

# **ENVIRONMENTAL IMPACT ASSESSMENT FOR JORAM SOLAR DEVELOPMENT, UPINGTON, NORTHERN CAPE PROVINCE**

## **VISUAL IMPACT ASSESSMENT SPECIALIST REPORT**

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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, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.

### Management Actions

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

### Receptors

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

### Sense of Place

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

### Scenic Corridor

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

### Scoping

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

### Viewshed

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

### 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**

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

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

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# 1 INTRODUCTION

VRM Africa was appointed by CapeEAPrac to undertake a Visual Impact Assessment for the proposed Joram Solar Development on behalf of Joram Solar (Pty) Ltd. The site is located near the town of Upington, Northern Cape. A full site survey was undertaken on the 4<sup>th</sup> August 2014.



Figure 1: Regional locality map

## 1.1 Terms of Reference

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.' (USA Bureau of Land Management. 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).

## 1.2 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.
- 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
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
  - The Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data (ASTGTM\_S2 3E014 and ASTGTM\_S24E014 data set). ASTER GDEM is a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (NASA) in USA. (*ASTER GDEM. METI / NASA. 2011*)
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure (*Lange 1994*). The project deliverables, including electronic copies of reports, maps, data, shape files and photographs are based on the author's professional knowledge, as well as available information. 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.

### 1.3 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. This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria. This involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification brought about by a proposed project, against the same elements found in the existing natural landscape (*BLM. USDI. 2004*).

The first step in the VRM process is determining the existing and planned landscape context. A document review is undertaken to identify key plans for the area, and a regional landscape survey is undertaken to define the key landscape features and the visual resources. The landscape character of the proposed project site is then surveyed and mapped to identify areas of similar land use and landscape character. These areas are then rated using the VRM scenic quality criteria.

Individuals, groups or communities who would be subjected to the visual influence of a particular project are referred to as receptors and are identified early on in the VIA process by means of a viewshed analysis. Visual receptors are then screened against VRM receptor sensitivity criteria to define Key Observation Points (KOPs), which are the most significant locations where people or communities make consistent use of the views associated with the proposed site. Preliminary survey using Google Earth has identified tourist related activities in the area. The sensitivity of these points is assessed by applying VRM receptor sensitivity criteria.

The proposed project activities are then finally assessed from the KOPs around the site. Photo montages are generated to represent the expected change in the views as seen from each KOP. The degree of contrast in terms of line, colour, texture and form is measured to determine the extent to which the proposed project meets the Visual Resource Management objectives defined for the site. If contrast generated is high, mitigations and recommendations can be made to assist in meeting the visual objectives.

Please refer to the Appendix for detailed descriptions of the methodology.

# VISUAL RESOURCE MANAGEMENT PROCESS DIAGRAM

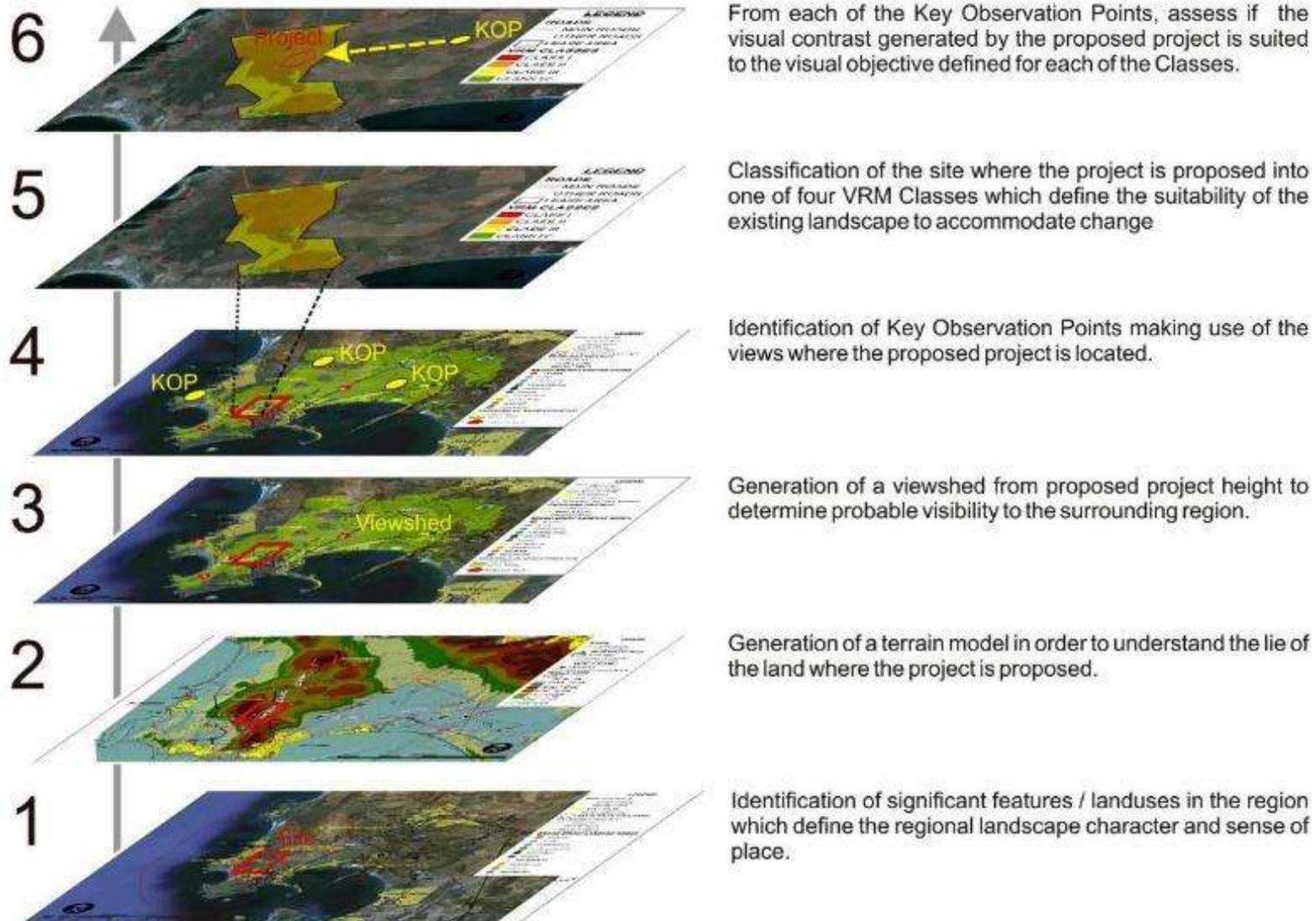


Figure 2: VRM process diagram

## 2 PROJECT DESCRIPTION

The study site is approximately 400ha and it is the intention of the applicant to undertake a single 75MW (PV) within this study site. Access to the study site will be via the existing farm road (this road will not require upgrading)

Associated infrastructure will include the following:

- An on-site Switching / Sub-station;
- Auxiliary Buildings (Control Centre, Administration offices, Security etc.);
- A network of Inverters, Transformers & Underground Cabling;
- Access roads;
- Perimeter security fencing;
- Rainwater tanks.

Access to the site will be along appropriate provincial and local roads. The proposed access roads to the site is from the Kleinbegin district road. The Kleinbegin road intersects the N10, 10km east of Upington. Three access road alternatives, with three possible entrances are being investigated to determine which one will have the least environmental impact and would be more viable (including in terms of SANRAL's and the provincial roads authority requirements).

The following project alternatives are to be assessed as part of the study:

### 1. *Layout Alternative 1*

The following key points were used to determine the footprint of Layout Alternative 1, within the preliminary Study Site

- Area of approximately 220 ha , to ensure the project would be economically viable, allowing for exclusions of environmental sensitive areas;
- Minimal disturbance to water washes and highly sensitive areas.
- Road access to the site with regard to distance and minimal disturbance to sensitive areas
- Grid connection taking into consideration distance and minimal disturbance to sensitive areas.

### 2. *Layout Alternative 2*

The following key points were used to determine the footprint of Layout Alternative 2, within the preliminary Study Site

- Area of approximately 220 ha , to ensure the project would be economically viable, allowing for exclusions of environmental sensitive areas;
- Minimal disturbance to water washes and highly sensitive areas.
- Road access to the site with regard to distance and minimal disturbance to sensitive areas
- Grid connection taking into consideration distance and minimal disturbance to sensitive areas.

### 3. *Layout Alternative 3 – Preferred Layout (to be developed):*

The preferred layout will be developed to be responsive to the constraints defined by the participating specialists, while at the same time achieving technical feasibility. This preferred layout

will be developed in the EIR phase of the Environmental Process and will become the layout that is proposed for authorisation.

Road Alternatives:

- Access road alternative 1 will be investigated and provide direct access to the proposed site from the Kleinbegin road at the existing farm entrance (point 1) parallel to the south boundary of the preliminary study site. This access road will then runs parallel the western boundary of the proposed site providing possible access to the south and north of the proposed Layout Alternative 1.
- Access road alternative 2 will be investigated and provide access from the Kleinbegin road at (point 2) to the proposed layout 2 alternative.
- Access road alternative 3 will be investigated and provide access from the Kleinbegin road at (point 3) to the proposed Layout Alternative 2 as well as proposed layout alternative 1.

*(CapeEAPrac. 2014)*

The following photographs below show examples of similar projects and technologies that are included as alternatives:



Fixed solar panels approximately 10m in height  
(Source: [www.hawaiiirenewableenergy.org/Villamesias2](http://www.hawaiiirenewableenergy.org/Villamesias2))



Tracking solar panels approximately 15m in height  
(Source: [www.solar\\_tracker16.ecoforlife.com.au](http://www.solar_tracker16.ecoforlife.com.au))



Fixed solar panel structures  
(Source: VRMA)

Figure 3: Photographic plate depicting examples of solar panels



Typical construction site and laydown with fences (overhead lighting not included)  
 (Source: VRMA)



Perspective view of typical PV Plant Layout  
 (Source: Solek; Joram Solar. August 2014)

Figure 4: Photographic plate depicting examples of typical PV plant and Construction Camp

## 2.1 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:

### **International Finance Corporation (IFC)**

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

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

As specific Visual Guidelines are not provided by the area we have referred to the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in EIA processes.

The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in EIA processes was referred to and 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, B., 2005*)

### 3 BASELINE ASSESSMENT

#### 3.1 Project Visibility

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 a landscape modification of a specified height would probably be seen. 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. 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. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (*Hull, R.B. and Bishop, I.E., 1988*).

Table 1: Proposed Project Heights Table

Project Phase	Proposed Activity	Approx. Height (m)	Approx. ZVI (km)
Construction and Operation	PV structures and Substation	10	12

A viewshed analysis was undertaken from the following locations:

- Proposed PV Site
  - North facing valley area
  - Southern south facing areas
  - Ridgeline area

The ZVI for the proposed PV site was extended to 12km as there is currently no precedent for built PV, no other industrial type structures in the area and no large vegetation. These factors lower the visual absorption capacity. Other proposed solar generation facilities in close proximity to the proposed Joram Solar are Illanga and Caroshoek CSP. See Figure below.

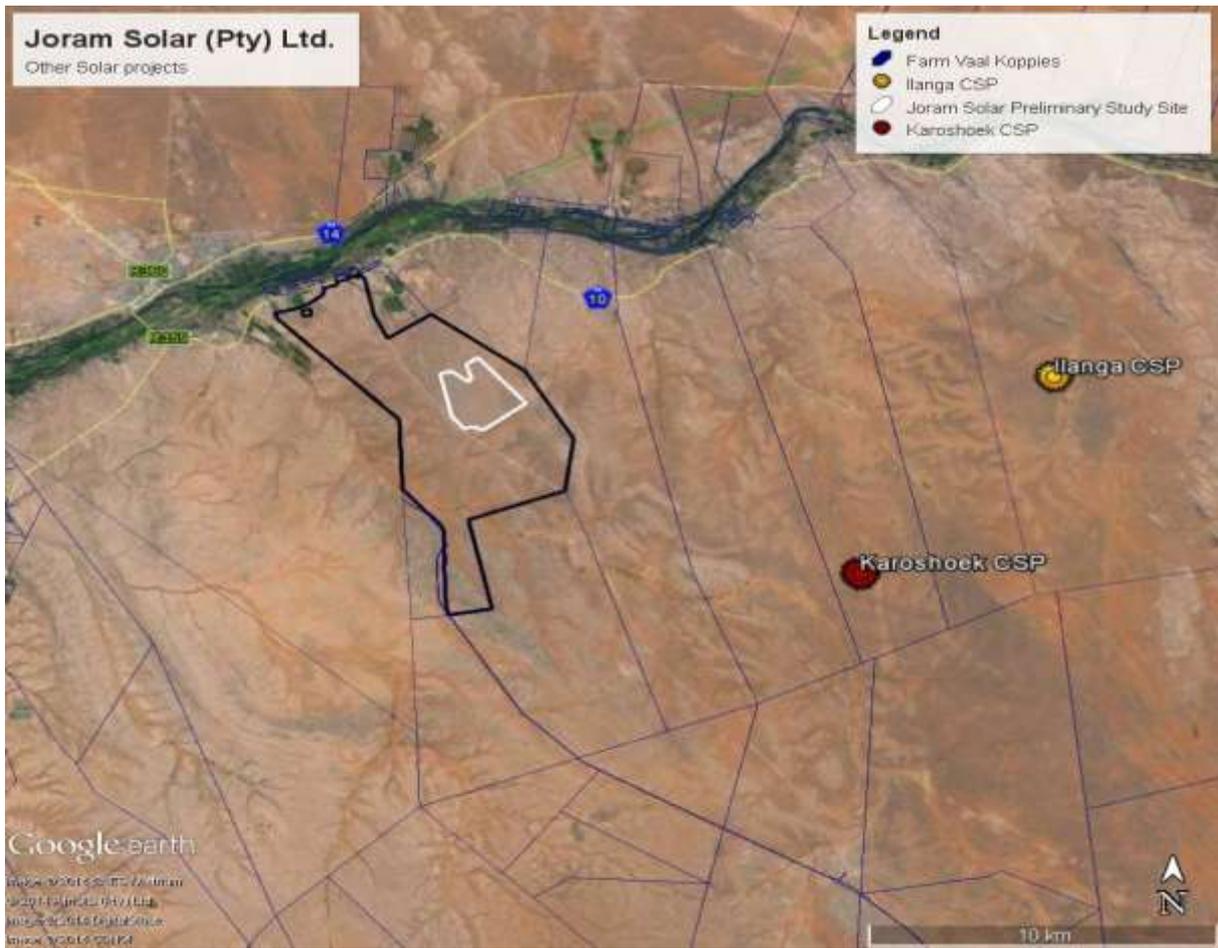


Figure 5: Showing other proposed solar generation facilities in close proximity to the proposed Joram Solar (Solek, 2014).

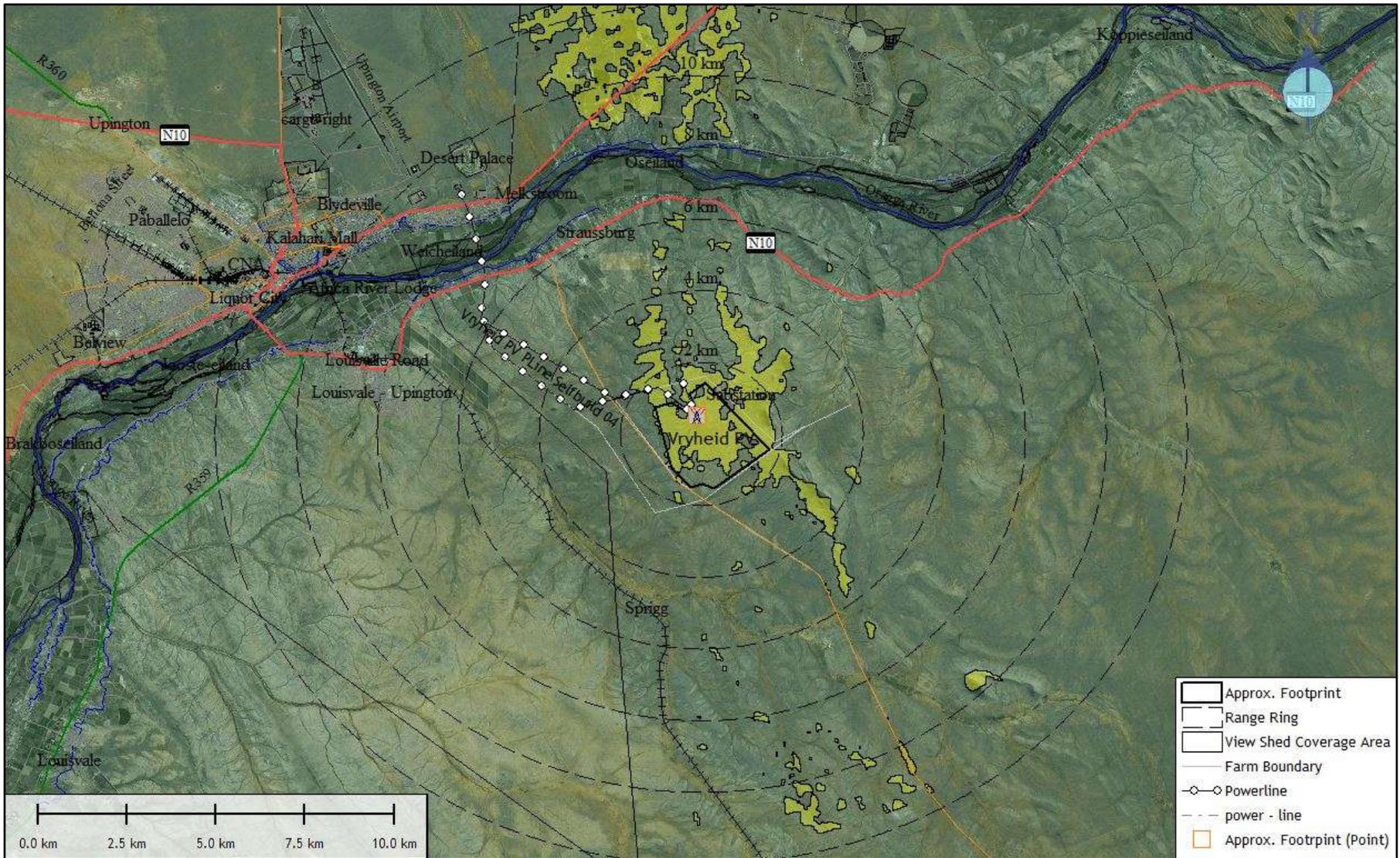


Figure 6: Viewshed from the valley area of the proposed site with a 10m offset overlay onto OS Satellite Image Map

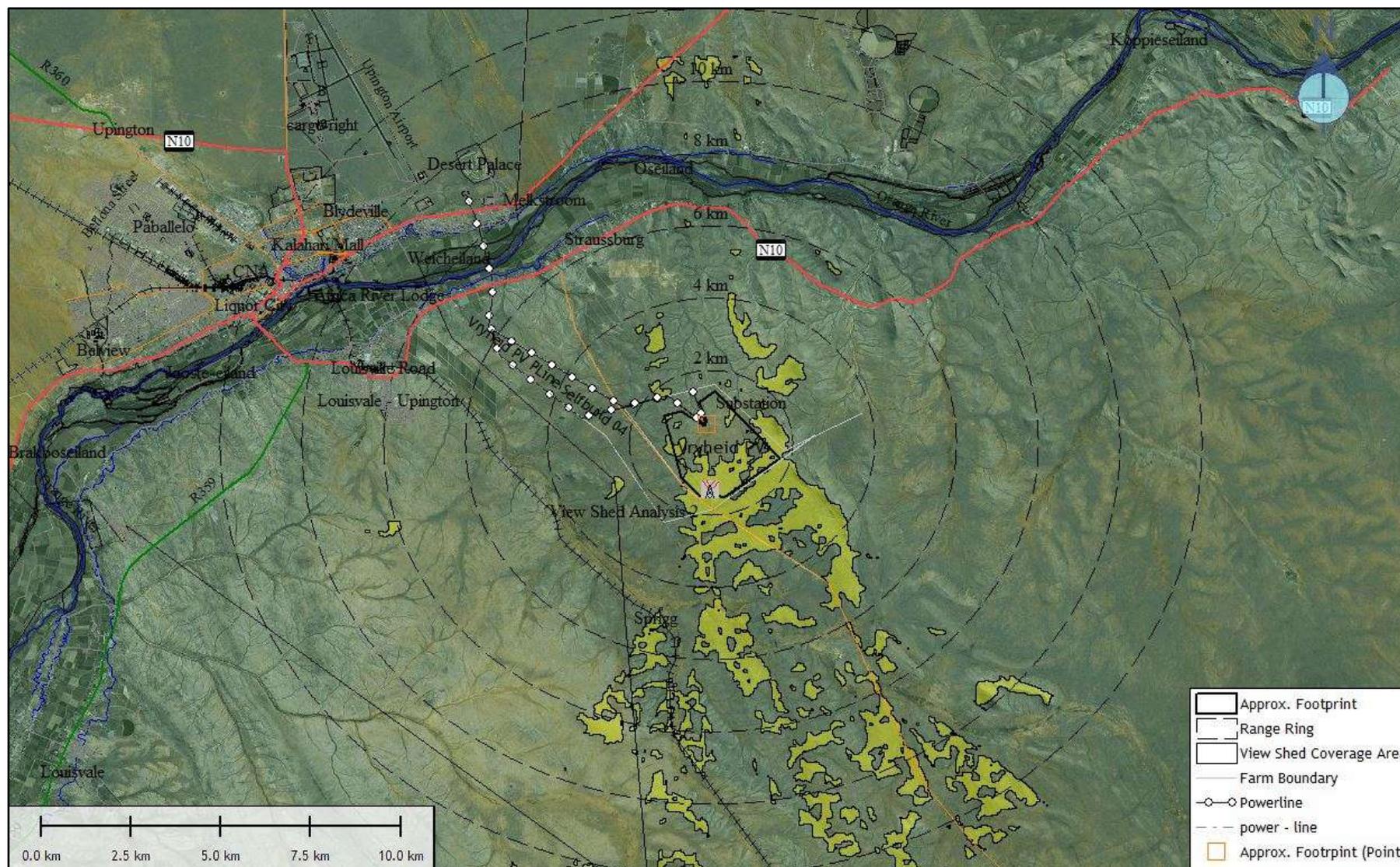


Figure 7: Viewshed from the southern area of the proposed site with a 10m offset overlay onto OS Satellite Image Map

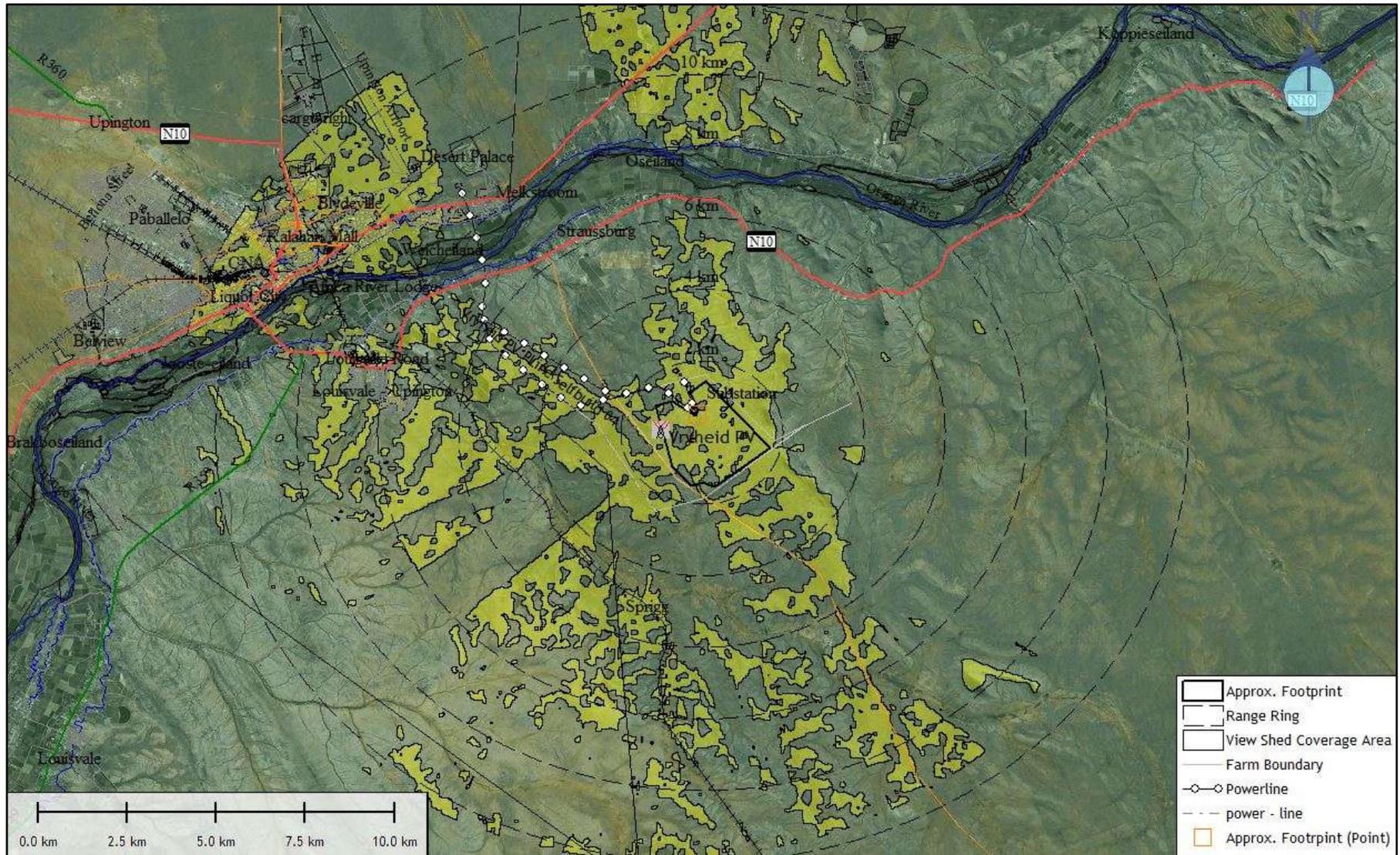


Figure 8: Viewshed from the ridgeline area of the proposed site with a 10m offset overlay onto OS Satellite Image Map

### 3.2 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, land form, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' (*Spon Press, 2002*). The following landmarks were identified as significant in defining the surrounding area's characteristic landscape:

- Low hills to the east of the site which add value from to the region;
- Agri Tourism And Viniculture Cultural Landscape adjacent to the Orange River;
- Rural road (Kleinbegin) which runs south from the N10 national road, west of the proposed site;
- N10 national road;
- Orange River; and
- Upington Residential.

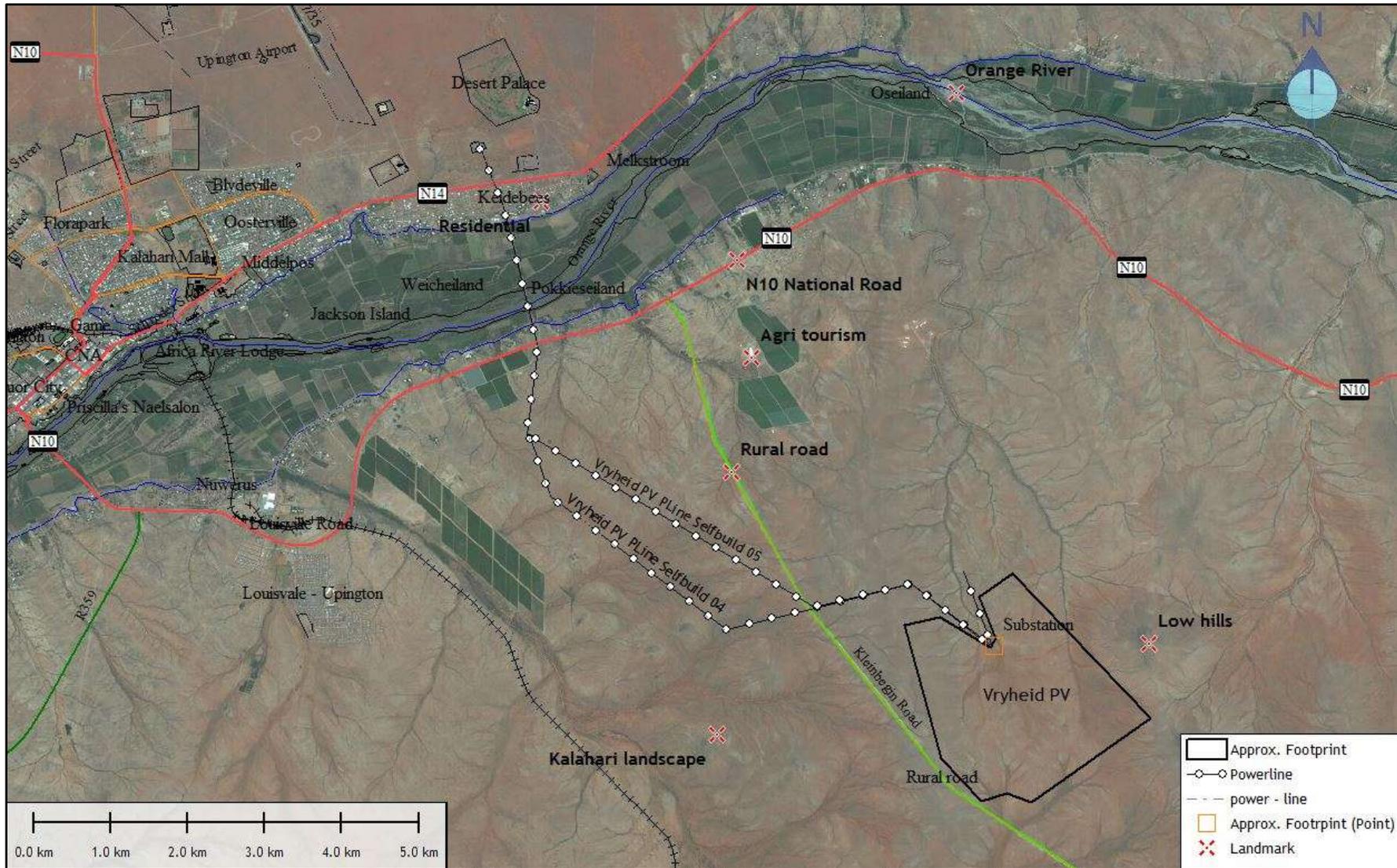


Figure 9: Landscape Context Photograph Points overlay onto Satellite Image

**Low hills**

Figure 10: Zoomed photograph taken east towards the low hills as seen from the proposed site

As depicted on all three of the PV site viewsheds, the low hills to the east of the site would have views of the proposed landscape modification. The low hills add landscape value by increasing undulation of the region. They are north-south aligned and rounded in form with limited man-made modifications. They significantly restrict the viewshed of the proposed PV site to the east.

Although having high exposure to the proposed project, there are no apparent tourist or residential receptors located in the vicinity (or directly using the visual resource) and it is likely that sensitivity to landscape change in the region would be low.

**Agri-tourism**

Figure 11: Photograph taken of the entrance to the Carpe Diem Raisons farm

As depicted in Figure 9, the only part on the proposed site which extends the potential visibility of the project to the north, is the ridgeline area to the west. It is unlikely that any

views of the site would be visible from the Carpe Diem Raisons farm. There are other similar types of agri-tourism initiatives taking place along the N10, but receptors making use of these tourist based activities would experience low exposure views (if at all).

### **Roads and infrastructure**



Figure 12: Photograph taken of the N10 (bottom) and Kleinbegin (top) roads

There are two roads which fall within the proposed PV and powerline viewshed, the rural road (Kleinbegin) and the N10 national road. The Kleinbegin road is routed south from the N10 national road to the west of the proposed site and acts as a low volume access for farms in the southern interior. The N10 national road links the town of Upington with Prieska in the south. This is an important tourist route and should be considered a tourist view corridor.

As depicted in the viewshed maps, it is unlikely that receptors using the N10 would have any view of the proposed PV site. As depicted in the powerline viewshed, the N10 receptors would have high exposure views of the powerline where it crosses over to the north. The proposed routing is aligned with an existing 132kv Eskom powerline which does increase the VAC levels, however the N10 should be considered as a KOP where landscape change should be moderated.

### Orange River And Viniculture Landscape



Figure 13: Photograph taken of the Orange River obscured by trees as seen from the elevated northern Upington residential areas

The main landscape feature in the area is the Orange River valley. This landscape includes the river and residential and agricultural developments along the valley. The cultural landscapes of this area are primarily associated with agricultural activities and vineyards on the more fertile lands along the Orange River and they add value to the overall vista. The types of receptors making use of the Orange River visual resources are mostly related to agriculture, tourism and residential. It is likely that maintaining the existing sense of place would be important to these receptors. The area is also strongly associated with the 'vineyard' cultural landscape and hence attractive to landscape based tourism. Although it is unlikely that receptors would have views of the proposed PV site, the proposed powerline does cross the Orange River and the cultivated areas adjacent the river. Due to the cultural landscape significance, it is likely that receptor sensitivity to change in landscape character in these areas would be *moderate to high*.

## Upington Residential



Figure 14: Photograph taken of the Upington residential areas

Located to the north of the Orange River on elevated ground, residential receptors look across the river towards the proposed site. As depicted on the viewshed maps, only the ridgeline areas of the proposed PV site would possibly be seen. The powerline is routed along an existing 132kv Eskom powerline corridor and residential receptors would have high exposure views of this. Due to the existing precedent, it is likely that receptor sensitivity would be moderated.

### 3.3 Site Landscape Character

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. The scenic quality is determined making use of the VRM scenic quality questionnaire (refer to addendum). In order to better understand the visual resources of the site, regional vegetation and terrain influences are described at a broad brush level.

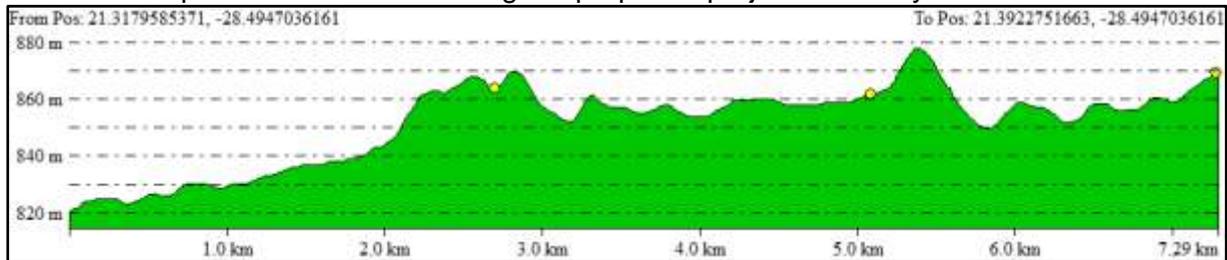
#### Topography

Elevation profiles were generated making use of ASTER data Digital Elevation Model. The profiles across the study area reflect an undulating terrain with some shallow ridgelines located on the proposed site. The low and high points on the site are 841 m and 877 m respectively.

The west to east profile depicts a gradual increase in elevation with the proposed site contained between two high points which restrict the east-west visibility as depicted on the valley area viewshed map. Also apparent is the close proximity of the western boundary of the proposed site to the ridgeline which will generate skyline intrusion as seen from the lower lying western areas.

The north to south profile depicts undulating terrain with some moderately prominent sections which increase regional visibility. The south-western section of the site has the potential to generate skyline intrusion to the lower lying western areas.

West to East profile with dots indicating the proposed project boundary



North to South profile with dots indicating the proposed project boundary



South to North along the proposed powerline routing

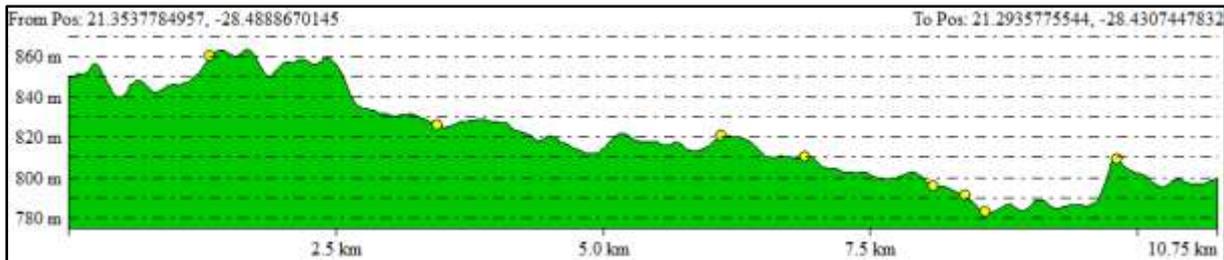


Figure 15: Terrain profiles generated from elevation model

The profile along the proposed powerline routing starts at a higher elevation of 850mamsl, increases in elevation to a shallow ridgeline before it starts to drop down into the Orange River valley low point of approximately 780mamsl. Continuing to the north over flat floodplains, the route crosses a steep sided valley in the vicinity of the Upington residential areas before flattening towards the substation location. In the vicinity of the proposed site, there are moderately prominent ridgelines which have the potential to generate higher levels of visual contrast due to skyline intrusion.

### **Site Visual Resources**

The VRM process requires that visual objectives are defined for each of the main physiographic rating units. The following broad brush Landscapes were identified and surveyed within the study area:

- Dry land agriculture south facing;
- Drainage lines;
- Dry land agriculture ridgeline;
- Dry land agriculture north facing;
- Kleinbegin Rural road;
- N10 National road; and
- Upington residential.

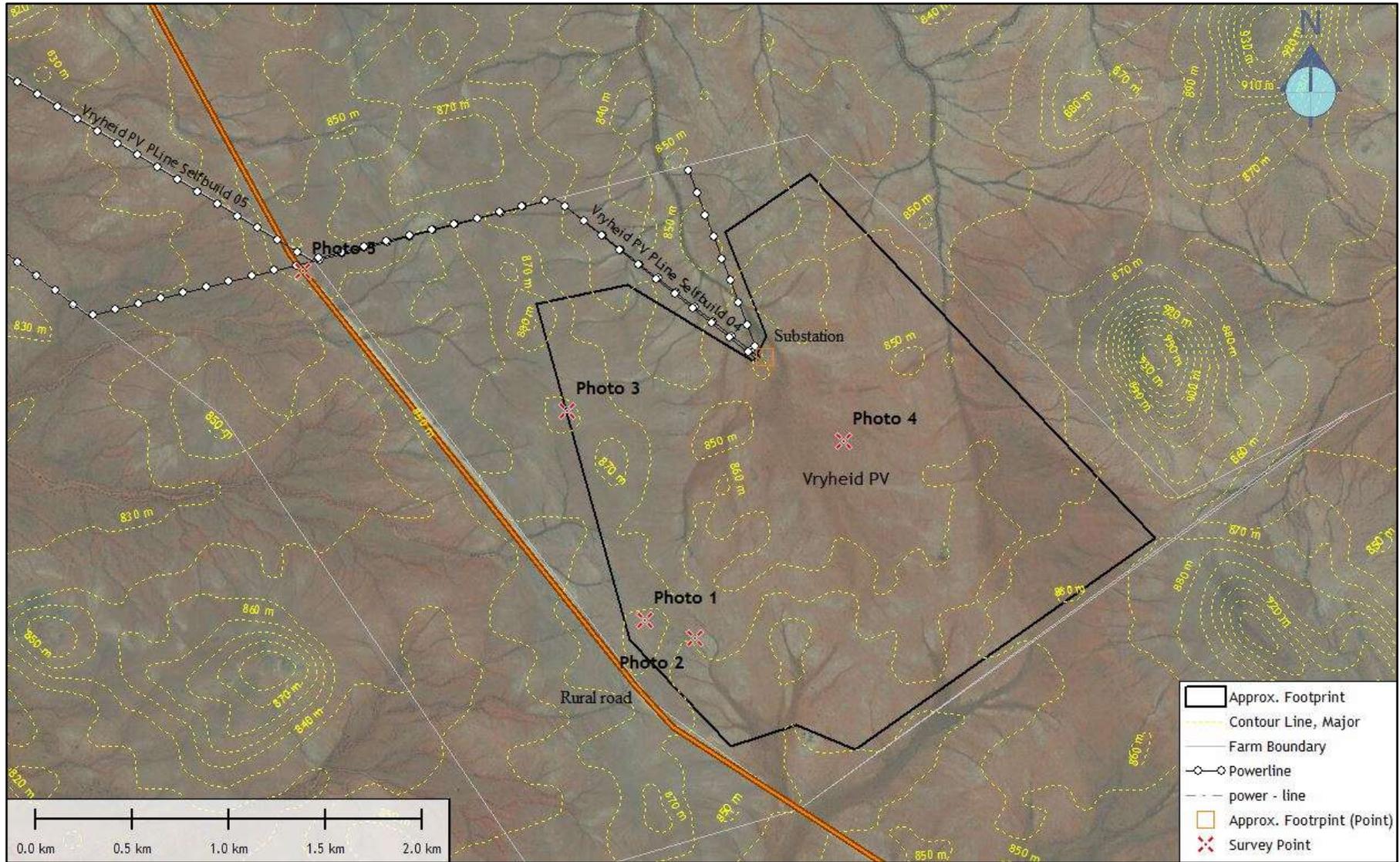


Figure 16: Southern landscape character survey points overlay onto OS satellite image map

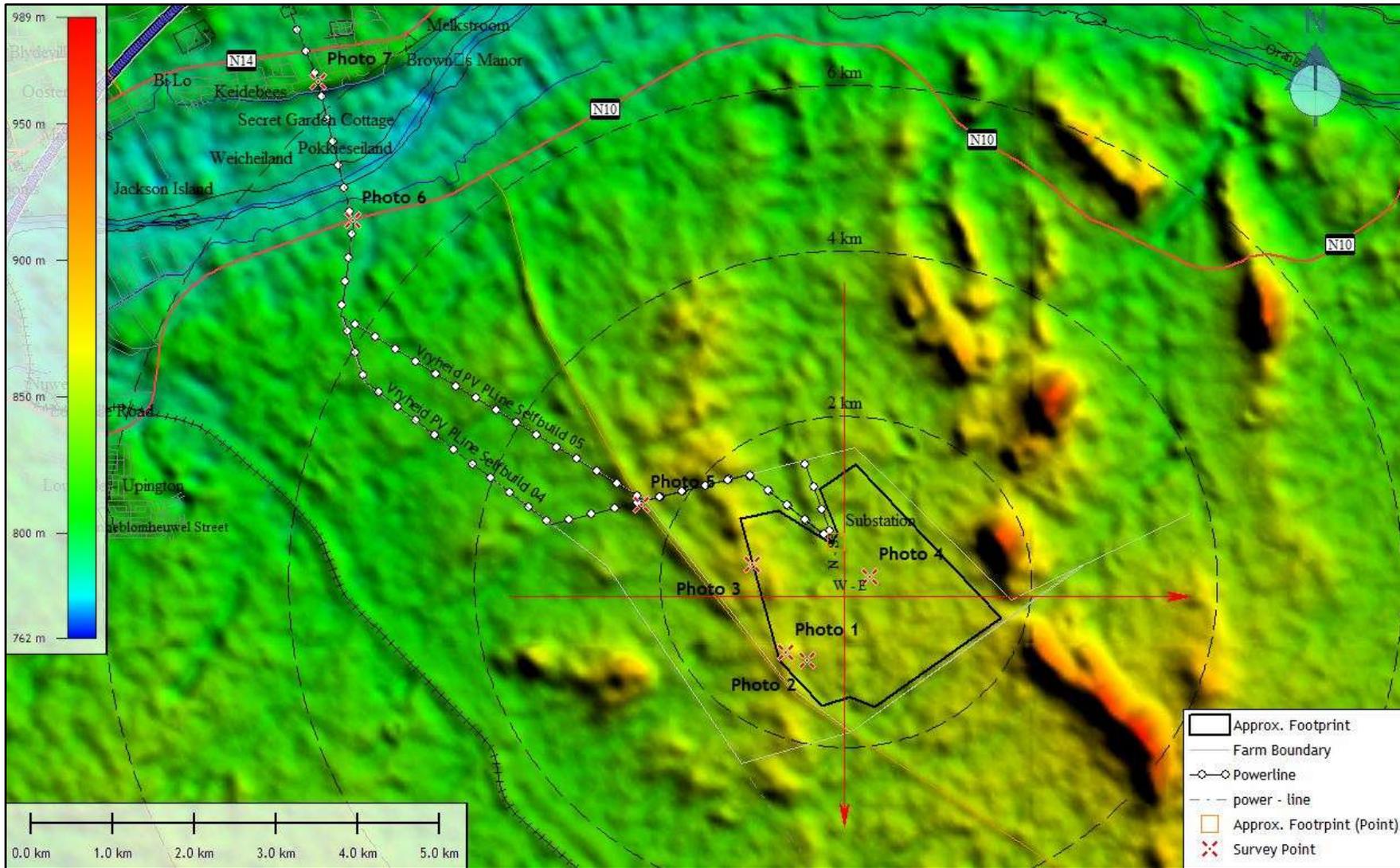


Figure 17: Regional elevation model and profile lines map

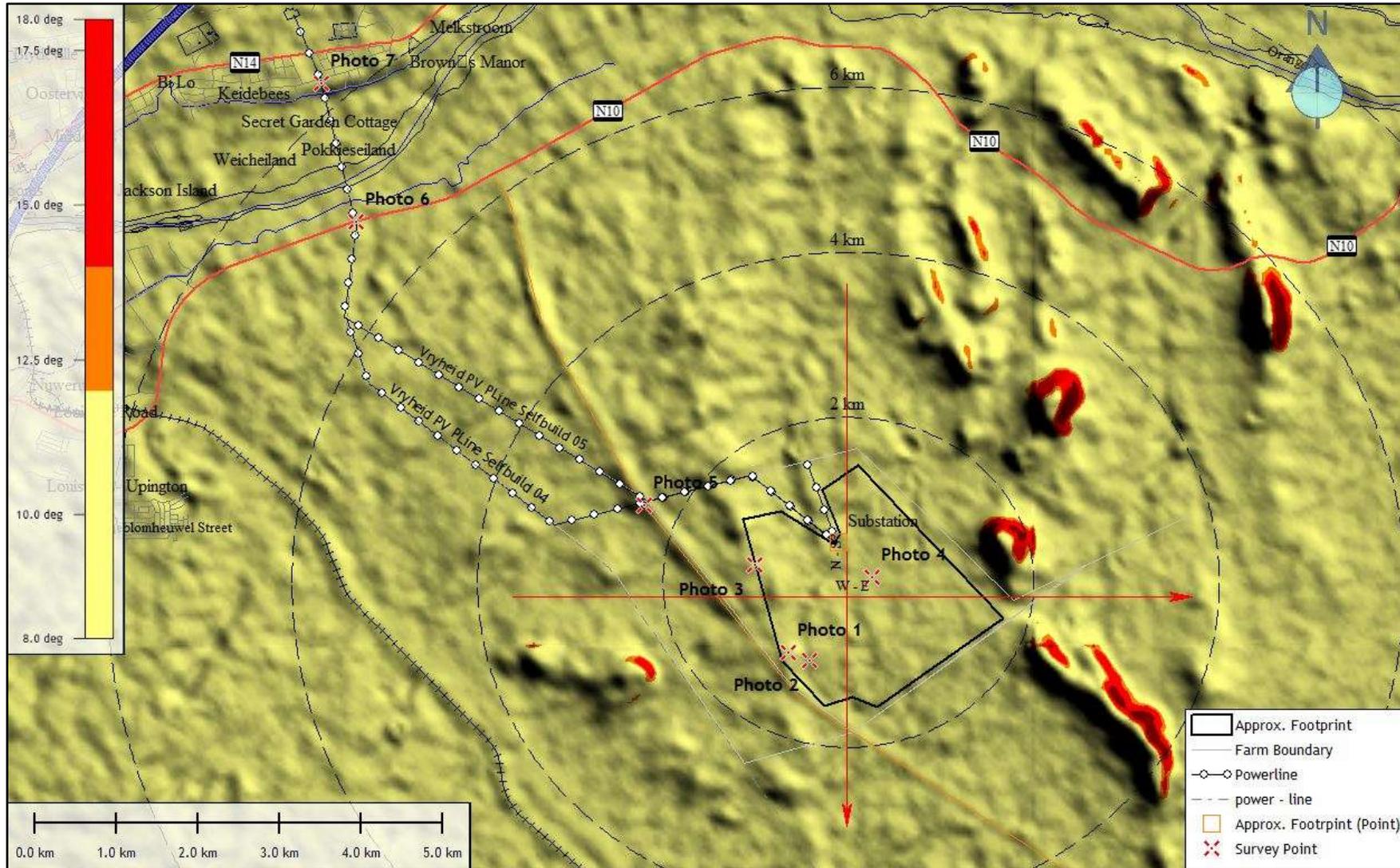


Figure 18: Broad brush slopes degrees map

Table 2: Landuse, Visual Absorption Capacity, Prominence and Receptors Exposure Table

Survey Points	Proposed Activity	Landuse	Viewshed	Exposure	VAC	ZVI
1	PV	Dry land agriculture south facing	High	Low	Low	FG/MG
2	PV	Drainage	Low	Low	Low	FG/MG
3	PV	Dry land agriculture ridgeline	High	Low	Low	FG/MG
4	PV and Substation	Dry land agriculture	Low	Low	Low	BG
			Medium	Low	Low	MG

(Key: FG = Foreground, MG = Middleground, BG = Background)

Table 3: Scenic Quality Table

Survey Points	Landform	Vegetation	Water	Colour	Scarcity	Adjacent scenery	Cultural Modification	Total	Scenic Quality
1	2	2	1	3	1	3	0	12	B
2	2	3	3	3	3	3	0	17	B
3	2	2	1	3	1	3	0	12	B
4	1	1	1	2	1	3	-1	8	C
<b>Sum.</b>	2	2	2	2	2	3	0		B

(Key: A= scenic quality rating of  $\geq 19$ ; B = rating of 12 – 18, C= rating of  $\leq 11$ )

Table 4: Receptor Sensitivity Table

<b>Survey Points</b>	<b>Type user</b>	<b>Amount use</b>	<b>Public interest</b>	<b>Adjacent land users</b>	<b>Special zoning</b>	<b>Receptor sensitivity</b>
<b>1</b>	Medium	Low	Low	High	Low	Medium
<b>2</b>	Medium	Low	Medium	High	Low	Medium
<b>3</b>	Medium	Low	Low	High	Low	Medium
<b>4</b>	Low	Low	Low	High	Low	Medium
<b>Sum.</b>	Medium	Low	Medium to Low	High	Low	Medium

## 4 RESULTS

### 4.1 VRM Findings

#### Visibility

Due to the raised ground adjacent to the site and to the south of the site, the visibility of the northern flat area where the PV and Substation are proposed is well contained. The viewshed is mainly to the north which is strongly associated with the higher VAC levels of Upington and the surrounding intensive agricultural areas. The visibility of this area is defined as *Low*.

The southern raised ground area of the site, extends the site visibility to the south into the open rural landscape which has low VAC levels and where the change in landuse would be strongly experienced. The visibility of this area of the proposed site is defined as *Medium*.

Along the western boundary of the proposed site is an elevated ridgeline. Should the proposed PV structures be placed in this vicinity, the proposed project visibility would extent further to the north, west and south. The visibility of this area is defined as *High*.

#### Exposure and Distance

Given that the majority of receptors would be located in the northern areas away from the proposed PV site, exposure to residential receptors is rated *Low*.

#### Scenic Quality

Making use of the VRM Scenic Quality Rating Questionnaire, the overall scenic quality of the site was rated as B, which equates to *Moderate*. This is due to the low rolling landform which has few interesting features, little or no variety or contrast in vegetation and the absence of water. The colours from the vegetation offer some variety but are generally not a dominant scenic element. The higher ratings for the site are related to the adjacent scenery where the low hills and undulating, open rural landscape to the south increases the regional scenic quality. Although interesting in its setting, it is fairly common within the region. Cultural modifications are limited to farm tracks and little or no visual variety to the area.

#### Receptor Sensitivity to Landscape Change

Making use of the VRM Scenic Quality Rating Questionnaire, the overall sensitivity of the surrounding receptors to landscape change was rated *Medium* for the proposed PV site, and *High* for the proposed Powerline. Due to the flat terrain which is well screened by the adjacent elevated land, most users would not see a portion of the site, reducing sensitivity. The southern and elevated ridgeline areas would extend the visibility to the south and possibly into the northern areas along the Orange River. Here the change in landscape modification would be more strongly experienced. Due to tourism interests, maintenance of visual quality to sustain adjacent landuse objectives would be higher.

## 4.2 VRM 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

The Classes are not prescriptive and are utilised as a guideline to determine the carrying capacity of a visually preferred landscape which is utilised to assess the suitability of the landscape change associated with the proposed project. The Visual Inventory Classes are defined using the matrix below and with motivation, can be adjusted to Visual Resource Management Classes which take zoning and regional planning into consideration if applicable.

Table 5: VRM Class Summary Table

Survey Points	Proposed Activity	Landuse	ZVI	Scenic Quality	Receptor sensitivity	Visual Inventory	Visual Resource Management
1	PV	Dry land agriculture south facing	FG/MG	B	Medium	Class III	Class II
2	PV	Drainage	FG/MG	B	Medium	Class III	Class I
3	PV	Dry land agriculture ridgeline	FG/MG	B	Medium	Class III	Class I
4	PV and Substation	Dry land agriculture	BG	C	Medium	Class IV	Class IV
			FG	B	Medium		

(Key: FG = Foreground, MG = Middleground, BG = Background, MH = Medium High)

### Class I

The drainage lines and the western elevated ridgeline identified on the proposed site should be suitability buffered and regarded as Class I (No-Go). 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.

### Class II

The landscapes identified as having a VRM Class II visual objective were the south facing areas to the south of the proposed site. Development of a PV plant on these areas would extend the industrial ZVI to the south into rural landscapes which currently exhibit higher levels of scenic quality. The visual objective is to retain the existing character the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract 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.

### **Class III**

The landscapes identified as having a VRM Class III visual objective were those associated with the proposed powerline. The presence of the existing Eskom powerline servitude along the northern section of the proposed route, increases the VAC levels, even though receptor sensitivities would be higher. 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.

### **Class IV**

The landscapes identified as having a VRM Class IV visual objective were those located on the flat terrain to the north of the proposed site. With little visibility and receptor sensitivity, this area is suited for landscape change without resulting in a significant change to 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.

### 4.3 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 is measured from these most critical locations, or receptors, surrounding the property.

To define the KOPs, potential receptor locations are identified in the viewshed analysis, which are 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
- Distance from property

Five locations were identified as having KOP status. The receptors at these points will have clear views of the proposed project which could result a change to local visual resources. These KOP's are:

- Rural Road North 1
- Rural Road North 2
- Rural Road South
- N10 National Road
- Upington Residential

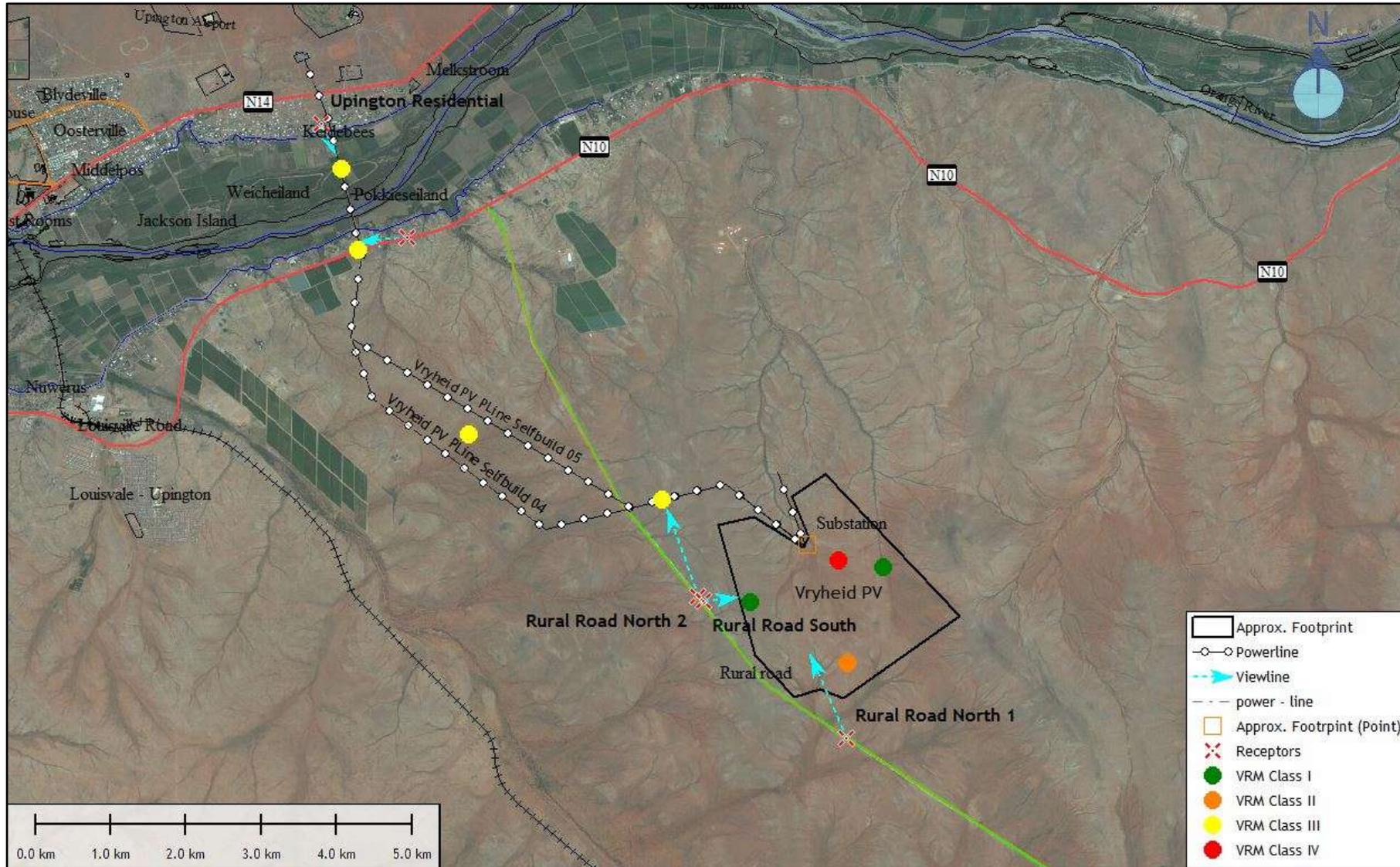


Figure 19: Key Observation Points overlaid onto VRM Classes and Proposed Development Footprint Map

## 5 IMPACT ASSESSMENT

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

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

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

The following criteria are utilised in defining the DoC:

- **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.



Figure 20: View of proposed PV site as seen from Rural Road North 1



Figure 21: Approximate position of PV panels on the skyline as seen from Rural Road South

Table 6: Key Observation Point Contrast Rating Table

Receptor	Visible	Type	VRM Class	Form	Line	Colour	Texture	DoC (Magnitude)	Visual objective met
<b>Rural Road North 1</b>	PV in foreground up to skyline	Rural road	Class II	Weak	Strong	Strong	Strong	Strong	No
<b>Rural Road South</b>	PV on foreground skyline	Rural road	Class I	NO-GO					No

Table 7: Landscape Character Environment Impacts Summary Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with mitigation	Mitigation	Mitigation Map Ref No.
PV Solar Facility	Cons.	W/Out	-ve	Local	Long	MH	HP	H		Retain southern, ridgeline and western facing slopes as No-Go areas (or until the area has become a de-facto PV Solar Facility hub. Lights at night management.	1
		With	-ve	Site	Long	MH	P		M		
	Ops.	W/Out	-ve	Local	Long	MH	HP	H		As above.	
		With	-ve	Site	Long	MH	P		M		
	Close	W/Out	-ve	Reg.	Perm	H	P	VH		Remove all structures and buildings. Rip compacted surfaces, rehabilitate and restore to indigenous, endemic vegetation.	
		With	-ve	Site	Short	L	P		L		
Access road	Cons.	W/Out	-ve	Local	Long	M	P	M		Erosion control, dust control with no dominant signage along the rural road.	
		With	-ve	Local	Long	L	P		L		
	Ops.	W/Out	-ve	Local	Long	M	P	M		Continued erosion and dust control.	
		With	-ve	Local	Long	L	P		L		
	Close	W/Out	-ve	Local	Long	M	P	M		Rip compacted surfaces, rehabilitate and restore to vegetation (unless the road can be incorporated into the subsequent landuse).	
		With	-ve	Site	Long	VL	P		VL		
Substation	Cons.	W/Out	-ve	Site	Long	M	P	M		NA	
		With	-ve	Site	Long	M	P		M		
	Ops.	W/Out	-ve	Site	Long	M	P	M		NA	
		With	-ve	Site	Long	M	P		M		
	Close	W/Out	-ve	Site	Perm	H	P	H		Rip compacted surfaces, rehabilitate and restore to vegetation (unless the road can be incorporated into the subsequent landuse).	
		With	-ve	Site	Short	VL	P		VL		

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

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with mitigation	Mitigation	Mitigation Map Ref No.
Cumulative Effects	Cons.	W/Out	-ve	Reg.	Perm	H	P	H		Effective coordination at a municipal level to manage possible negative effects of landscape degradation.	
		With	+ve	Reg.	Perm	M	P		M		
	Ops.	W/Out	-ve	Reg.	Perm	H	P	H		As above.	
		With	+ve	Reg.	Perm	M	P		M		
	Close	W/Out	-ve	Reg.	Perm	H	P	H		As above.	
		With	+ve	Reg.	Perm	M	P		M		

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

### **PV Solar Facility**

Without mitigation the proposed PV facility has a strong potential to generate *Negative High* visual impacts due to skyline intrusion on the west ridgeline. The area to the south of the proposed site currently has higher scenic qualities that typify the Kalahari landscape of the Upington area. With mitigation the ridgeline and southern development areas which have strong drainage lines would not be developed. This would significantly reduce skyline intrusions and the southern ZVI of the project. With mitigation the visual significance would be reduced to *Negative Moderate*. Once the project life is completed, all structures should be removed, the compact areas ripped and then rehabilitated and restored to indigenous, endemic vegetation. Lights at night have the potential to significantly increase the proposed project ZVI and light management is recommended (refer to generic light mitigations in the Appendix).

### **Access Road**

Without mitigation the access road has the potential to generate *Negative Moderate* visual impacts due to dust and soil erosion. Mitigation would reduce the impact to *Negative Low*. Once the project life cycle is completed, the roads should be ripped and then rehabilitated and restored to indigenous, endemic vegetation (unless the road can be incorporated into a future land-usage).

### **Substation**

Without and with mitigation the proposed substation has the potential to generate *Negative Moderate* visual impacts due to low prominence and limited visibility. Once the project life cycle is completed, the structure should be ripped and then rehabilitated and restored to indigenous, endemic vegetation (unless the substation can be incorporated into a future land-usage).

### **Cumulative Effects**

Without mitigation the potential for regional landscape degradation from ad hoc planning of new PV solar projects could result in *Negative High* cumulative impacts as landscape resources in the area become degraded from sprawling PV. This effect has the potential to significantly detract from the current viticulture cultural landscape associated with the Orange River which is not recommended. Effective planning at a municipal level is required to coordinate the expansion of the proposed solar energy projects so as not to detract from existing visual resources. Cumulative significance could then be reduced to a *Moderate Positive* effect by adding an interesting visual experience to the landscape.

## 6 CONCLUSION

VRM Africa was appointed by CapeEAPrac to undertake a Visual Impact Assessment for the proposed Joram Solar Facility on behalf of Joram Solar (Pty) Ltd. The site is located near the town of Upington, Northern Cape. A full site survey was undertaken on the 4<sup>th</sup> August 2014. The study site is approximately 400 ha and it is the intention of the applicant to do 2 phases of 75MW (PV) within this study site. Access to the study site will be via the existing farm road (this road will not require any upgrade).

It is the recommendation of this study that the proposed project, with mitigation, would not significantly detract from the current visual resources which has important receptors which should be recognised. A development setback on the western and southern boundaries was defined to ensure that skyline intrusion on the western raised ground and maintenance of the southern rural visual resources are not compromised.

## 7 REFERENCES

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3. *Cape EAPrac*, 2014. Final Scoping Report for the proposed JORAM Solar Development. Report Reference: KHH320/10. George.
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9. U.K Institute of Environmental Management and Assessment (IEMA). 'Guidelines for Landscape and Visual Impact Assessment' Second Edition, Spon Press, 2002. Pg 44.

## 8 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

### DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

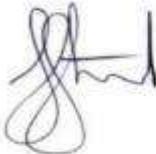
Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa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

## 8.1 Curriculum Vitae

### Curriculum Vitae (CV)

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

#### 7. Educational qualifications:

- University of Natal (Pietermaritzburg):
- Bachelor of Arts: Psychology and Geography
- Bachelor of Arts (Hons): Human Geography and Geographic Information Management Systems

#### 8. Professional Accreditation

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

#### 9. Association involvement:

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

#### 10. Conferences Attended:

- IAIAAsa 2012
- IAIAAsa 2011
- IAIA International 2011 (Mexico)
- IAIAAsa 2010
- IAIAAsa 2009
- IAIAAsa 2007

#### 11. Continued Professional Development:

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

**12. Countries of Work Experience:**

- South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

**13. Relevant Experience:**

Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa which specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. In association with ILASA qualified landscape architect Liesel Stokes, he has assessed of over 100 major landscape modifications through-out southern and eastern Africa. The business has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

**14. Languages:**

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

**15. Projects:**

A list of **some** of the large scale projects that VRMA has assessed has been attached below with the client list indicated per project (Refer to [www.vrma.co.za](http://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 Desalination 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 Rheebeek 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 Residential	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	GrooteSchoor 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 Sulphur 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	Sulphur 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

## 9 ANNEXURE 2: QUESTIONNAIRES AND VRM TERMINOLOGY

### 9.1 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. (*ASTER GDEM. METI / NASA. 2011*)

#### 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 are 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  $\geq 19$ ;*

*B = rating of 12 – 18,*

*C = rating of  $\leq 11$*

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:

- Classes I and II** are the most valued;
- Class III** represents a moderate value; and
- 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 8: 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 is 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*).

## 9.2 Questionnaires

### Scenic Quality Rating Questionnaire

KEY FACTORS	RATING CRITERIA AND 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.
<b>SCORE</b>	<b>2</b>	<b>0</b>	<b>-4</b>
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

<b>FACTORS</b>	<b>QUESTIONS</b>	
<b>Type of Users</b>	<b>Maintenance of visual quality is:</b>	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
<b>Amount of use</b>	<b>Maintenance of visual quality becomes more important as the level of use increases:</b>	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low
<b>Public interest</b>	<b>Maintenance of visual quality:</b>	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
<b>Adjacent land Users</b>	<b>Maintenance of visual quality to sustain adjacent land use objectives is:</b>	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
<b>Special Areas</b>	<b>Maintenance of visual quality to sustain Special Area management objectives is:</b>	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

### 9.3 VRM Terminology

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

## 10 ANNEXURE 3: GENERAL LIGHTS AT NIGHT MITIGATIONS

### Mitigation:

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

### Mesopic Lighting

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

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

**'Good Neighbour – Outdoor Lighting'**

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

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

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

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

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

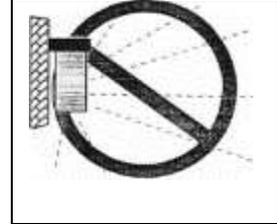
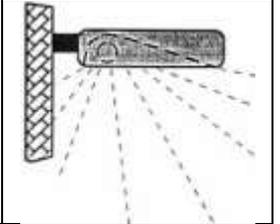
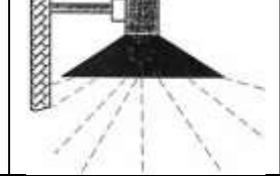
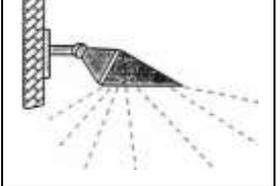
**Energy Waste** Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

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

**How do I switch to good lighting?**

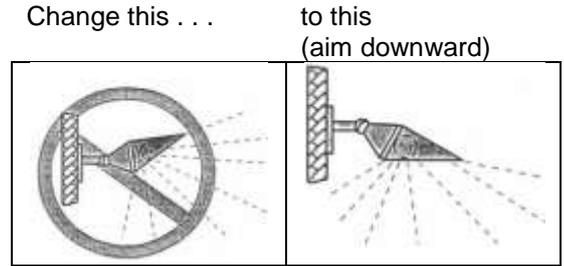
Provide only enough light for the task at hand; don't over-light, and don't spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the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

**Good and Bad Light Fixtures**

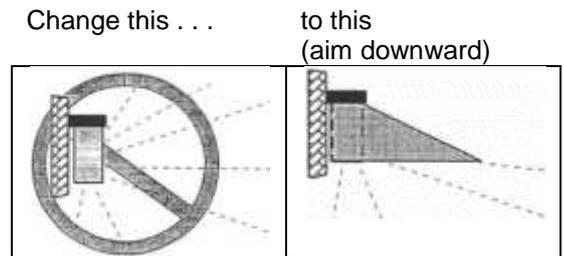
<p><b>Typical "Wall Pack"</b></p> 	<p><b>Typical "Shoe Box" (forward throw)</b></p> 
<p><b>BAD</b> Waste light goes up and sideways</p>	<p><b>GOOD</b> Directs all light down</p>
<p><b>Typical "Yard Light"</b></p> 	<p><b>Opaque Reflector (lamp inside)</b></p> 
<p><b>BAD</b> Waste light goes up and sideways</p>	<p><b>GOOD</b> Directs all light down</p>
<p><b>Area Flood Light</b></p> 	<p><b>Area Flood Light with Hood</b></p> 
<p><b>BAD</b> Waste light goes up and sideways</p>	<p><b>GOOD</b> Directs all light down</p>

1. Aim lights down. Choose “full-cutoff shielded” fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.
3. If colour discrimination is not important, choose energy-efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact fluorescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.

**What You Can Do To Modify Existing Fixtures**

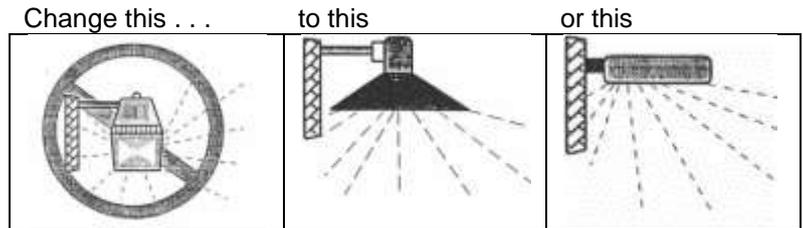


**Floodlight:**



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!

**Wall Pack**



Yard Light

Opaque Reflector

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.