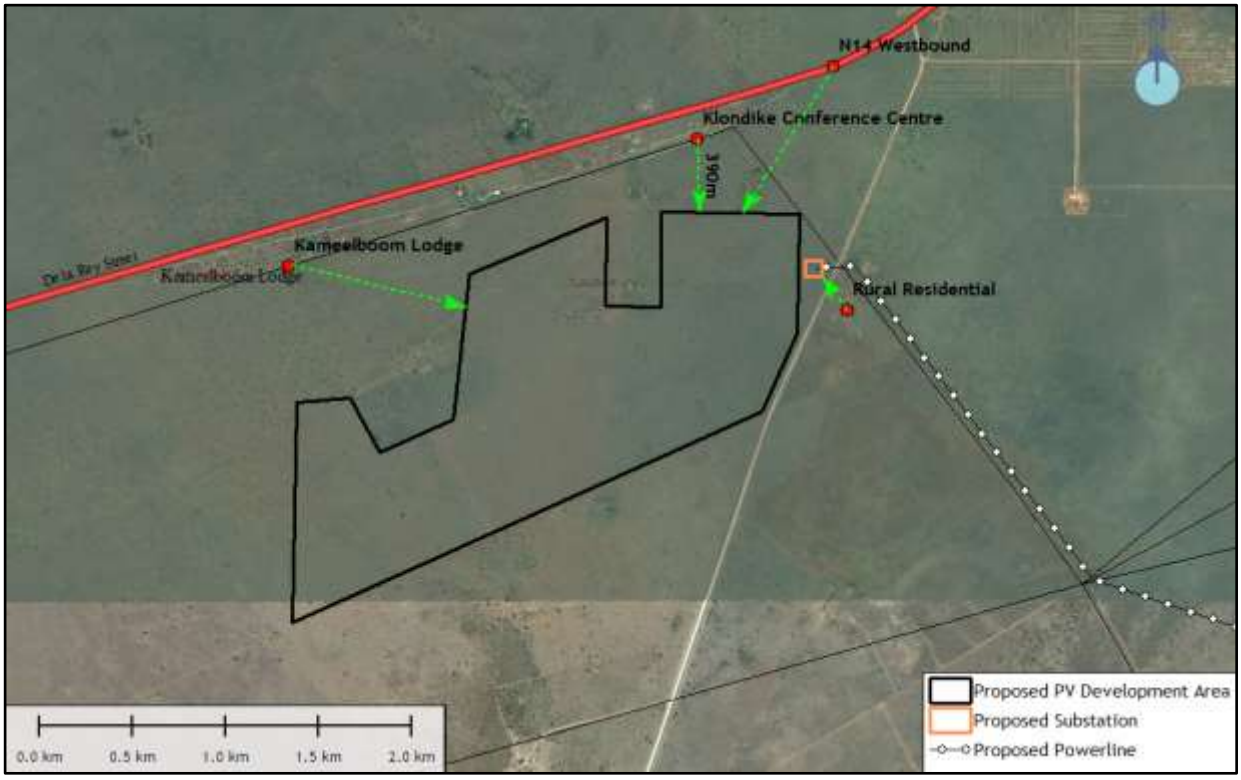

Figure 26: Map depicting the main receptor locations associated with the proposed study area.

Figure 27: Photograph taken from N14 westbound towards the proposed site.

Figure 28: View towards the proposed site as seen from Kameelboom Lodge campsite.

Figure 29: Photograph from the Klondike Conference Centre chalets towards the proposed site.

Figure 30: Photograph towards the proposed substation as seen from the district road to the east of the site.

5 FINDINGS

5.1 Visual Absorption Capacity

The VAC of the site is rated ***Medium***. There is some undulation of the landscape, but the main feature increasing the VAC levels is the treed Vaalbosveld remains landscape. Cultural modifications also include the Naledi residential areas to the east, the Eskom distribution power lines to the south, distribution power lines on the site and surrounding the site, as well as numerous farmsteads around the site. The proposed power line is also aligned along two existing Eskom servitudes which increases the vertical visual element in the landscape.

5.2 Project Visibility

The proposed PV structures have a constrained viewshed extent and as such is rated ***Local***. Even within the 2km buffer distance area, fragmentation of the viewshed is starting to take place. Beyond the 6km distance, a visual incidence is very unlikely. It is likely that the PV project zone of visual influence would not extend beyond the foreground / middle ground buffer of 4 kilometres from the site. This is mostly due to the surrounding Vaalbosveld trees, which in most instances will be higher than the proposed PV structures that would significantly fragment most views.

The proposed power line routing has a constrained viewshed extent and as such is rated ***Local***. The 2km high exposure area depicts full coverage, but views start to fragment in the 2km to 6km distance zone, limiting visual extent to the northeast areas. It is likely that the power line zone of visual influence would not extend beyond two kilometres from the site, due to the small visual footprint of the monopoles.

5.3 Project Exposure

The overall visual exposure of the proposed landscape modification to the surrounding receptors is defined as ***high***. The N14 and the three tourist facilities located adjacent the proposed site, are located in close proximity.

5.4 Scenic Quality

The Scenic Quality rating for the modified Vaalbosveld landscape is rated ***Medium to Low***. Landform is rated low due to the flat terrain that has no outstanding landscape features. Vegetation is rated medium due to the Vaalbosveld type trees that offer some variety and colour to the landscape. Water is absent on the site and rated low. Colours are shades of greens from the trees and the yellows from the grasses. Adjacent dwellings are well screening by local trees that hide the house colours. Adjacent scenery is rated medium to low. The existing adjacent residential areas, the power lines and the road infrastructure increase the local VAC levels. Scarcity is rated low as the land is zoned agriculture and is interesting within it's setting but is fairly common within the region.

5.5 Receptor Sensitivity

The overall receptor sensitivity to the landscape change is likely to be ***low***. The type of users do include tourist who could be more sensitive to landscape change, however the higher VAC of the area and close proximity of the site to the Naledi residential development are likely to reduce receptor sensitivity to low. The area is buffered from the N14 and would be mainly screened from these receptors. Other receptors include adjacent tourism accommodation and conference activities and the amount of use is rated medium. The partial screening and higher VAC from the remaining vaalbosveld trees in the buffer zone, would reduce public interest and is rated low. Adjacent land users include tourists that use the site as part of their tourism based sense of place and as such is rated high. The area is zoned agricultural and rated low for special zonings.

6 IMPACT ASSESSMENT

6.1 Contrast Rating from Key Observation Points

In the VRM methodology, the magnitude of the impact 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).*

A visual contrast rating was undertaken to determine the degree of contrast generated by the proposed landscape modification in relation to the defined VRM Class Objective. The following criteria are utilised in defining the Degree of Contrast:

- **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.

Table 7: Proposed Project Contrast Rating Table

KOP	N14 Westbound	Klondike Conference Centre	Kameelboom Lodge / Mata Hara B&B	Rural residential	Summary
Form	None	Medium	Weak	Weak	Weak
Line	None	Weak	Weak	Medium	Weak
Colour	None	Strong	Weak	Medium	Medium
Texture	None	Strong	Weak	Medium	Medium
Degree of Contrast	None	Strong	Weak	Medium	Medium
Recommd. Class	III	II	III	III	III
Visual Objective Met?	Yes	Yes (with mitigation)	Yes	Yes (with mitigation)	Yes (with mitigation)
Magnitude	None	Medium	Low	Medium to Low	Medium to Low

In most instances, form, line, colour and texture of the proposed landscape change are likely to generate either weak or low levels of contrast to the existing landscape. This is due to the distance buffer from the receptors and the wooded landscape created by the medium sized bushveld trees in this buffer area, as well as the higher VAC levels for the area. Existing contrast in the landscape includes numerous power lines, bushveld vegetation, fences and some structures. For these receptors, the Class III visual objective would be met without mitigation.

However, there is an area to south of the Mata Hara B&B where the natural vegetation has been cleared for intensive agricultural purposes. In this area, clearer views of the proposed PV project would create stronger levels of visual contrast. For this receptor, the Class III visual objective required to maintain the tourist rural agricultural sense of place would not be met with out mitigation. Mitigation would require that this buffer area, where the natural trees have been removed, be replanted with indigenous bushveld trees such that clear views of the PV panels will be partially obscured.

Visual impact significance impacts were defined making use of the DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA processes. *(Oberholzer. 2005).*

Table 8: DEA&DP Visual and Aesthetic Guideline Rating Criteria Table

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 (Im):** *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

6.2 PV Impact Assessment

Table 9: PV Impacts Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Magnitude	Probability	Significance
PV Project by phase	Cons.	W/Out	-ve	L	S	H	G	MH
		With	-ve	L	S	M	G	M
	Ops.	W/Out	-ve	L	L	M	P	M
		With	-ve	L	L	L	P	L
	Close	W/Out	-ve	L	S	H	G	MH
		With	-ve	L	S	M	G	M
	Cuml.	W/Out	-ve	L	L	M	P	M
		With	-ve	L	S	L	G	L
PV Project Summary	**All**	**W/Out**	**-ve**	**L**	**L**	**H**	**P**	**MH**
		With	**-ve**	**L**	**L**	**L**	**P**	**L**

Without mitigation, the Visual Significance for all phases of development is likely to be ***Medium to High***. With mitigation, the Visual Significance for all phases is likely to be ***Medium to low***.

6.2.1 *Construction Phase*

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as to road users. The proposed project is semi-industrial in nature and would be located in an agricultural area with limited man made infrastructure. Construction phase impacts are likely to be ***medium to high*** without mitigation due to the closer proximity to the tourist facilities located to the north of the proposed site. With mitigation, the impacts can be reduced to ***medium***.

<u>Mitigations</u>

- Allow the existing trees growing in the northern buffer area to continue to grow as part of the PV screening buffer.
- Plant rescue of the Camel Thorn trees as per the botanical specialists recommendation and replanting them in the field cleared of vegetation to the south of Mata Hara B&B (Refer to Figure 31 below).
- Plant indigenous Vaalbosveld tree species between the proposed access road and the existing district road to the east.
- Restrained signage and a single access road.
- The laydown area should be sited away from any drainage lines.
- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- Topsoil (if any) from the footprints of the road and structures should be dealt with in accordance with the EMP.
- Construction should not take place at night-time.
- The buildings and structures should be painted a grey-brown colour.

- Fencing around the laydown and buildings should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked on a monthly basis for the collection of litter caught on the fence.
- Implementation of erosion prevention measures to manage the run-off from the cleared site and the roadways.
- Plant rescue of any significant plant species as specified by the botanical specialist.

Figure 31: Yellow area identifying the proposed rehabilitation and tree-screening zone.

6.2.2 *Operation Phase*

During the operation phase, vehicles will frequent the area and may cause a cumulative visual nuisance to landowners and residents in the area, as well as to road users. The proposed project is semi-industrial and would be located in an agricultural area with limited existing man made infrastructure. Operation phase visual significance without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.
- On-going maintenance of the tree rescue / screening area to ensure that the screening trees continue to grow.
- Pro-active management of lights at night so as to ensure security without significantly extending the lights at night visual influence (refer to appendix for generic lights at night recommendations).

6.2.3 *Closure Phase*

Closure phase would involve the movements of heavy vehicles, components, and equipment and construction crews to disassemble the PV structures, and rehabilitate the area. Due to the remoteness of the locality, closure phase visual significance without mitigation is rated ***Medium to High***, which can be reduced to ***Low*** with mitigation

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.
- All structures associated with the development need to be dismantled and removed.
- All compacted areas should be rehabilitated according to the rehabilitation specialists' recommendations.

6.2.4 *Cumulative Effects*

Cumulative Effects could arise from the combined visual massing of all the proposed Klondike PV projects, as well as the other PV projects that are proposed around the Eskom Mookodi substation. However, due to the higher VAC of the area which has medium to low levels of scenic quality, the cumulative visual significance effects across all phases without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

Mitigations

- Erosion and litter control during construction;
- Erosion monitoring during operation;
- Restrained signage for all the Klondike PV projects preferably making use of a single laydown and a single access road;
- Removal and rehabilitation for deconstruction.

6.3 Power Line Impact Assessment

Table 10: Power Line Impacts Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Magnitude	Probability	Significance
Power Line Project by phase	Cons.	W/Out	-ve	L	S	L	G	L
		With	-ve	L	S	VL	G	VL
	Ops.	W/Out	-ve	L	L	L	P	L
		With	-ve	L	L	VL	P	VL
	Close	W/Out	-ve	L	S	L	G	L
		With	-ve	L	S	VL	G	VL
	Cuml.	W/Out	-ve	L	L	M	P	M
		With	-ve	L	S	VLL	G	L
Power Line Project Summary	**All**	**W/Out**	**-ve**	**L**	**L**	**L**	**P**	**L**
		With	**-ve**	**L**	**L**	**VL**	**P**	**VL**

Without mitigation, the Visual Significance for all phases of development is likely to be ***low*** due to the routing adjacent either a 88kV or a 400kV Eskom power lines. With mitigation, the Visual Significance for all phases is likely to be ***very low***.

6.3.1 *Construction Phase*

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as to road users. Due to the close proximity of the proposed power lines to the two existing Eskom power lines (transmission and distribution), construction phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very Low*** with mitigation.

Mitigations

- Laydown area should be sited away from any drainage lines.
- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- Topsoil (if any) from the footprints of the road and structures should be dealt with in accordance with the EMP.
- Construction should not take place at night-time.
- Implementation of erosion prevention measures to manage the run-off from the cleared site and the roadways.

6.3.2 *Operation Phase*

The proposed project is semi-industrial and would be located in an agricultural area with limited existing man made infrastructure. Due to the close proximity of the proposed power lines to the two existing Eskom power lines (transmission and distribution), construction phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.

6.3.3 *Closure Phase*

Closure phase would involve the movements of heavy vehicles, components, and equipment and construction crews to disassemble the PV structures, and rehabilitate the area. Due to the close proximity of the proposed power lines to the two existing Eskom power lines (transmission and distribution), construction phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- All structures associated with the development need to be dismantled and removed.
- All compacted areas should be rehabilitated according to the rehabilitation specialists' recommendations

- On-going maintenance to manage any on-going soil erosion.

6.3.4 *Cumulative Effects*

Cumulative Effects could arise from the combined visual massing of all the proposed PV power lines converging on the Eskom Mookodi. If not effectively integrated by the different projects, congestion could take place. However, due higher VAC levels of the surrounding area that has lower levels of scenic quality, the visual significance of the cumulative effects across all phases without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- Erosion and litter control during construction;
- Erosion monitoring during operation;
- Power line integration planning by DEA / Eskom;
- Removal and rehabilitation for deconstruction.

7 CONCLUSION

It is the recommendation of this visual assessment that the proposed Klondike Delta PV development should be authorised. The proposed development is also located within the Renewable Energy Development Zones (REDZs) Area 6 that has been identified as a strategic growth point for renewable energy development. Three other solar energy facilities have been proposed for the area, but will not be within the proposed development's visual context, reducing cumulative massing effects.

Without mitigation, the Visual Significance for all phases of the proposed PV development is likely to be ***Medium to High***. This is due to the closer proximity of the tourist receptors located to the north of the proposed site. With mitigation, and the rehabilitation of the open field (or screening trees planted in front of the tourist areas), the Visual Significance for all phases is likely to be ***Medium to low***.

Without mitigation, the Visual Significance for all phases of the proposed Power Line is likely to be ***Low*** due to the routing adjacent either a 88kV or a 400kV Eskom power lines. With mitigation, the Visual Significance for all phases is likely to be ***Very Low***.

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9 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

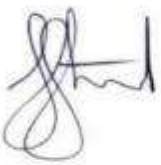
Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa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

9.1 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**
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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, 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	LOCATION
2014	Joram Solar	Solar Energy	Northern Cape
2014	RERE PV Postmasberg	Solar Energy	Northern Cape
2014	RERE CPV Upington	Solar Energy	Northern Cape
2014	Rio Tinto RUL Desalinisation Plant	Industrial	Namibia
2014	NamPower PV	Solar Energy	Namibia
2014	Pemba Oil and Gas Port Expansion	Industrial	Mozambique
2014	Brightsource CSP Upington	Solar Energy	Northern Cape
2013	Cape Winelands DM Regional Landfill	Industrial	Western Cape
2013	Drennan PV Solar Park	PV Solar Energy	Eastern Cape
2013	Eastern Cape Mari-culture	Mari-culture	Eastern Cape
2013	Eskom Pantom Pass Substation	Substation /Tx lines	Knysna
2013	Frankfort Paper Mill	Plant	Free State
2013	Gibson Bay Wind Farm Transmission lines	Tranmission lines	Eastern Cape
2013	Houhoek Eskom Substation	Substation /Tx lines	Western Cape
2013	Mulilo PV Solar Energy Sites (x4)	PV Solar Energy	Northern Cape
2013	Namies Wind Farm	Wind Energy	Northern Cape
2013	Rossing Z20 Pit and WRD	Mining	Namibia

2013	SAPPI Boiler Upgrade	Plant	Mpumalanga
2013	Tumela WRD	Mine	North West
2013	Weskusfleur Substation (Koeburg)	Substation /Tx lines	Western Cape
2013	Yzermyn coal mine	Mine	Mpumalanga
2012	Afrisam	Mine	Saldana
2012	Bitterfontein	PV Energy	N Cape
2012	Bitterfontein slopes	Slopes Analysis	N Cape
2012	Kangnas PV	Energy	N Cape
2012	Kangnas Wind	Energy	N Cape
2012	Kathu CSP Tower	Solar Power	Northern Cape
2012	Kobong Hydro	Hydro & Powerline	Lesotho
2012	Letseng Diamond Mine Upgrade	Mine	Lesotho
2012	Lunsklip Windfarm	Windfarm	Stilbaai
2012	Mozambique Gas Engine Power Plant	Plant	Mozambique
2012	Ncondezi Thermal Power Station	Substation /Tx lines	Mozambique
2012	Sasol CSP Tower	Solar Power	Free State
2012	Sasol Upington CSP Tower	Solar Power	Northern Cape
2011	Beaufort West PV Solar Power Station	Power Station	Beaufort West
2011	Beaufort West Wind Farm	Wind Energy	Beaufort West
2011	De Bakke Cell Phone Mast	Mast	Western Cape
2011	ERF 7288 PV	PV	Beaufort West
2011	Gecko Industrial park	Industrial	Namibia
2011	Green View Estates	Residential	Mossel Bay
2011	Hoodia Solar	PV expansion	Beaufort West
2011	Kalahari Solar Power Project	Solar Power	Northern Cape
2011	Khanyisa Power Station	Power Station	Western Cape
2011	Laingsburg Windfarm	Level 4	Mpumalanga
2011	Olvyn Kolk PV	Solar Power	Northern Cape
2011	Otjikoto Gold Mine	Mining	Namibia
2011	PPC Rheebieck West Upgrade	Industrial	
2011	Slopes analysis Erf 7288 Beaufort West	Slopes	Beaufort West
2011	Southern Arterial	Road	George
2010	Bannerman Etango Uranium Mine	Mining	Namibia
2010	Bantamsklip Transmission Revision	Transmission	Eastern Cape
2010	Beaufort West Urban Edge	Mapping	Beaufort West
2010	Bon Accord Nickel Mine	Mine	Barbeton
2010	Herolds Bay N2 Development Baseline	Residential	George
2010	MTN Lattice Hub Tower	Structure	George
2010	N2 Herolds Bay Residental	Residential	Herolds Bay
2010	Onifin(Pty) Ltd Hartenbos Quarry Extension	Mining	Mossel Bay
2010	Rossing South Board Meeting	Mining	Namibia

2010	Still Bay East	Mapping	SA, WC
2010	Vale Moatize Coal Mine and Railwayline	Mining_rail	Mozambique
2010	Vodacom Mast	Structure	Reichterbosch
2010	Wadrif Dam	Dam	Beaufort West
2009	Asazani Zinyoka UISP Housing	Residential Infill	Mossel Bay
2009	Bantamsklip GIS Mapping	Mappig	Western Cape
2009	Eden Telecommunication Tower	Structure Tower	George
2009	George Landscape Characterisation	George SDF	George
2009	George Western Bypass	Structure Road	George
2009	Rossing Uranium Mine Phase 2	Mining	Namibia
2009	Sun Ray Wind Farm	Wind Energy	Still Bay
2008	Bantamsklip Transmission Lines Scoping	Transmission	Western Cape
2008	Erf 251 Damage Assessment	Residential VIA	Great Brak
2008	Erongo Uranium Rush SEA	SEA	Namibia
2008	Evander South Gold Mine Preliminary VIA	Mining	Mpumalanga
2008	George Open Spaces System	George SDF	George
2008	GrooteSchuur Heritage Mapping	Mapping	Cape Town
2008	Hartenbos River Park	Residential VIA	Hartenbos
2008	Kaaimans Project	Residential	Wilderness
2008	Lagoon Garden Estate	Residential VIA	Great Brak
2008	Moquini Beach Hotel	Resort	Mossel Bay
2008	NamPower Coal fired Power Station	Power Station	Namibia
2008	Oasis Development	Residential VIA	Plettenberg Bay
2008	RUL Sulpher Handling Facility	Mining	Walvis Bay
2008	Stonehouse Development	Residential VIA	Plettenberg Bay
2008	Walvis Bay Power Station	Structure	Namibia.
2007	Calitzdorp Retirement Village	Residential VIA	Calitzdorp
2007	Calitzdorp Visualisation	Visualisation	Calitzdorp
2007	Camdeboo Estate	Residential VIA	Graaff Reinet
2007	Destiny Africa	Residential	George
2007	Droogfontein Farm 245	Residential VIA	Danabaai
2007	Floating Liquified Natural Gas Facility	Structure tanker	Mossel Bay
2007	George Municipality Densification	George SDF	George
2007	George Municipality SDF	George SDF	George
2007	Kloofsig Development	Residential VIA	Vleesbaai
2007	OCGT Power Plant Extension	Structure Power Plant	Mossel Bay
2007	Oudtshoorn Municipality SDF	Mapping	Oudtshoorn
2007	Oudtshoorn Shopping Complex	Structure Mall	Oudtshoorn
2007	Pezula Infill (Noetzie)	Residential VIA	Knysna
2007	Pierpoint Nature Reserve	Residential VIA	Knysna
2007	Pinnacle Point Golf Estate	Golf/Residential	Mossel Bay

2007	Rheebok Development Erf 252 Apeal	Residential VIA	Great Brak
2007	Rossing Uranium Mine Phase 1	Mining	Namibia
2007	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Beaufort West
2007	Sedgefield Water Works	Structure	Sedgefield
2007	Sulpher Handling Station Walvis Bay Port	Industrial	Namibia
2007	Trekkopje Uranium Mine	Mining	Namibia
2007	Weldon Kaya	Residential VIA	Plettenberg Bay
2006	Fancourt Visualisation Modelling	Visualisation	George
2006	Farm Dwarsweg 260	Residential VIA	Great Brak
2006	Fynboskruin Extention	Residential VIA	Sedgefield
2006	Hanglip Golf and Residential Estate	Golf/Residential	Plettenberg Bay
2006	Hansmoeskraal	Slopes Analysis	George
2006	Hartenbos Landgoed Phase 2	Residential VIA	Hartenbos
2006	Hersham Security Village	Residential VIA	Great Brak
2006	Ladywood Farm 437	Residential VIA	Plettenberg Bay
2006	Le Grand Golf and Residential Estate	Golf/Residential	George
2006	Paradise Coast	Residential VIA	Mossel Bay
2006	Paradyskloof Residential Estate	Residential VIA	Stellenbosch
2006	Riverhill Residential Estate	Residential VIA	Wilderness
2006	Wolwe Eiland Access Route	Road	Victoria Bay
2005	Harmony Gold Mine	Mining	Mpumalanga.
2005	Knysna River Reserve	Residential VIA	Knysna
2005	Kruisfontein Infill	Mapping	Knysna
2005	Lagoon Bay Lifestyle Estate	Residential VIA	Glentana
2005	Outeniquabosch Safari Park	Residential	Mossel Bay
2005	Proposed Hotel Farm Gansevallei	Resort	Plettenberg Bay
2005	Uitzicht Development	Residential VIA	Knysna
2005	West Dunes	Residential VIA	Knysna
2005	Wilderness Erf 2278	Residential VIA	Wilderness
2005	Wolwe Eiland Eco & Nature Estate	Residential VIA	Victoria Bay
2005	Zebra Clay Mine	Mining	Zebra
2004	Gansevallei Hotel	Residential VIA	Plettenberg Bay
2004	Lakes Eco and Golf Estate	Golf/Residential	Sedgefield
2004	Trekkopje Desalination Plant	Structure Plant	Namibia
1995	Greater Durban Informal Housing Analysis	Photogrametry	Durban

10 ANNEXURE 2: QUESTIONNAIRES AND VRM TERMINOLOGY

10.1 Methodology Detail

Viewshed

The visible extent, or viewshed, is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, 2005).* This reflects the area, or extent, where the landscape modification would probably be seen. However, visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature. Therefore the views of a landscape modification would not necessarily influence the landscape character within all areas of the viewshed. The information for the terrain used in the 3D computer model on which the visibility analysis is based on the Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data, a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (NASA) in USA. (NASA, 2009)

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.

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:

i. ***Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
ii. ***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
iii. ***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.

Scenic Quality

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 making use of the VRM scenic quality questionnaire (refer to addendum). Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale. The scores are totalled and assigned a A (High), B (Moderate) or C (low) based on the following split:
A= scenic quality rating of ≥19;
B = rating of 12 – 18,
C= rating of ≤11

The seven scenic quality criteria are defined below:

- **Land Form:** Topography becomes more of a factor as it becomes steeper, or more severely 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 an area.

Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

- **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.

Visual Resource Management (VRM) Classes

The VRM Classes represent the relative value of the visual resources of an area and are determined making use of the VRM Class Matrix see Table 8 below:

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

The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity. The Visual Inventory Classes are defined using the matrix below and with motivation, can be adjusted to Visual Resource Management Classes:

Table 11: VRM Class Matrix Table

		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

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

The visual objectives of each of the classes is listed below:

- The Class I objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention. Class I is assigned when a specialist decision is made to maintain a natural landscape.
- 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.
- 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.
- 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.

Key Observation Points (KOPs)

KOPs are defined by the Bureau of Land Management as the people (receptors) 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 important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:
- 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; and
- Distance from property.

Contrast Rating

The contrast rating, or impacts assessment phase, is undertaken to determine if the VRM Class Objectives are met. The suitability of landscape modification is assessed by comparing the degree of potential contrast from the proposed activity in comparison to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape by assessing 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 proposed landscape 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.

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 and 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)*.

10.2 Questionnaires

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 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 wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
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.

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

10.3 VRM Terminology

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

11 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/).* (NELPAG)

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.

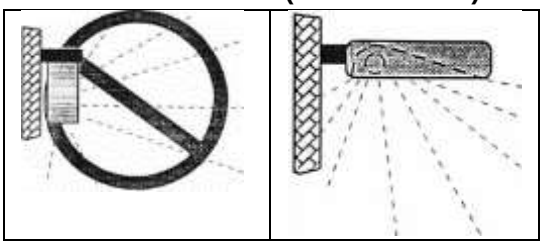
Glare Here’s the basic rule of thumb: If you can see the bright bulb from a distance, it’s a bad light. With a good light, you see lit ground instead of the dazzling bulb. “Glare” is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

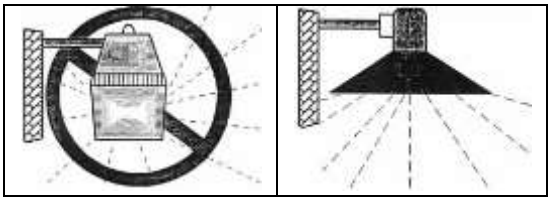
Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

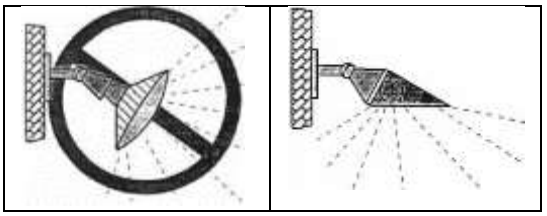
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

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.

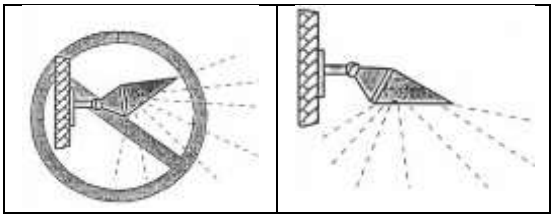
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may 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.

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!

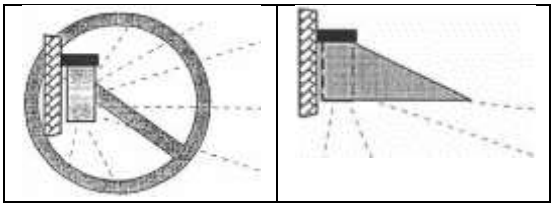
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



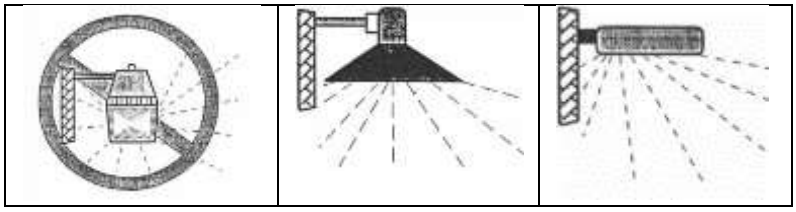
Floodlight:

Change this . . . to this (aim downward)



Wall Pack

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.