PROPOSED BRQ SOUTH AFRICA NAMAQUA PV SOLAR ENERGY FACILITY

Near Kamieskroon in the Northern Cape Province

VISUAL IMPACT ASSESSMENT

AS PART OF A BASIC ASSESSMENT PROCESS

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- May 2012 -

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

MetroGIS (Pty) Ltd, specialising in visual impact assessments and Geographic Information Systems, undertook this visual assessment.

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 impact 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 (i.e. in the Northern Cape province).

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Namaqua BRQ PV Solar Energy Facility in the Northern Cape. Neither the author nor MetroGIS will benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

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 of the project 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:

Table 1: Level of Confidence

	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 ***6*** *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 **2** and
- The information available, understanding of the project 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 facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Chief Directorate National Geo-Spatial Information.

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 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 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 SEF and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed SEF 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 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 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 facility**

  In order to refine the visual exposure of the proposed 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 SEF.

  Proximity radii for the proposed development site are created in order to indicate the scale and viewing distance of the 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 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 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 SEF 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.

2. BACKGROUND

BRQ South Africa (Pty) Ltd is proposing the establishment of a Photovoltaic Solar Energy Facility (SEF) on a site about 27km south of Springbok and 33km north of Kamieskroon within the Nama Khoi Local Municipality in the Northern Cape Province.

Solar energy generation is generally considered to be an environmentally friendly electricity generation option. The company intends to utilise photovoltaic (PV) technology to construct an alternative energy generation facility with a total generating capacity of up to 20MW.

The proposed PV Solar Energy Facility will consist of a photovoltaic (PV) solar energy component as well as associated infrastructure. A formal layout of the SEF has not yet been finalised, but infrastructure is likely to include the following:

- An array of PV panels;
- An on-site switching station;
- An overhead power line feeding into the Eskom electricity network;
- Internal access roads and
- A workshop area for maintenance and storage.

3. SCOPE OF WORK

The study area for the visual assessment encompasses a geographical area of 12x9 km (the extent of the maps displayed below) and includes a minimum 4km buffer zone from the boundaries of the proposed development area.

The project is proposed to be located on the Farms Mesklip 14/259 and Mesklip 23/259, comprising an area of approximately 183ha (the development site indicated on the maps).

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.

Anticipated issues related to the proposed facility include:

- The visibility of the facility to, and potential visual impact on, observers travelling along main and secondary roads within the study area, specifically the N7 national road.
- The visibility of the facility to, and potential visual impact on homesteads and settlements within the study area.
- The potential visual impact of the facility on the visual character of the landscape, sense of place and tourism potential of the region.
- The potential visual impact of ancillary infrastructure (i.e. switching station, power line, access roads and workshop) on observers in close proximity to the proposed facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

4. THE AFFECTED ENVIRONMENT

Regionally, the site is located approximately 27km (straight line measurement) south of Springbok in the Northern Cape Province.

The study area is situated on land that ranges in elevation from about 480m a.s.l. along the valley bottom in the south west of the study area, to 920m a.s.l. in the north west.

The dominant topographical unit or terrain type of the study area is *low mountains* of the Namaqualand Highlands. The proposed development site is nestled in a valley encapsulated by low mountains and hills at an average elevation of 580m above sea level. The terrain immediately surrounding the site is generally flat, but becomes elevated and severely undulating in all directions beyond the site boundaries (refer to **Map 1**).

The most significant hydrological feature within the study area is the Buffels River. This river and a number of other stream beds occurring throughout the study area, are all non-perennial water courses that only experience inundation for short periods of time during seasonal downpours. The region is generally considered to be arid with a low rainfall of less than 300mm per annum.

The study area is considered to be natural with no large scale developments or infrastructure. The broad land use is sheep farming with a limited number of homesteads (only two) occurring within the study area. The average population density within the local municipality (Nama Khoi Local Municipality) is roughly 1 person per square km[2], with the highest concentrations located within the towns of Springbok (2001 population 12,294) and Kamieskroon (less than 1,000).

The N7 national road traverses a section of the study area in the south west at a distance of 4km from the proposed development site at the closest. This route is frequented by tourists travelling between Cape Town and Namibia, and is extensively utilised during the famous Namaqualand flowering season during spring. The Goegab Nature Reserve (not shown on the maps), located east of Springbok, is described as one of best places to experience the transformation of

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[2]http://en.wikipedia.org/wiki/Springbok,_Northern_Cape

the predominant dry *shrubland* land cover types into fields of blossoming desert flowers. Other roads within the region include the secondary road between Kamieskroon and Springbok (traversing about 2km east of the proposed site) and a number of farm access roads, including the Burkes Pass road that cross over the proposed PV site.

Apart from roads in the area, existing infrastructure includes an Eskom 22kV distribution power line, which traverses alongside the Burkes Pass road where it enters the mountainous terrain. Other than the roads, scattered homesteads and this power line, the study area is generally considered to be in a natural state.

As previously mentioned the land cover types within the study area is relatively homogeneous for this region and consist primarily of *Shrubland*, identified as *Namaqualand Blomveld* (flower veld) along the valley floor, and *Namaqualand Klipkoppe* (stone hills) *Shrubland* within the elevated hills and low mountains. No cultivated agricultural activities occur within the study area.

The character of the landscape is one of undeveloped, wide open spaces. The visual quality of the landscape is considered to be high and the sense of place defined by an absence of development and vast Namaqualand semi-dessert.

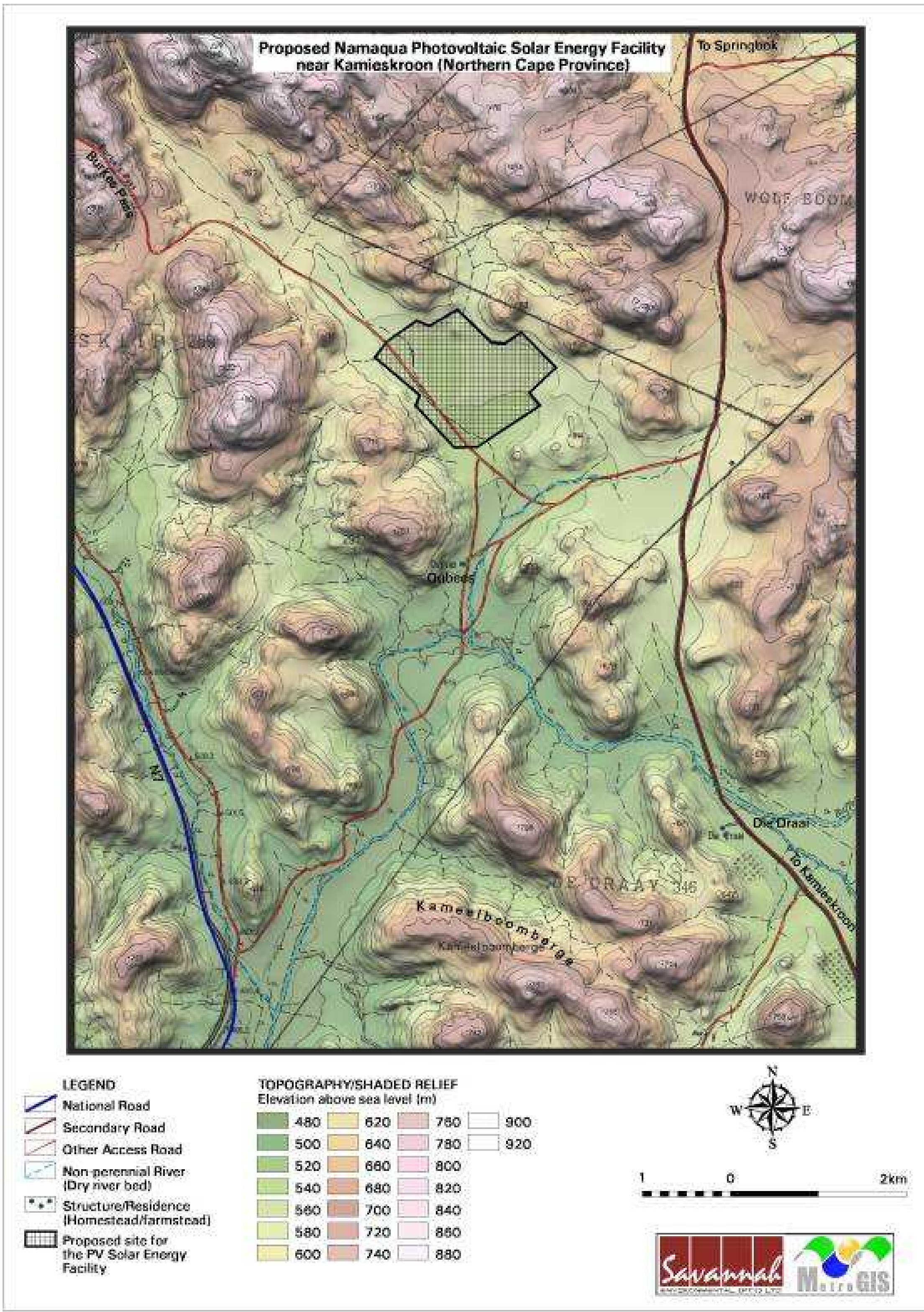
Figure 1: View from the site to the north.

Note the virtual absence of vegetation in the foreground and low growth form of the vegetation in the background.

Figure 2: View from the site to the south.

Figure 3: View from the site to the west.

Figure 4: View from the site to the east.



Map 1: Locality, topography and shaded relief of the broader study area.

RESULTS

5.1. Potential visual exposure

The result of the preliminary viewshed analyses for the proposed SEF is shown on the map overleaf (**Map 2**). The initial viewshed analysis was undertaken at offsets of 2m above average ground level (i.e. the approximate maximum height of the PV structures).

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

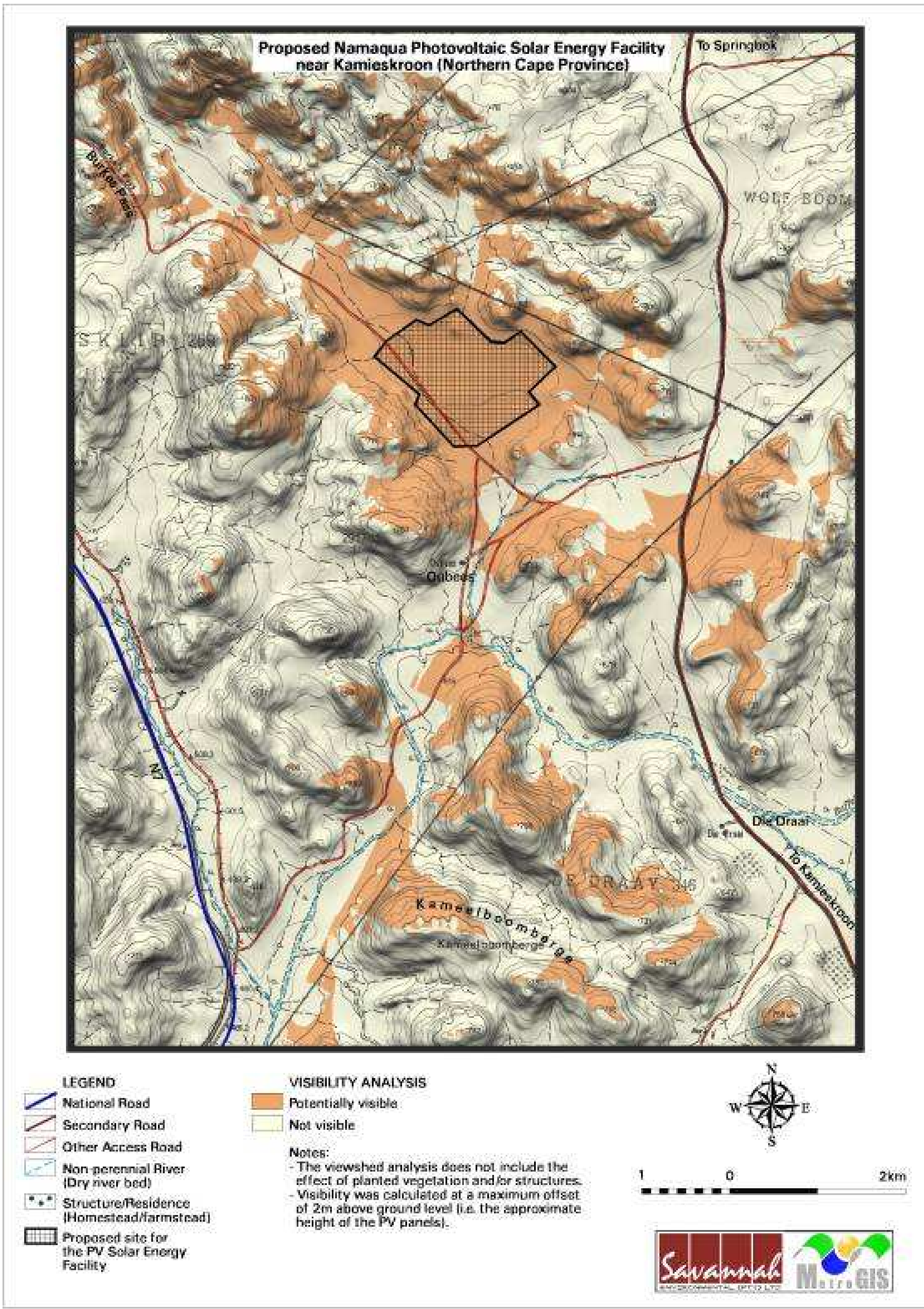
It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed SEF, therefore signifying a worst-case scenario. The viewshed analysis was based on a provisional zone identified for the development of the PV structures on site.

The proposed facility has a very contained core area of potential visual exposure. This is due to the location of the site in a valley surrounded by hills and mountains. The visual exposure of the proposed PV plant beyond this valley immediately becomes scattered and restricted to higher lying terrain and hills, due to the undulating nature of the topography.

The proposed facility is expected to be visible from the Kamieskroon-Springbok secondary road for a short section (approximately 1km). It will similarly be exposed to sections of other farm access roads at various intervals and at varying distances. The Burkes Pass road (traversing the site) is expected to afford observers, travelling along this road, with the best short range views of the PV plant. The proposed facility will not be visible from the N7 national road.

Neither of two identified homesteads/farmsteads (*Oubees* and *Die Draai*) is expected to be exposed to the facility.

It is envisaged that the proposed facility would be visible to observers travelling along the roads mentioned above, within (but not restricted to) a 4km radius of the proposed facility.



Map 2: Potential visual exposure of the proposed facility.

Note that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed SEF, therefore signifying a worst-case scenario

5.2. Visual absorption capacity

Land cover within the study area consists virtually exclusively of *Shrubland,* which is described as communities dominated by low, woody, self-supporting multi-stemmed plants, branching at or near the ground, between 0.2 and 2m in height.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment and especially the area in close proximity to the proposed WEF is deemed low by virtue of the nature of the vegetation and the low occurrence of urban development. Figures 1-4 also illustrate this low VAC.

In addition, the design, appearance and colour of the PV structures means that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light / shade characteristics.

Where homesteads and settlements occur, some more significant vegetation and trees may have been planted, which would contribute to visual absorption. As this is not a consistent occurrence, however, VAC will not be taken into account for any of the homesteads or settlements, thus assuming a worst case scenario in the impact assessment.

5.3. Visual distance/ observer proximity to the 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 normal cone of vision for a stationary person, which is accepted to be 30 degrees in both the vertical and the horizontal fields. This cone of vision allows for no head or eye movement and no loss of focus of the object in question.
- The maximum horizontal extent or widest cross section of the proposed facility that an observer will be able to perceive.
- The maximum height of the tallest infrastructure.

For a solar energy facility, the horizontal extent is of most significance. Despite being made up of smaller components (i.e. the individual PV panels), a SEF 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 normal 30 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 proposed facility) are shown on **Map 3**.

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

- 4 – 8 km - Medium to longer distance view where the 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 facility would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the facility. *Please note that due to the constrained visual exposure of the facility, this zone is not applicable for this study.*

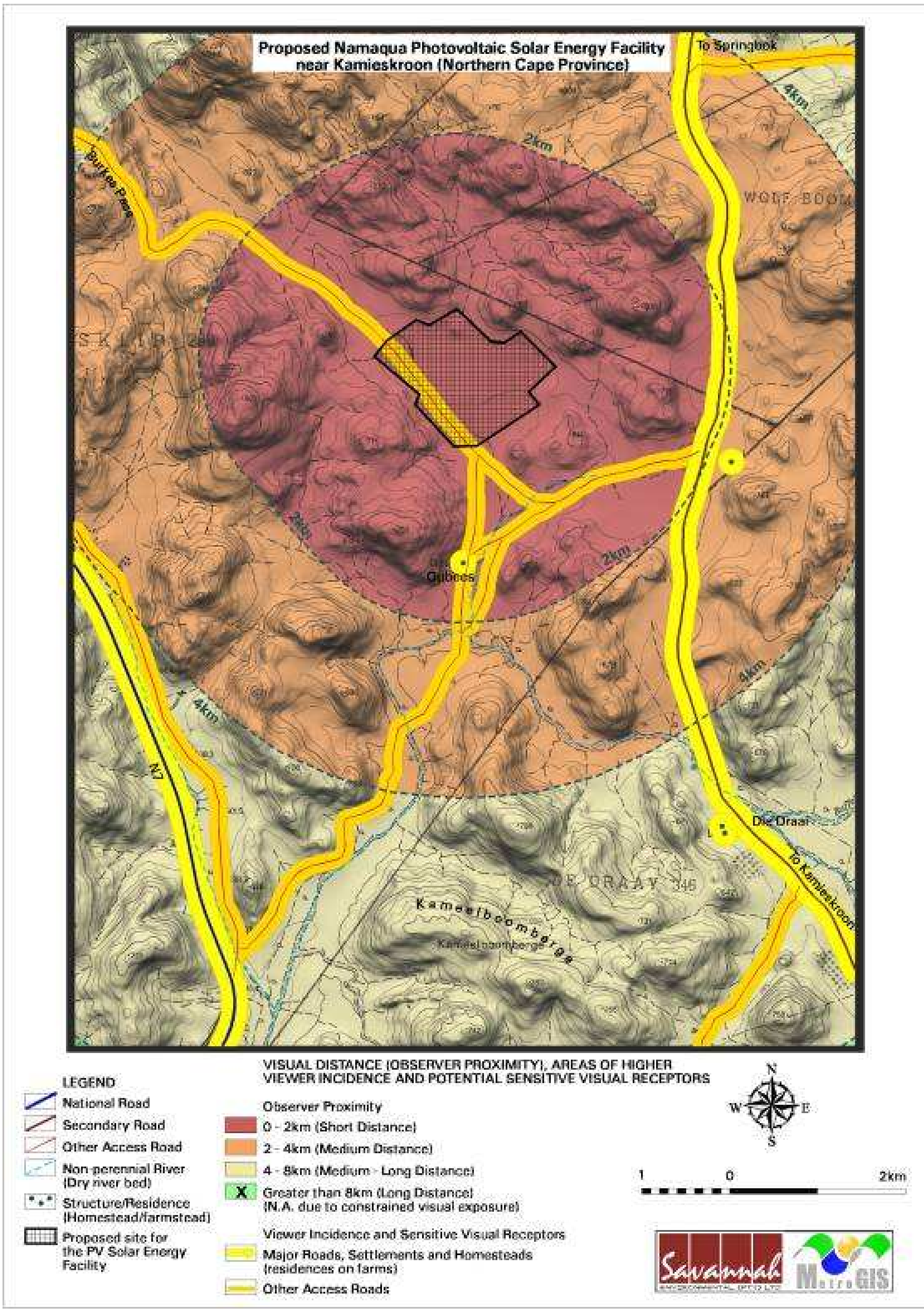
5.4. Viewer incidence / viewer perception

Refer to **Map 3**. Viewer incidence is expected to be the highest along the N7 national road (in the event that it would have been visible) and major secondary roads within the region and to a lesser degree the access roads to homesteads and other structures (e.g. wind pumps and livestock pens). Commuters using these roads could be negatively impacted upon by visual exposure to the facility, and are thus considered to be sensitive to visual intrusion.

Other areas of higher viewer incidence would include the two homesteads identified within the study area. Once again these homesteads were found to not be exposed to the proposed development, but are indicated on the map for completeness sake.

In terms of viewer sensitivity, the most vulnerable to potential visual impacts include mainstream tourists visiting and travelling through the area, primarily along the N7 national road. Daily commuters travelling along the secondary and farms access roads are also considered to sensitive receptors, but are expected to be less sensitive than tourists and visitors to the region.

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



Map 3: 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, viewer perception and visual distance of the proposed SEF site options are displayed on **Map 4**.

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 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.

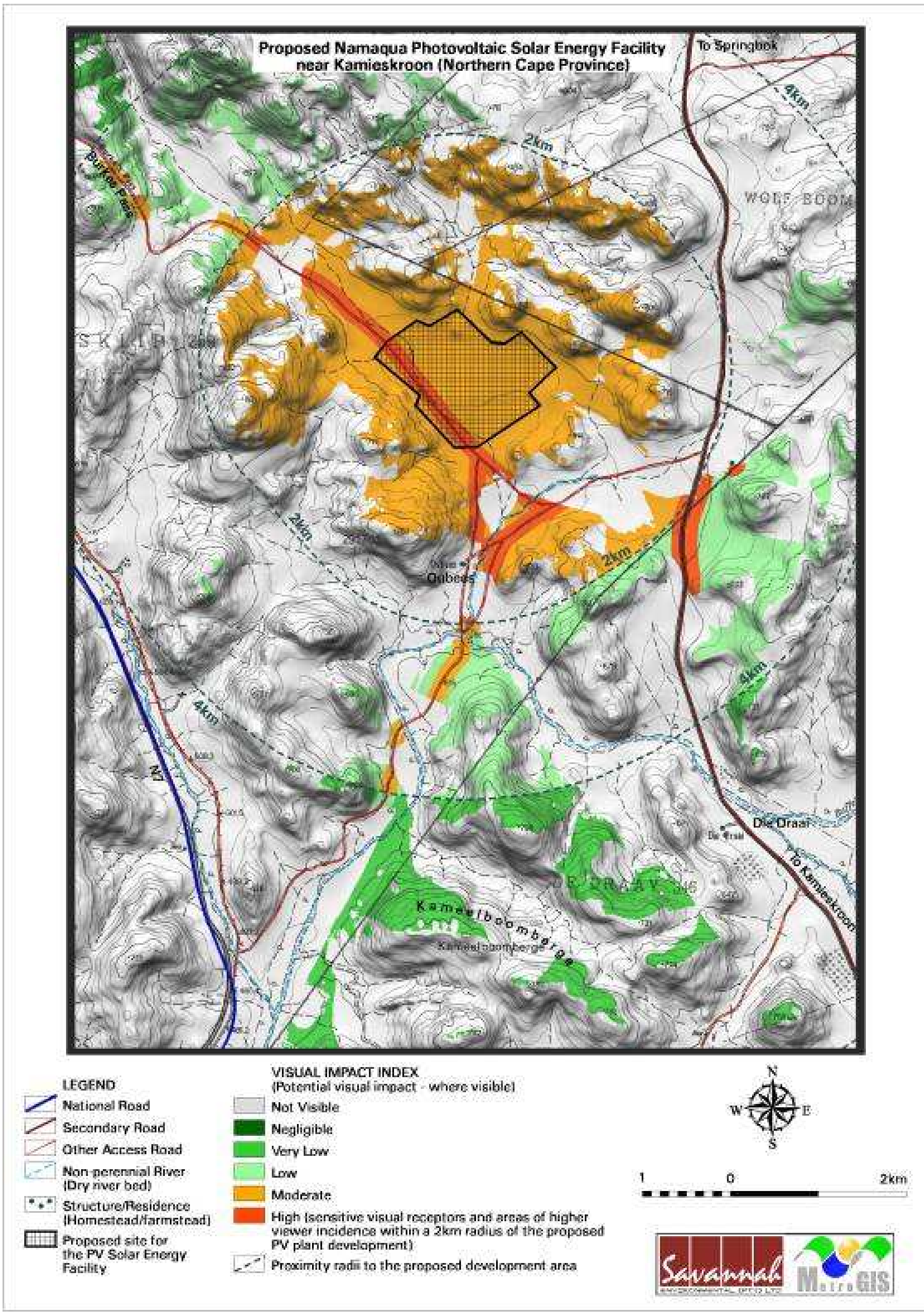
- Areas of potentially **moderate** visual impact are indicated within a 2km radius of the proposed facility, where potentially sensitive visual receptors are predominantly absent.

  Within the 2km radius, sensitive visual receptors are limited to users of the local access roads (e.g. the Burkes Pass road) which traverses the proposed development site and a section of the Kamieskroon to Springbok secondary road. These sensitive visual receptors are likely to be exposed to a potentially **high** visual impact.

- The extent of potential visual impact remains **moderate** (local access roads) to **high** (along the section of secondary road), between the 2km and 4km radius north east of the proposed development. Other visually exposed areas within this zone are likely to experience potentially **low** visual impacts, once again due to the relative absence of observers.

- Between the 4km and 8km radius, the viewshed becomes increasingly fragmented, with visual exposure greatly restricted to mountain tops and tall hills located south and north west of the site. These areas are likely to experience potentially **very low** visual impact.

- Any exposure, beyond a radius of 8km from the site is expected to be **negligible.**



Map 4: Visual impact index of the proposed 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 2: 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 SEF) 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 read off the Visual Impact Index Map. Where more than one value is applicable, then the higher of these will be used in order to simulate a worst case scenario.
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **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

Note: As discussed in section 5.2. above, this assessment does not take into account and Visual Absorption of the natural vegetation, and as such represents a worst case scenario.

5.7.1 The SEF and ancillary infrastructure

Potential visual impact on sensitive visual receptors in close proximity to the proposed SEF.

Sensitive visual receptors in close proximity to the proposed SEF (i.e. **within a 2km radius**) include observers travelling along the Kamieskroon-Springbok secondary road as well the local access roads (e.g. Burkes Pass road).

Primary infrastructure refers to the PV panels with a height of 2m, while ancillary infrastructure potentially includes the proposed on-site switching station, the workshop and a new overhead power line.

Both the primary and ancillary infrastructure could present a visual impact as these structures are built forms within a natural context. In addition, vegetation will need to be removed for these structures to be built.

The anticipated visual impact on users of roads, resulting from the proposed SEF and ancillary infrastructure is likely to be of **high** significance, but it may be mitigated to **moderate**. This result is extracted from the table below, where the value indicated as **high** (magnitude) on the visual impact index was inserted and further evaluated in terms of extent, duration and probability.

Table 2a: Impact table summarising the significance of visual impacts on users of roads in close proximity to the proposed SEF.

Nature of Impact: Potential visual impact on users of roads in close proximity to the proposed SEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
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 30-50m wide) of intact natural vegetation along the perimeter of the development site.
- Retain and maintain natural vegetation in all areas outside of the development footprint.
- Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

- Rehabilitation of all construction areas.
- Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

- Maintain the general appearance of the facility as a whole.

➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Remove infrastructure and roads not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: N.A.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

The visual exposure map indicates that the two identified homesteads located within the study area, would not be exposed to the proposed PV development.

No table is presented for this *nature of impact* (i.e. potential visual impact on residents of homesteads in close proximity to the proposed SEF) as the *magnitude* is **none**, the expected *significance* is **negligible** and the *status* ultimately **neutral**.

Potential visual impact on sensitive visual receptors within the region.

The contained visual exposure of the proposed SEF and the general absence of sensitive visual receptors within the region (i.e. **beyond the 2km radius**) dictates that this anticipated visual impact would likely be of **low** significance, both before and after mitigation.

Table 3: 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	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 30-50m wide) of intact natural vegetation along the perimeter of the development site. ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. Construction: ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Remove infrastructure and roads not required for the post-decommissioning use of the		

site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: N.A.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

5.7.2. Lighting Impacts

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

The area immediately surrounding the proposed facility has a very low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another potential lighting impact is that known as sky glow. Sky glow 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 the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow.

This anticipated impact is likely to be of **moderate** significance, and may be mitigated to **low**.

Table 4: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed SEF.

Nature of Impact: Potential visual impact on of lighting on visual receptors in close proximity of the proposed SEF.		
	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: Planning & operation: ➢ 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: There is a very limited existence of lighting impacts as a result of only two identified homestead within the study area. The development of the proposed SEF may contribute to a cumulative lighting impact within an otherwise rural/natural setting.		

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

5.7.3. Construction Impacts

Potential visual impact of construction on observers in close proximity to the proposed SEF.

During the construction period, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that 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 visual impact is likely to be of **low** significance, both before and after mitigation. The low incidence of visual receptors in close proximity to the proposed facility reduces the probability of this impact occurring.

Table 5: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed SEF.

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed SEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Very short term **(1)**	Very short term **(1)**
Magnitude	Moderate **(6)**	Moderate **(6)**
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: 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 SEF and ancillary infrastructure

Potential visual impact of the proposed facility on the visual character of the landscape, the sense of place and the tourism potential 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 character of the landscape is one of undeveloped, wide open spaces. Development, where this occurs is of a domestic scale. The visual quality of the landscape is considered to be high and the sense of place defined by an absence of development within the expansive Namaqua-land.

The nature of the impact is again that of an expansive built form within a natural context. In addition, vegetation will need to be removed for these structures to be built. It is this very same vegetation that, for most part of the year appears to be dry and dull shrubland, transforms the Namaqualand into the flowering wonderland that has made the region famous both locally and internationally.

The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place and tourism potential, is expected to be of **moderate** significance, both before and after mitigation. The small scale of the proposed facility serves as potential mitigation of this impact and the limited occurrence of sensitive visual receptors for most part of the year reduces the probability somewhat. This specific location is also not recognised as an end destination for tourists visiting the region and is not visible from the main tourist route (N7) to Springbok or the Goegab Nature Reserve. This statement is applicable to most of the mainstream tourists visiting the region, but it may not apply to some of the more adventurous visitors that prefer to "stay of the beaten track" (i.e. travel along the secondary road between Kamieskroon and Springbok or travel down the Burkes Pass road).

Table 6: Impact table summarising the significance of visual impacts on the visual character of the landscape, sense of place and tourism potential of the region.

Nature of Impact: Potential visual impact on the visual character of the landscape, sense of place and tourism potential of the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(45)**
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 30-50m wide) of intact natural vegetation along the perimeter of the development site. ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. Construction: ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Remove infrastructure and roads not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: N.A.
Residual impacts: The visual impact will be removed after decommissioning, provided the 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 2m) is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

Secondary impacts anticipated as a result of the proposed facility (i.e. visual character, sense of place, tourism value and tourism potential) are also not possible to mitigate.

The following mitigation is, however possible:

- Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of the development site.

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. This measure will help to soften the appearance of the facility within its context.

- In terms of ancillary infrastructure, it is recommended that the access road, power line and ancillary infrastructure be planned in such a way and in such a location that clearing of vegetation is minimised. This implies consolidating infrastructure as much as possible and making use of already disturbed areas rather than pristine sites wherever possible.

- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for the SEF 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, entails proper planning, management and rehabilitation of the construction site and all disturbed areas. 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 and all ancillary structures and infrastructure will ensure that the facility does not degrade, 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 SEF has exhausted its life span, the main facility and all associated 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 of both primary and secondary visual impacts as listed above be implemented and maintained on an ongoing basis.

6. IMPACT STATEMENT

The finding of the Visual Impact Assessment undertaken for the proposed Namaqua PV Solar Energy Facility is that the visual environment surrounding the site will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years). Potential visual impacts will be concentrated within 2km of the proposed facility, although the extent of visual impact may not be limited to this zone.

The proposed facility would be visible within an area that incorporates certain sensitive visual receptors. These include users of secondary roads and local access roads.

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

- The potential visual impact of the facility and ancillary infrastructure on users of roads in close proximity to the proposed facility (within a 2km radius) will be of **moderate** significance.

- The potential visual impact of the facility and ancillary infrastructure on residents of homesteads in close proximity to the proposed facility (within a 2km radius) will be **negligible**.

- The potential visual impact on sensitive visual receptors within the region will be **low**.

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

- Lastly, the anticipated impact on the visual character of the landscape and the sense of place of the region will be of **moderate** significance.

It must also be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed SEF, therefore signifying a worst-case scenario.

The anticipated visual impacts listed above (i.e. post mitigation impacts) are moderate and low, and none are considered to be fatal flaws from a visual perspective. The main considerations in this regard are the small size of the proposed facility, the relatively contained viewshed and extent of visual exposure and the very low occurrence of potentially sensitive visual receptors.

It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (Chapter 5.9) and management plan (Chapter 7).

7. 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 7: Management Programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Namaqua SEF.	
Project	SEF and ancillary infrastructure (i.e. access road, power lines, switching

Component/s	station and workshop).		
Potential Impact	Primary visual impact of the 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**
Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of the development site. This buffer may be within or behind the security fence.		BRQ SA (Pty) Ltd / design consultant	Early in the planning phase.
Retain and maintain natural vegetation in all areas outside of the development footprint.		BRQ SA (Pty) Ltd / design consultant	Early in the planning phase.
Plan the ancillary buildings in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than pristine areas.		BRQ SA (Pty) Ltd / design consultant	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the facility and the ancillary infrastructure. The following is recommended: o Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; o Making use of minimum lumen or wattage in fixtures; o Making use of down-lighters, or shielded fixtures; o Making use of Low Pressure Sodium lighting or other types of low impact lighting. o 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.		BRQ SA (Pty) Ltd / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure of PV panels, ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 2km) and within the region.		
Monitoring	Not applicable.		

Table 8: Management Programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Namaqua SEF.	
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**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.		BRQ SA (Pty) Ltd / contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.		BRQ SA (Pty) Ltd / contractor	Early in the construction phase.
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.		BRQ SA (Pty) Ltd / contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.		BRQ SA (Pty) Ltd / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.		BRQ SA (Pty) Ltd / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).		BRQ SA (Pty) Ltd / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.		BRQ SA (Pty) Ltd / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. Consult an ecologist to give input into rehabilitation specifications.		BRQ SA (Pty) Ltd / 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 9: Management Programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Namaqua SEF.			
Project Component/s	SEF and ancillary infrastructure (i.e. access road, power lines, switching station and workshop).		
Potential Impact	Visual impact of 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**
Maintain the general appearance of the		BRQ SA (Pty) Ltd /	Throughout the operational

facility as a whole, including the turbines the internal roads, servitudes and the ancillary buildings.	operator	phase.
Maintain roads to forego erosion and to suppress dust.	BRQ SA (Pty) Ltd / operator	Throughout the operational phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	BRQ SA (Pty) Ltd / operator	Throughout the operational phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 10: Management Programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Namaqua SEF.		
Project Component/s	SEF and ancillary infrastructure (i.e. access road, power lines, switching station and workshop).	
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**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the offices, workshop, storage areas, access roads etc.	BRQ SA (Pty) Ltd / operator	During the decommissioning phase.
Rehabilitate access roads not required for the post-decommissioning use of the site. Consult an ecologist to give input into rehabilitation specifications.	BRQ SA (Pty) Ltd / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	BRQ SA (Pty) Ltd / 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.	

8. REFERENCES/DATA SOURCES

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