PROPOSED KAKAMAS 2 PHOTOVOLTAIC SOLAR ENERGY FACILITY

ON A SITE WEST OF KAKAMAS, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

AS PART OF A BASIC ASSESSMENT PROCESS

Produced for:

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in collaboration with V&L Landscape Architects CC.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modelling, and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the Proposed Kakamas 2 Photovoltaic Solar Energy Facility on a site west of Kakamas. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

1. This assessment was undertaken during the planning stage of the project and is based on information available at that time.

1.3. Level of Confidence

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
  - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
  - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
  - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

- The information available, understanding and experience of this type of project by the practitioner:

[1] Adapted from Oberholzer (2005).

- 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
- 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
- 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

*The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is high:*

- The information available, and understanding of the study area by the practitioner is rated as **3** and
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**.

1.4. Methodology

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed PV facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General.

The approach utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc;
- The identification of sensitive environments upon which the proposed PV facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analysis takes into account the dimensions of the proposed structures.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed PV facility, including associated infrastructure, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **Determine Potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed PV facility and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed PV facility and related infrastructure on the site indicate the potential visibility.

- **Determine the Visual Absorption Capacity of the Landscape**

  This is the capacity of the receiving environment to absorb the potential visual impact of the proposed PV facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

  The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

  The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

  The digital terrain model utilised in the calculation of the visual exposure of the PV facility does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **Determine Visual Distance and Observer Proximity to the PV facility**

  In order to refine the visual exposure of the proposed PV facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the PV facility.

  Proximity radii for the proposed development site are created in order to indicate the scale and viewing distance of the PV facility and to determine the prominence of the structures in relation to their environment.

  The visual distance theory and the observer's proximity to the PV facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed PV facility.

- **Determine Viewer Incidence and Viewer Perception**

  The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be

no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed PV facility and its related infrastructure.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **Determine the Visual impact index**

  The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the magnitude of each impact.

- **Determine Impact significance**

  The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude, and probability. Mitigation is proposed where relevant.

2. BACKGROUND

INCA Kakamas Solar (Pty) Ltd (INCA), a subsidiary of INCA Energy, is proposing the establishment of a Photovoltaic Solar Energy Facility approximately 3km west of Kakamas, within the Kai Garieb Local Municipality in the Northern Cape Province.

INCA intends to utilise photovoltaic (PV) technology to construct an alternative energy generation facility with a total generating capacity of up to 10MW.

Photovoltaic technology uses the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. Silicon wafers act as semiconductors, and when struck by light produce electricity. Individual photovoltaic cells are linked in circuit and placed behind a protective transparent cover sheet to collectively form a photovoltaic panel/array.

The photovoltaic panels are fixed to support structures which are either bolted directly into the ground or fixed by means of concrete foundations. These structures can be adjusted in terms of their angle relative to the sun. When photovoltaic panels are connected as strings, each string may be allocated its own inverter.

Photovoltaic energy generation is generally considered an environmentally friendly electricity generation option.

The proposed PV facility will consist of the following infrastructure:

- An array of Photovoltaic solar panels with a generating capacity of up to 10MW;
- Cabling between the project components (laid underground) and
- Internal access roads.

The proposed Kakamas 2 facility will be developed as a second phase to the authorised Kakamas 1 facility, located to the immediate north of the proposed site. In this respect, it is anticipated that the substation, workshop, maintenance area etc, which form part of the Kakamas 1 facility, will also service the proposed Kakamas 2 facility.

2. SCOPE OF WORK

The project is proposed on the Remainder of Farm 1178 (Kakamas and Suid Nedersetting).

The study area for the visual assessment encompasses a geographical area of 865km² (the extent of the maps displayed below) and includes a minimum 15km buffer zone from the proposed development area.

The scope of work for this assessment includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability, and significance of the construction and operation of the proposed infrastructure.

In this regard, specific issues related to the visual impact have been identified and include the following:

- The visibility of the PV facility to, and potential visual impact on observers travelling along main roads (i.e. the N14 and the R359) and secondary roads in close proximity[2] to the proposed PV facility as well as within the region[3].
- The visibility of the PV facility to, and potential visual impact on residents of farms and homesteads in close proximity to the proposed PV facility as well as within the region.
- The visibility of the facility to, and visual impact on urban areas in close proximity to the proposed PV facility as well as within the region.
- The potential visual impact of the PV facility on the visual character of the landscape and sense of place of the region.
- The potential impact on tourist routes (N14) and tourist destinations within the region.
- The potential visual impact of ancillary infrastructure (i.e. the internal access roads) on observers in close proximity to the proposed facility.
- The potential visual impact of operational, safety and security lighting at night on observers residing in close proximity of the PV facility.
- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed PV facility.
- Potential cumulative visual impacts, especially in light of the approved Kakamas 2 facility, located to the immediate north. Other solar facilities are also proposed in the area, but have not yet been approved.

[2] For the purpose of this study, close proximity is considered to be within 2km of the proposed PV facility.
[3] For the purpose of the visual assessment, the region is considered to be beyond the 2km radius of the proposed PV facility but still within the study area.

- Potential residual visual impacts after the decommissioning of the PV facility.
- The potential to mitigate visual impacts and inform the design process.

4. THE AFFECTED ENVIRONMENT

Regionally, the study area is located south west of Upington, and east of Augrabies within the Northern Cape Province. Refer to **Map 1**.

The study area occurs on land that ranges in elevation from about 640m a.s.l. along the Orange / Gariep River, to 1000m a.s.l. at the top of the hills in the north east of the study area.

The site and the immediate surrounding area is generally flat, sloping gently northwards towards the Orange / Gariep River. Low hills occur just beyond the site, and larger hills occur in the north west and south east. To the north east, more substantial sets of parallel dune hills are present.

The perennial Orange / Gariep River is the dominant hydrological feature in the study area, and flows in a roughly westerly direction, bypassing the site about 3km to the north. The Hartbees River and a number of non-perennial tributaries are also present, and make their way towards the Orange / Gariep River. The terrain of the study area is described as *lowlands with hills.* Refer to **Map 1**.

The Orange River has to a large degree dictated the settlement pattern in this arid region by providing a source of permanent water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district and also its international claim to fame. Cattle and game farming practises also occur at a less intensive degree.

The majority of the study area is sparsely populated (less than 10 people per km^2). The main urban centre within the study area is the town of Kakamas. Other built up areas include *Marchland*, *Augrabies, Kakamas*, *Langverwag Lutzburg*, *Cillie* and *Taaipit.*

Farms and homesteads are concentrated along the Orange / Gariep River belt, and are also found scattered, at a much lower density, throughout the remainder of the study area to the north and south of the river.

The N14 national road traverses the study area from east to west, while the R359 arterial road extends to the north west and south east. A number of secondary roads are also present in the area.

Rail infrastructure (for freight) follows the alignment of the N14 to Kakamas, bypassing the site on its southern boundary. Other industrial infrastructure includes the Taaipit/Renosterkop 132 kV power line and the Taaipit Substation.

The climate is semi arid, with the study area receiving between 123mm and 185mm of rainfall per annum. Land cover is primarily *shrubland* with *thicket and bushland* occurring primarily in the north east. Cultivated land in the form of irrigated agricultural fields dominates land use along either bank of the river. Refer to **Map 2.**

There are no formally protected or conservation areas within the study area. Natural vegetation types include primarily *Orange River Broken Veld.*

Figure 1: The southern outlying parts of Kakamas on the southern bank of the Orange / Gariep River.

Figure 2: Typical vineyard within the agricultural strip along the Orange / Gariep River.

In terms of tourism, the study area is located within the Orange River region, which is a known tourist area. Attractions include the scenic river, ecotourism (such as hiking, 4x4 and canoeing), adventure tourism, cultural historic sites and South Africa's largest wine producing region[4].

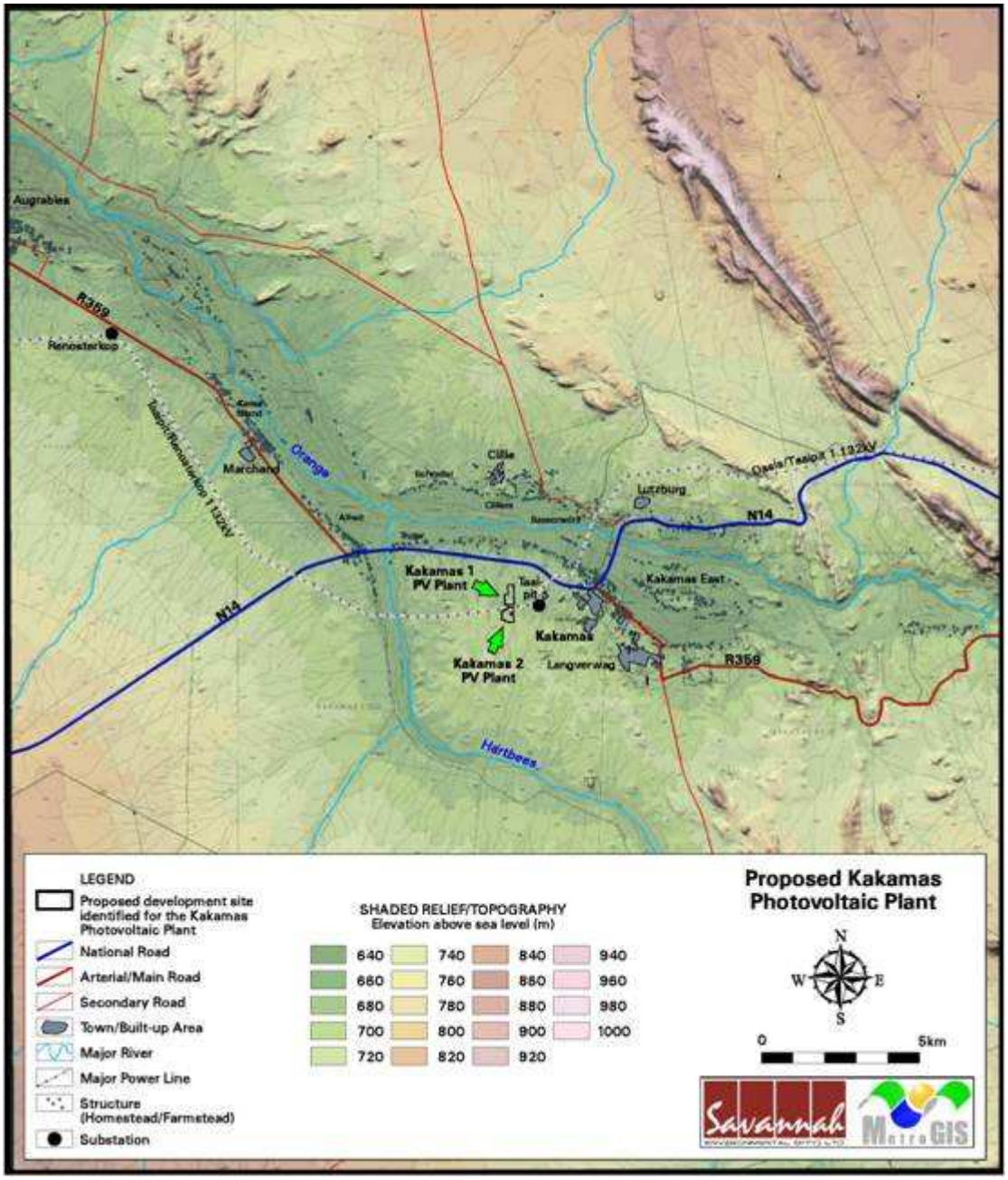
The N14 is an important tourist access route on a national level, and within the region, it functions as part of the wine route meander. Tourist facilities have not been mapped, but it is expected that tourist accommodation and amenities are to be found within the small towns, urban centres and even some of the farms and homesteads along the river valley and to a lesser extent within the natural, undeveloped area beyond.

The visual landscape is one of wide-open spaces and little development, with the parallel dune hills and the Orange / Gariep River belt representing the most visually apparent natural features. Farming along the river lends a rural and agricultural flavour to the visual environment. Beyond the farming belt, however, development is sparse and very small in scale and the landscape character is one of undeveloped wide open space.

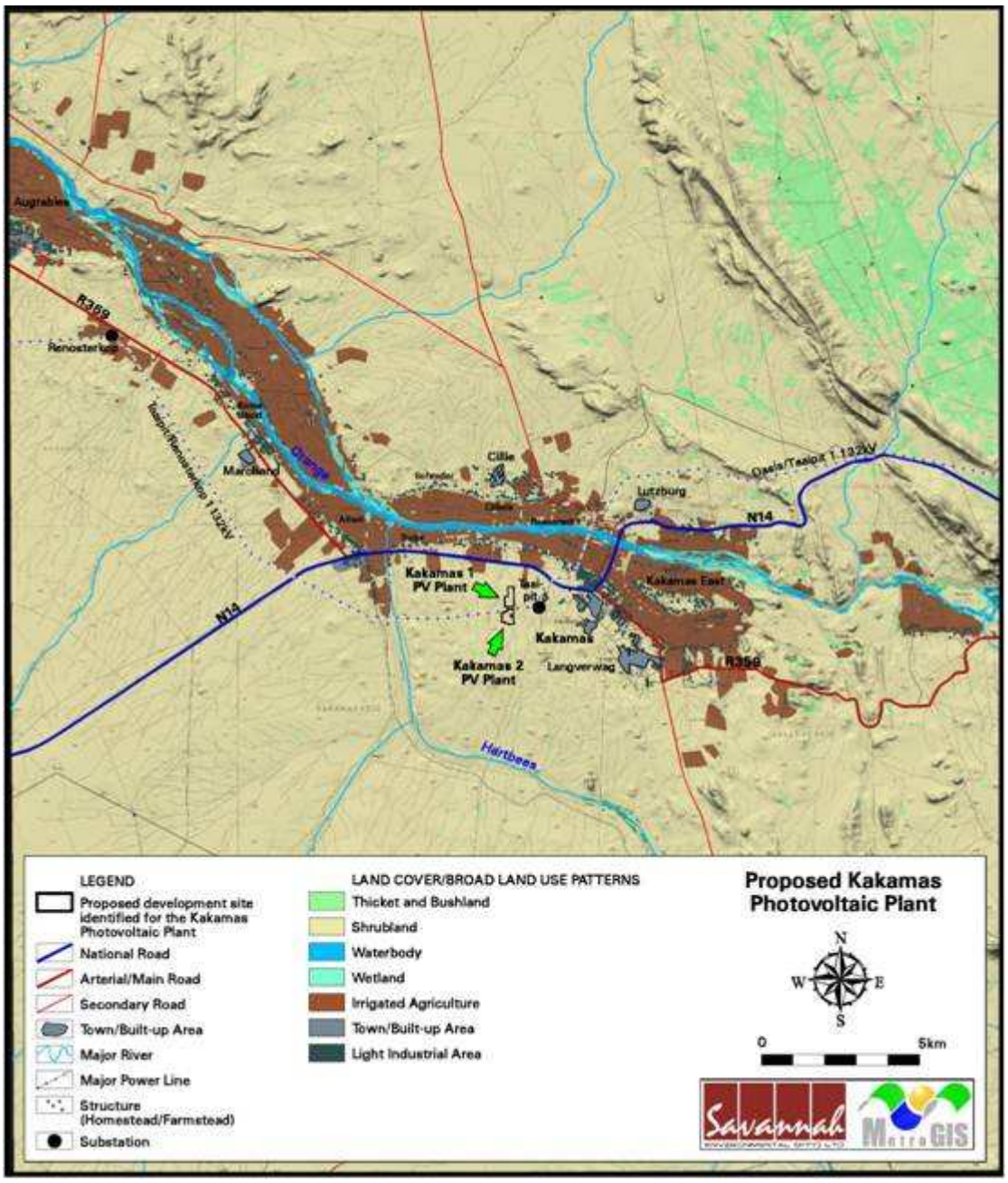
Both the agricultural landscape and the undeveloped landscape beyond are considered to have a high visual quality. In addition, the dramatic contrast between the arid shrubland and the lush vineyards growing on the edge of the Orange River lends a unique visual quality and sense of place to the region.

Figure 3: Visual quality of the regional landscape showing the contrast between the arid shrubland and the lush Orange River valley vineyards.

[4] The Orange River Wine Route is centered around Upington. The Orange River Cellars (ORC) comprise 6 wineries representing nearly 900 producers. http://www.tourismgrading.co.za



Map 1: Proposed layout of the site and topography and shaded relief of the broader study area.



Map 2: Land cover and broad land use patterns within the study area.

5. RESULTS

5.1. Potential visual exposure

The result of the visibility analysis for the proposed PV facility is shown on **Map 3**. The analysis was undertaken from a number of indicative vantage points within the site at an offset of 4m (i.e. the maximum height of the PV panels) above average ground level.

This was done in order to determine the general visual exposure of the area under investigation, simulating the proposed structures associated with the PV facility.

It must be noted that the viewshed analyses do not include the potential shielding effect of vegetation cover or existing structures on the exposure of the proposed PV facility, and it does not take into consideration the limitations of the human eye, therefore signifying a worst-case scenario.

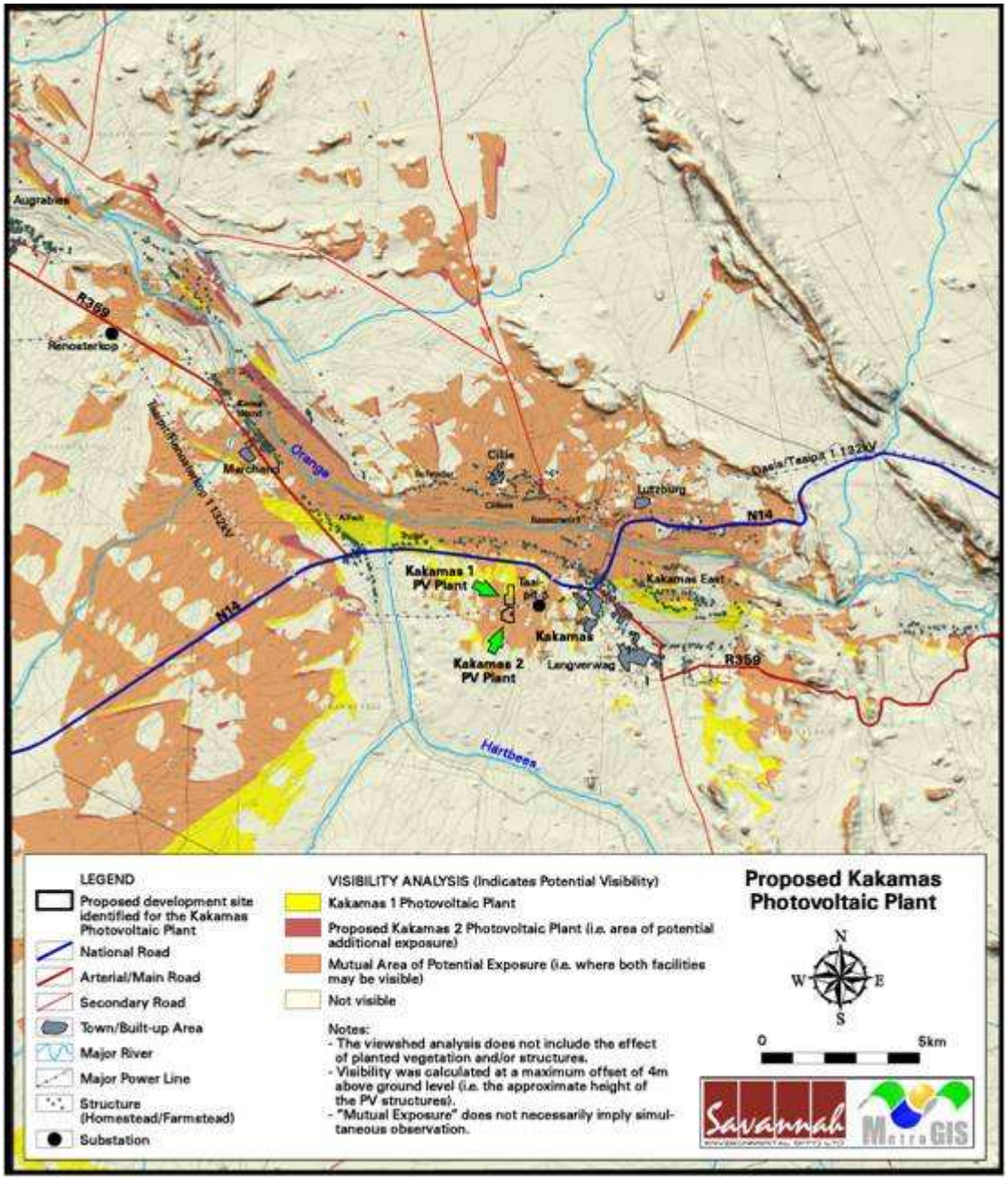
Map 3 not only shows the potential visual exposure of the proposed Kakamas 2 facility, but also indicates a comparative and cumulative viewshed analysis of both the Kakamas 1 and Kakamas 2 facilities. The pink shading indicates those areas potentially affected by both facilities. The yellow represents those areas only affected by the authorised Kakamas 1 facility, while the brown shows the areas outside of the Kakamas 2 viewshed, which will potentially be affected by the proposed Kakamas 2 facility.

The analysis clearly indicates that the viewshed for the proposed Kakamas 2 facility will lie almost entirely within that of the authorised Kakamas 2 facility. Exceptions include small areas to the north west, within the river valley.

In general, the PV facility is likely to be visually exposed to a primary area within approximately 7km of the proposed facility. This includes the site itself, and the areas predominantly to the north, north west and east. Areas to the direct south of the facility appear to fall outside of the viewshed.

Further afield, the zone of potential visual exposure lies to the west, and to a lesser extent to the north west and east.

Visually exposed areas are concentrated along the lower lying Orange River valley to the north, north west and north east of the site. In addition, the south west facing slopes of the ridges in the north east of the study area may also be visually exposed.



Map 3: Potential visual exposure of the proposed PV facility.

5.2. Visual absorption capacity

The study area receives between 123 mm and 185 mm of rainfall per annum. Land cover is mostly *shrubland* interspersed with *thicket and bushland*. *Agricultural fields* occur along the Orange River in within the river valley. The vegetation type is *Orange River Broken Veld.*

The Visual Absorption Capacity (VAC) of the natural areas, where the thicket and bushland is intact, is moderate to low, but where the land cover is primarily shrubland, the VAC drops to low.

VAC within urban and built up areas is higher due to the presence of buildings, structures and visual clutter.

In the vicinity of farms and homesteads, trees and other vegetation may contribute to the screening of the proposed PV facility, thus elevating the VAC. This is not a given however, and must therefore be discounted in an effort to accommodate an overall worst case scenario.

VAC will therefore not be taken into account for this VIA, except within urban area of Kakamas, where this will be of relevance.

5.3. Visual distance / observer proximity to the PV facility

MetroGIS determined proximity radii based on the anticipated visual experience of the observer over varying distances. The following factors are considered for the determination of appropriate proximity radii:

- The maximum cone of vision for a stationary person, which is accepted to be 60 degrees in both the vertical and the horizontal fields. This cone of vision allows for easy eye movement and no loss of focus of the object in question.
- The maximum horizontal extent or widest cross section of the proposed PV facility that an observer will be able to perceive.
- The maximum height of the tallest infrastructure.

For a PV facility, the horizontal extent is of most significance. Despite being made up of smaller components (i.e. the individual PV panels), a PV facility will manifest as a single visual entity. It follows that the larger the facility, the larger will be the anticipated visual impact at any given distance, and the more visible the facility will be over larger distances.

In this respect, the proximity radii are calculated as a function of the critical point at which an observer will be able to perceive the full extent of the facility within a maximum 60 degree cone of vision.

MetroGIS developed this methodology in the absence of any known and/or acceptable standards for South African solar energy facilities.

The proximity radii used for this study (calculated from the boundary of the site) are shown on **Map 4** and are as follows:

- 0 – 2 km - Short distance view where the PV facility would dominate the frame of vision and constitute a very high visual prominence.
- 2 – 4 km - Medium distance views where the PV facility would be easily and comfortably visible and constitute a high visual prominence.

- 4 – 8 km - Medium to longer distance view where the PV facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 8 km - Long distance view where the PV facility would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the PV facility.

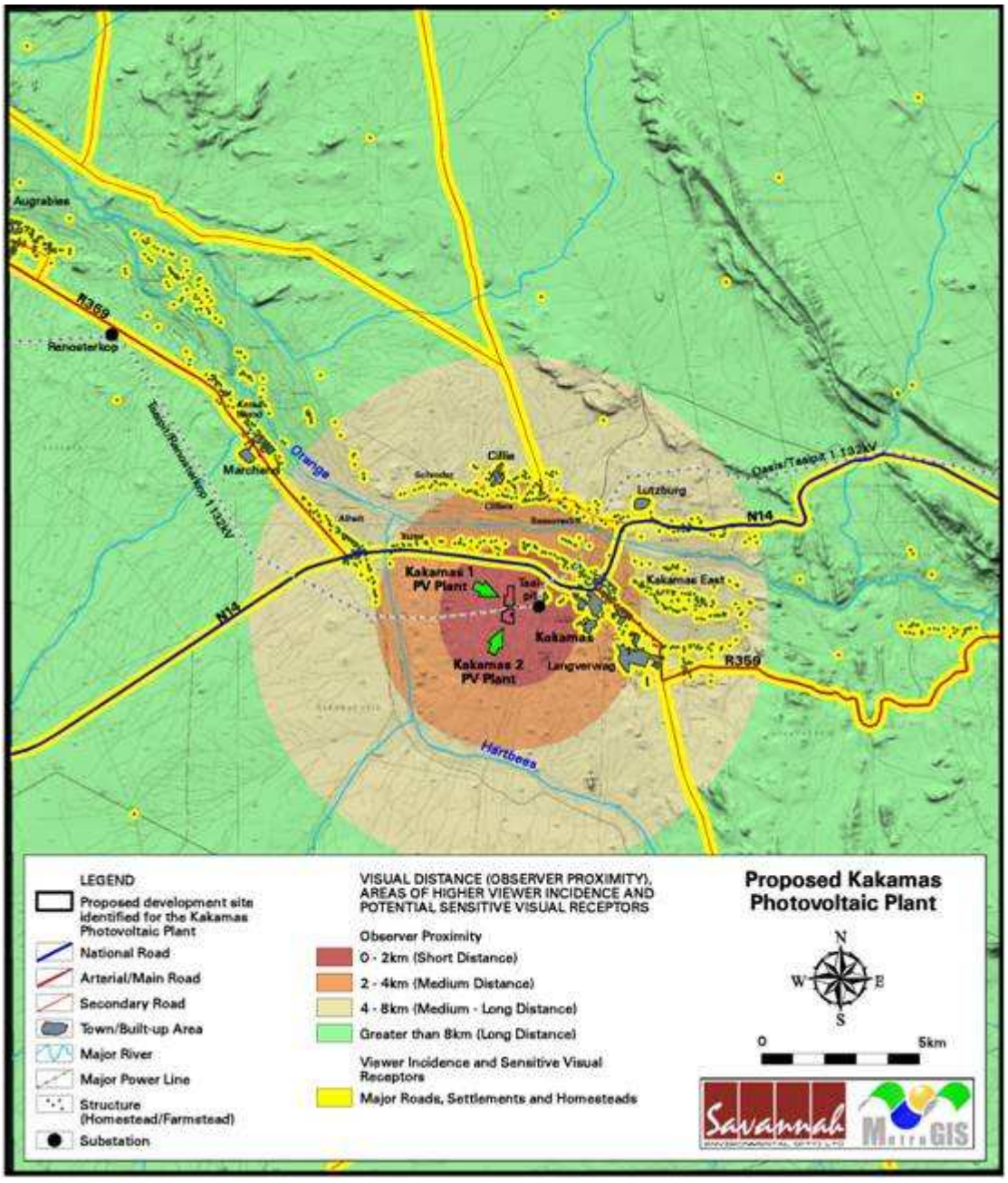
5.4. Viewer incidence / viewer perception

Refer to **Map 4**. Viewer incidence is calculated to be the highest along the National, arterial and secondary roads (highlighted as yellow strips) within the study area. Commuters and tourists using these roads could be negatively impacted upon by visual exposure to the PV facility.

Other than along the above roads, viewer incidence is concentrated in the small town of Kakamas, small urban areas and within the farms and homesteads (highlighted as yellow dots) along the river and further afield within the study area.

The sensitivity of visual receptors is considered to be lower within urban areas than within rural farms and homesteads beyond the urban zone. This is due to the more state of the visual environment within urban areas due to buildings, structures and visual clutter.

The severity of the visual impact on visual receptors decreases with increased distance from the proposed PV facility.



Map 4: Observer proximity, areas of high viewer incidence and potential sensitive visual receptors.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed PV facility are displayed on **Map 5**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, a potential visual exposure to the proposed PV facility, a high viewer incidence, and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The following is of relevance:

- Areas of potentially **moderate** visual impact are indicated on the site itself and within a 2 km radius of the proposed PV facility. The extent of potential visual impact is constrained in all directions due to the undulating topography and low hills in close proximity.

  Areas of potentially **high** visual impact are limited to short stretches of the N14 as it bypasses the site, the built up area of Taaipit and a few farms and homesteads on the southern bank of the river (north of the site).

- Potential visual impact between the 2 km and 4 km radius is concentrated in the north, in an area straddling the Orange / Gariep River valley. These areas are likely to be exposed to **low** visual impact.

  Sensitive visual receptors within this zone of potential visual impact include the N14 in the east, a secondary road in the north east, and a number of farms and homesteads within the river valley to the north. These receptors will potentially be exposed to **moderate** visual impact. Of Those receptors located on the northern bank of the river are located on land sloping towards the proposed site, thus orientating them towards the proposed PV facility.

  Areas to the west, south and east, including the urban areas of Kakamas, and Langverwag, will not be exposed to potential visual impact.

- Between 4 km and 8 km, the magnitude of visual impact is reduced to **very low**. Visually exposed areas lie to the west, north west, north, north east, and to a lesser extent to the east.

  Stretches of the N14 in the east and west, the R359 in the north west as well as a secondary road in the north are likely to be exposed to **low** visual impact. Similarly, the urban areas of Lutzville and Cillie, as well as a number of farms and homesteads within the river valley and along the afore-mentioned roads may be exposed to low visual impact. Due to the slope of the land, receptors located on the northern bank of the river are orientated towards the proposed site.

  Areas to the south and east are screened from potential visual impact.

- Visual impacts beyond the 8km are considered to be mostly **negligible** as it is unlikely that the PV facility will be visible from this distance.

The figure below helps to place the above explanations in context by illustrating what scale a PV panel will be perceived at different viewing distances

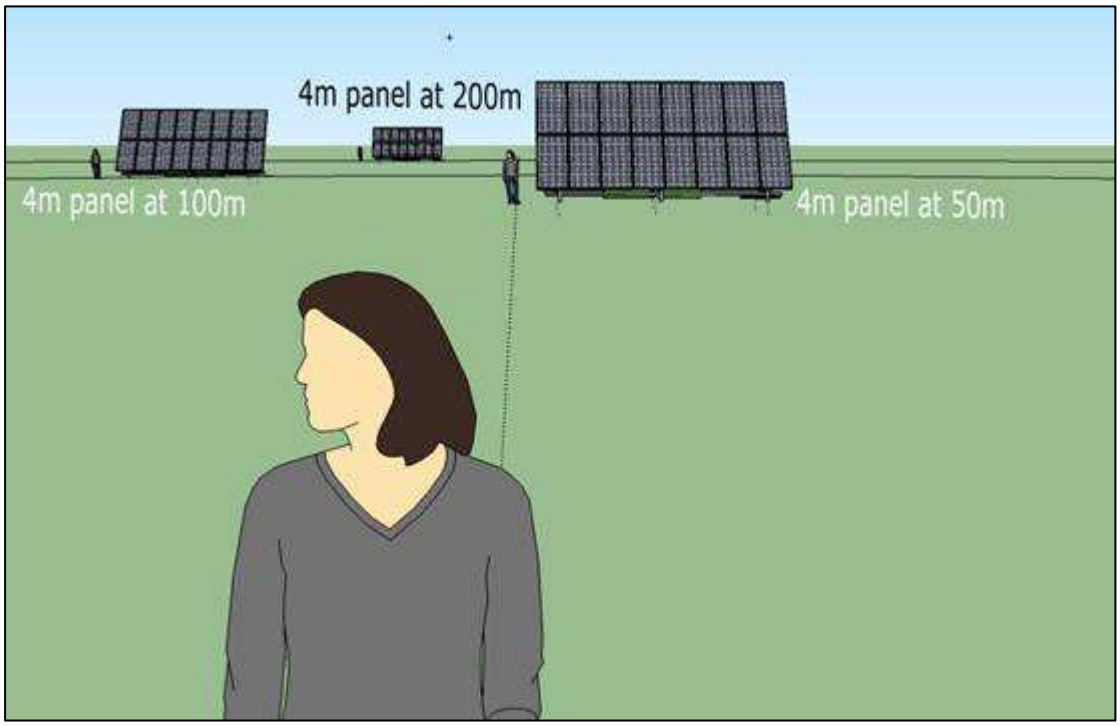
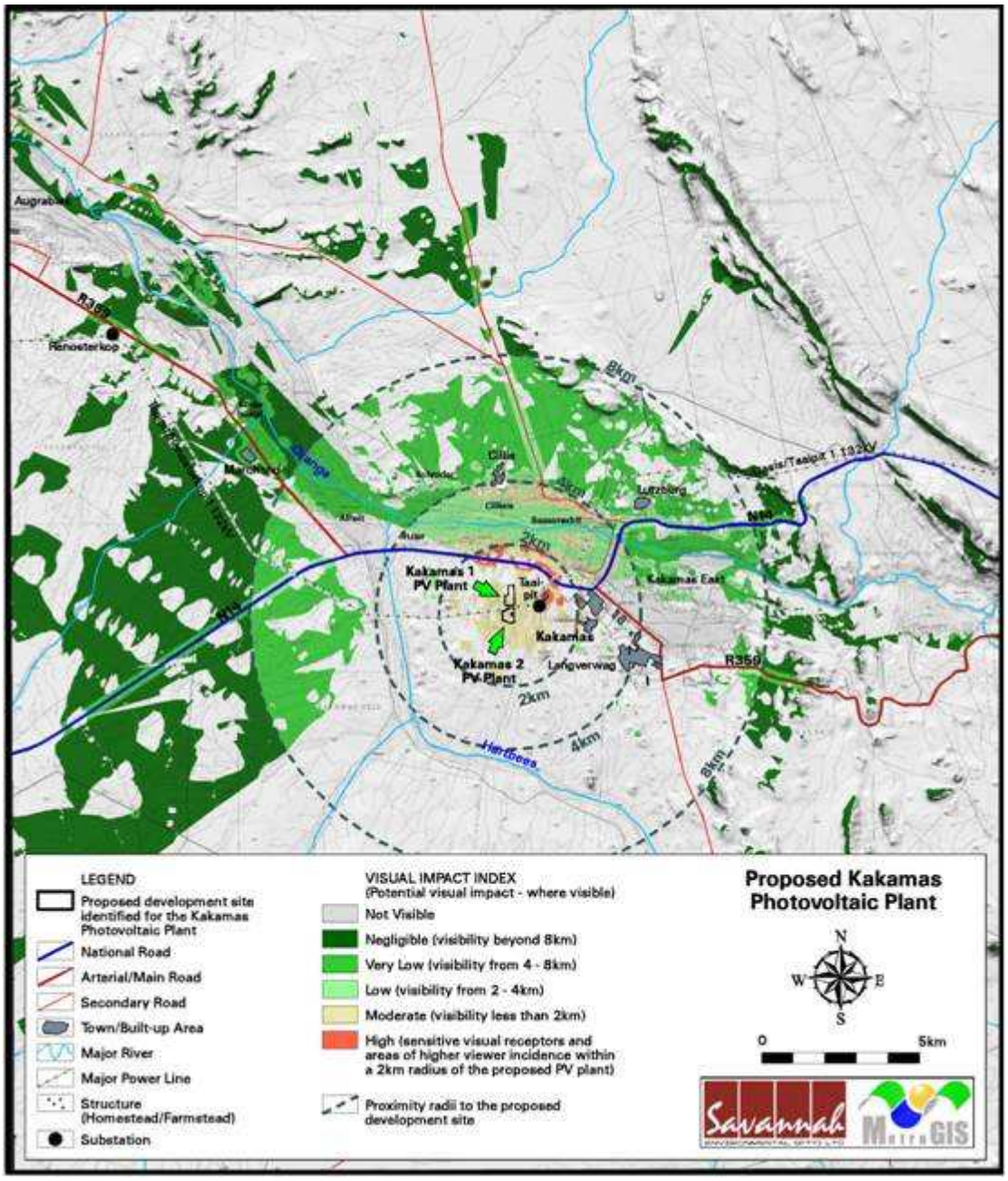


Figure 4: Visual experience of 4m high PV panels at a distance of 50m, 100m and 200m.



Map 5: Visual impact Index of the proposed PV facility.

5.6. Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 3: Scope of Work) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed PV facility) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1).
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10). This value is informed by the Visual Impact Index. Where more than one value is applicable, the higher of the two will be used to allow for a worst case scenario.
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5). This value is read from the visual impact index.
- **Status** (positive, negative, or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5)
- **Significance** - low, medium, or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**). The significance weighting for each potential visual impact (as calculated above) is as follows:

- **<30 points: Low** (where the impact would not have a direct influence on the decision to develop in the area)
- **31-60 points: Medium/moderate** (where the impact could influence the decision to develop in the area)
- **>60: High** (where the impact must have an influence on the decision to develop in the area)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

5.7 Visual Impact Assessment: Primary Impacts

5.7.1 The PV facility

Potential visual impact on users of national, arterial and secondary roads in close proximity to the proposed facility.

The 4m high PV panels will present a visual impact as these structures are built forms within an otherwise natural context. In addition, vegetation will need to be removed for these structures to be built.

Visual impacts on stretches of the N14 as it bypasses the site within 2km of the proposed facility are expected to be of **moderate** significance both before and after mitigation.

Table 1: Impact table summarising the significance of visual impacts on users of national, arterial and secondary roads in close proximity to the proposed facility.

Nature of Impact: Potential visual impact on users of national, arterial and secondary roads in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site.
- Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement.
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the PV facility as a whole, including buffer areas.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Potential visual impact on residents of farms and homesteads in close proximity to the proposed facility.

Visual impacts of the proposed facility on a few farms and homesteads on the southern bank of the river (north of the site) within 2km of the site are expected to be of **moderate** significance both before and after mitigation.

Table 2: Impact table summarising the significance of visual impacts on residents of farms and homesteads in close proximity to the proposed facility.

Nature of Impact: Potential visual impact on residents of farms and homesteads in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: • Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site. • Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement. • Retain and maintain natural vegetation in all areas outside of the development footprint. Operations: • Maintain the general appearance of the PV facility as a whole, including buffer areas. Decommissioning: • Remove infrastructure not required for the post-decommissioning use of the site. • Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications. • Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Potential visual impact on residents of built up areas in close proximity to the proposed facility.

Visual impacts of the proposed facility on the small built up area of Taaipit, located within 2km of the site are expected to be of **moderate** significance both before and after mitigation.

Table 3: Impact table summarising the significance of visual impacts on residents of built up areas in close proximity to the proposed facility.

Nature of Impact: Potential visual impact on residents of built up areas in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site.
- Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement.
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the PV facility as a whole, including buffer areas.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Potential visual impact on sensitive visual receptors (users of roads and residents of farms and homesteads) within the region

The visual impact (beyond the 2km radius) on the N14, R359 and the secondary road to the north of the site is expected to be of **moderate** significance and may be mitigated to **low.**

A limited number of farms and homesteads within the river valley north of the site will be similarly impacted upon.

Table 4: Impact table summarising the significance of visual impacts on sensitive visual receptors within the region.

Nature of Impact: Potential visual impact on sensitive visual receptors within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(39)**	Low **(26)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: • Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site. • Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement. • Retain and maintain natural vegetation in all areas outside of the development footprint. Operations: • Maintain the general appearance of the PV facility as a whole, including buffer areas. Decommissioning: • Remove infrastructure not required for the post-decommissioning use of the site. • Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications. • Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Potential visual impact on residents of urban areas within the region.

Potential visual impacts of the proposed facility on the urban areas of Lutzville and Cillie (beyond the 2km radius) are expected to be of **low** significance both before and after mitigation.

Table 5: Impact table summarising the significance of visual impacts on residents of urban areas within the region.

Nature of Impact: Potential visual impact on residents of urban areas within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site.
- Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement.
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the PV facility as a whole, including buffer areas.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

5.7.2 Ancillary infrastructure

Potential visual impact of internal access roads on observers in close proximity to the proposed facility.

Within the facility's footprint, access roads will be required for both construction and operation of the proposed PV facility. Internal access roads have the potential of manifesting as a network of landscape scarring, and may thus represent a potential visual impact within the viewshed area.

No dedicated viewshed has been generated for the access roads, but as they have no vertical dimension, it is not likely that they will be highly visible. The VAC of the vegetation will also contribute to the reduction of anticipated magnitude and of the probability of this impact occurring.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **low** significance, both before and after mitigation.

Table 6: Impact table summarising the significance of visual impact of the internal access roads on observers in close proximity to the proposed facility.

Nature of Impact: Potential visual impact of the internal access roads on observers in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(28)**	Low **(14)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: • Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site. • Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement. • Retain and maintain natural vegetation in all areas outside of the development footprint. • Layout and construction of roads with due cognisance of the existing vegetation. Construction: • Rehabilitation of construction roads. Operation: • Maintenance of roads to avoid erosion and suppress dust. Decommissioning: • Rip and rehabilitate roads not required for post decommissioning use. Consult an ecologist regarding appropriate species. • Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of access roads will contribute to the cumulative visual impact of road infrastructure within the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the access roads and denuded areas are rehabilitated. Failing this, the visual impact will remain.		

5.7.3. Lighting Impacts

Potential visual impact of lighting at night on observers in close proximity to the proposed facility.

The area surrounding the proposed facility has a relatively low incidence of receptors, being mainly agricultural and rural in nature. In this respect, light trespass and glare from the security lighting for the PV facility infrastructure is likely to impact on residents in the area, especially those orientated towards the proposed PV facility, and in close proximity.

Another potential lighting impact is that known as sky glow, which is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust, or smog. The sky glow intensifies with the increase in light sources.

The anticipated impact of lighting in close proximity to the proposed facility is likely to be of **moderate** significance, and may be mitigated to **low**.

Table 7: Impact table summarising the significance of visual impact of lighting at night on observers in close proximity to the proposed facility.

Nature of Impact: Potential visual impact of lighting at night on observers in close proximity to the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: <u>Planning & operation</u>: • Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); • Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; • Making use of minimum lumen or wattage in fixtures; • Making use of down-lighters, or shielded fixtures; • Making use of Low Pressure Sodium lighting or other types of low impact lighting. • Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Cumulative impacts: The construction of the PV facility and ancillary infrastructure will increase the cumulative visual impact of lighting at night within the region. This is relevant in light of the populated places of Lutzburg, Cillie and Kakamas as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7.4. Construction Impacts

Potential visual impact of construction on visual receptors in close proximity to the proposed facility.

During the construction period, there will be a noticeable increase in heavy vehicles utilising the roads to the development site. This may cause, at the very least, a visual nuisance to other road users and land owners in the area.

Dust from construction work could also result in potential visual impact. This anticipated impact is likely to be of **moderate** significance, and may be mitigated to **low**.

Table 8: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed facility.

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Very short term **(1)**	Very short term **(1)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site.
- Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement.
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Construction:

- Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources.
- Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.

Cumulative impacts:
None.

Residual impacts:
None.

5.8 Visual Impact Assessment: Secondary Impacts

5.8.1 The PV facility

Potential visual impact on the visual character of the landscape and sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The most noteworthy aspect contributing to the sense of place of this region is dramatic contrast between the arid shrubland and the lush vineyards growing on the edge of the Orange River.

The visual landscape is one of wide-open spaces and little development, with the parallel dune hills and the Orange / Gariep River belt representing the most visually apparent natural features. Farming along the river lends a rural and agricultural flavour to the visual environment. Beyond the farming belt, however, development is sparse and very small in scale and the landscape character is one of undeveloped wide open space.

The anticipated visual impact of the PV facility on the visual character of the landscape, and by implication, on the sense of place, is expected to be of **low** significance before and after mitigation.

Table 9: Impact table summarising the significance of visual impacts on the visual character of the landscape and sense of place of the region.

Nature of Impact: Potential visual impact of the proposed facility on visual character of the landscape and sense of place of the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	**Low (26)**	**Low (13)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site.
- Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement.
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the PV facility as a whole, including buffer areas.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.

Residual impacts:

The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Potential visual impact on tourist routes and tourist destinations within the region.

The study area is located within the Orange River region, which is a known tourist area. The N14 is an important tourist access routes on a national level, and within the region, it functions as part of the wine route meander.

It is expected that tourist accommodation and amenities are to be found within the town of Kakamas, the smaller urban centres, some of the farms and homesteads along the river valley and to a lesser extent within the natural, undeveloped area beyond. The visual impact on tourist access routes and tourist destinations within the region is likely to be of **low** significance both before and after mitigation.

Table 10: Impact table summarising the significance of visual impacts on tourist routes and tourist destinations within the region.

Nature of Impact: Potential visual impact of the proposed facility on tourist routes and tourist destinations within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	**Low (26)**	**Low (13)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	Yes	
Mitigation: Planning: • Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site. • Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement. • Retain and maintain natural vegetation in all areas outside of the development footprint. Operations: • Maintain the general appearance of the PV facility as a whole, including buffer areas. Decommissioning: • Remove infrastructure not required for the post-decommissioning use of the site. • Rehabilitate all roads and cleared areas. Consult an ecologist regarding rehabilitation specifications. • Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the PV facility will increase the cumulative visual impact of electrical infrastructure within the region. This is relevant in light of the major distribution power lines and Taaipit Substation near to the site as well as the approved Kakamas 1 PV facility to the immediate north of the site. Other solar facilities are also proposed in the area, but have not yet been approved.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

5.9 The potential to mitigate visual impacts

The appearance and size of the PV panels (with an approximate height of 4m) cannot be altered, therefore visual impact is difficult to mitigate in this environment. The following mitigation is, however possible:

- In terms of screening, a 100m buffer of intact natural vegetation may be retained along the perimeter of the development site.

  Of relevance is that the PV panel blocks will remain visible within this landscape. However, with a buffer in place the visual prominence of the PV facility will be softened.

- This buffer may be supplemented with additional vegetation to increase visual absorption capacity. An ecologist should be consulted with respect to appropriate species and placement.

- It is also recommended that natural vegetation be maintained in all areas outside of the actual development footprint.

- In terms of ancillary infrastructure, the access roads may be planned so that the unnecessary clearing of vegetation is avoided. This implies consolidating infrastructure as much as possible and making use of already disturbed areas rather than pristine sites wherever possible.

- Possible mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the PV facility. The correct specification and placement of lighting and light fixtures for the PV facility and the ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

    - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of minimum lumen or wattage in fixtures;
    - Making use of down-lighters, or shielded fixtures;
    - Making use of Low Pressure Sodium lighting or other types of low impact lighting.
    - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

    - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    - Reduce the construction period through careful logistical planning and productive implementation of resources.
    - Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.

- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the PV panels, the internal roads, the power line servitude and ancillary buildings and infrastructure will ensure that the PV facility does not degrade visually, thus aggravating visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- Once the PV facility has exhausted its life span, the main facility and all roads and infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

Good practice requires that the mitigation as listed above be executed fully and comprehensively, and maintained on an ongoing basis.

6. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the Proposed Kakamas 2 PV Solar Energy Facility and its associated infrastructure will have a limited impact on the visual environment, especially within 2 km of the proposed PV facility.

The PV facility has an advantage over other more conventional power generating facilities (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

The facility further has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants. The advantage being that the facility can become an attraction or a landmark within the region, that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

Of relevance to visual impact is that the PV facility is likely to be visible to a number of sensitive visual receptors in close proximity to the proposed facility and within the region. These include users of the N14 and R359, residents of Taaipit, Cillie and Lutzburg as well as residents of farms and homesteads within the river valley to the north.

In addition, the area potentially affected by the proposed development is a known tourist area. Attractions include the scenic river, ecotourism (such as hiking, 4x4 and canoeing), adventure tourism, cultural historic sites and South Africa's largest wine producing region. In addition, the N14 is an important tourist access route on a national level. Within the region, it functions as part of the wine route meander.

Lastly, both the agricultural zone along the river and the undeveloped landscape beyond are considered to have a high visual quality. In addition, the dramatic contrast between the arid shrubland and the lush vineyards growing on the edge of the Orange River lends a unique visual quality and sense of place to the region.

A number of mitigation measures have been proposed (section 5.9), which, if implemented and maintained, will reduce the significance of many of the potential visual impacts associated with the proposed PV facility.

If mitigation is undertaken as recommended, it is concluded that the significance of anticipated visual impacts may be reduced to acceptable levels. As such, the PV facility would then be considered to be acceptable from a visual perspective.

7. IMPACT STATEMENT

The finding of the Visual Impact Assessment undertaken for the Proposed Kakamas 2 PV Solar Energy Facility is that the visual environment surrounding the site, especially within a 2 km radius, will be visually impacted upon for the anticipated operational lifespan of the PV facility (i.e. 20 - 30 years).

The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

- The potential visual impact of the PV facility on users of main and secondary roads in close proximity to the proposed PV facility will be of **moderate** significance.

- Similarly, the potential visual impact of the PV facility on residents of farms and homesteads in close proximity to the proposed PV facility will be of **moderate** significance, as will that on residents of built up areas.

- Within the greater region, the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of farms and homesteads) will be of **low** significance.

- Similarly, the potential visual impact on residents of built up areas within the region will be of **low** significance.

- In terms of ancillary infrastructure, the anticipated visual impact of the access roads on observers in close proximity to the proposed PV facility will be of **low** significance.

- Visual impacts related to lighting will be of **low** significance, as will that of construction.

- Lastly, the secondary visual impact of the proposed PV facility on tourist routes and destinations within the region will be of **low** significance, as will the anticipated visual impact on the visual character of the landscape and on the sense of place of the region.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from moderate to low significance, although none are considered to be fatal flaws for the proposed PV facility. The primary considerations in this regard include the relatively contained extent of potential visual impact and the relatively low occurrence of sensitive visual receptors within a 2 km radius.

Considering all factors, it is recommended that the development of the PV facility as proposed be supported, subject to the implementation of the recommended mitigation measures (Chapter 5.9) and Management Programme (Chapter 8).

8. ENVIRONMENTAL MANAGEMENT PROGRAMME

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts.

Table 11: Management plan – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Kakamas 2 PV facility.		
Project Component/s	PV facility and ancillary infrastructure.	
Potential Impact	Primary visual impact of the PV facility due to the presence of the PV panels and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 2 km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
o Retain a buffer (approximately 100m wide) of intact natural vegetation along the perimeter of the development site. o Supplement buffer with additional vegetation to increase visual absorption capacity. Consult an ecologist with respect to appropriate species and placement. o Retain and maintain natural vegetation in all areas outside of the development footprint.	INCA / design consultant	Early in the planning phase.
o Plan the access roads in such a way that does not require unnecessary clearing of vegetation. o Make use of already disturbed sites rather than pristine areas wherever possible.	INCA / design consultant	Early in the planning phase.
Design and plan lighting to ensure the correct specification and placement of lighting and light fixtures for the PV facility and the ancillary infrastructure: o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights; o Make use of minimum lumen or wattage in fixtures; o Make use of down-lighters or shielded fixtures; o Make use of Low Pressure Sodium lighting or other types of low impact lighting. o Make use of motion detectors on security lighting.	INCA / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure of PV panels and lighting at night to observers on or near the site (i.e. within 2km) and within the region.	
Monitoring	Not applicable.	

Table 12: Management plan – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Kakamas 2 PV facility.		
Project Component/s	Construction site	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 2 km of the site).	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
o Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	INCA / contractor	Early in the construction phase.
o Reduce the construction period through careful logistical planning and productive implementation of resources.	INCA / contractor	Early in the construction phase.
o Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	INCA / contractor	Early in and throughout the construction phase.
o Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	INCA / contractor	Throughout the construction phase.
o Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	INCA / contractor	Throughout the construction phase.
o Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	INCA / contractor	Throughout the construction phase.
o Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	INCA / contractor	Throughout the construction phase.
o Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.	INCA / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 13: Management plan – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Kakamas 2 PV facility.		
Project Component/s	PV facility and ancillary infrastructure.	
Potential Impact	Visual impact of PV facility degradation and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 2 km of the site).	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
o Maintain the general appearance of the facility as a whole, including the PV panels.	INCA / operator	Throughout the operational phase.
o Maintain roads to forego erosion and to suppress dust.	INCA / operator	Throughout the operational phase.
o Monitor rehabilitated areas, and implement remedial action as and when required.	INCA / operator	Throughout the operational phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the PV facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 14: Management Programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Kakamas 2 PV facility.		
Project Component/s	PV facility and ancillary infrastructure.	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 2 km of the site).	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
o Remove infrastructure not required for the post-decommissioning use of the site. o Rehabilitate all areas. An ecologist should be consulted to assist or give input into specifications.	INCA / operator	During the decommissioning phase.
o Rehabilitate access roads not required for the post-decommissioning use of the site. An ecologist should be consulted to assist or give input into specifications.	INCA / operator	During the decommissioning phase.
o Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	INCA / operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

9. REFERENCES/DATA SOURCES

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