PROPOSED KOTULO TSATSI ENERGY PV1, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Kotulo Tsatsi Energy (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
1st Floor, Block 2, 5 Woodlands Drive Office Park,
Cnr Woodlands Drive & Western Service Road
Woodmead, 2191

Produced by:

Lourens du Plessis (GPr GISc) t/a LOGIS
PO Box 384, La Montagne, 0184
M: 082 922 9019 E: lourens@logis.co.za
W: logis.co.za

- March 2021 -

TABLE OF CONTENTS

FIGURES

MAPS

TABLES

1. STUDY APPROACH

1.1. Qualification and experience of the practitioner

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT Atlas and has had several of his maps published in various tourism, educational and environmental publications.

He 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.

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Kotulo Tsatsi Energy PV1. He will not 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:

---

[1] Adapted from Oberholzer (2005).

- 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 study area and experience of this type of project by the practitioner:

  - 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 **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 Geographical 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 topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

Visual Impact Assessment (VIA)

The VIA is determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the solar energy facility layout.

The visual impact is determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) are not considered.

The VIA considers potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region.

The following VIA-specific tasks were undertaken:

- **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 (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **Determine visual distance/observer proximity to the facility**

In order to refine the visual exposure of the 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 this type of structure.

Proximity radii for the proposed infrastructure 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 (anticipated) negative visual perception of the proposed facility.

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that may be exposed to the project infrastructure.

This is done in order to focus attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, protected areas, etc.), that should be addressed.

- **Determine the visual absorption capacity (VAC) 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 discernible detail in visual characteristics of both environment and structure decreases.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software is used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section are displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in this VIA report.

- **Site visit**

A site visit was undertaken in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

2. BACKGROUND

The Applicant, **Kotulo Tsatsi Energy (Pty) Ltd,** is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Kotulo Tsatsi Energy PV1) located on a site located approximately 70km south-west of the town of Kenhardt and 60km north east of Brandvlei in the Northern Cape Province. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 200MW.

The facility will be located within Portion 3 of the Farm Styns Vley 280. The PV facility is planned to be located adjacent to the authorised 100MW Kotulo Tsatsi Energy PV2 facility, and within an area previously authorised for CSP project infrastructure. The project site[2] falls under the Hantam Local Municipality which is part of Namakwa District Municipality. The site is accessible via an existing gravel farm road (known as Soafskolk Road) which provides access to the farm from the R27 which is located east of the project site.

Figure 1: Regional locality of the proposed project area.

The PV infrastructure assessed in this application is in response to the Applicant's need to change the authorised generation technology for the facility located on the farm Portion 3 of Farm Styns Vley 280. That is, a technology change from the previously authorised CSP project infrastructure to PV project infrastructure. In this regard, the solar PV facility will be connected to the grid via a previously authorised grid connection solution[3], which consists of a collector substation,

---

[2] The project site is defined as Portion 3 of Farm Styns Vley 280, which has the extent of ~ 2560ha.

3 A CSP facility plus associated infrastructure, including a complete grid connection to Aries Substation was previously authorised on the site. This PV facility infrastructure replaces the CSP facility infrastructure, and will retain the authorised grid connection solution (including all substations and power lines) and other

switching station and a power line to the Eskom Aries Substation located north-east of the project site.

Kotulo Tsatsi Energy PV1 is planned to be bid into the Department of Mineral Resources and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply with Kotulo Tsatsi Energy PV1 set to inject up to $200MW_{AC}$ into the national grid.

A development envelope of ~847ha was defined through the Scoping evaluation of the site, and has now been assessed for the project which includes the PV infrastructure required to generate 200MW of electricity. The infrastructure to be developed within the development envelope will be known as the development footprint and will have an extent of ~810ha. The infrastructure associated with this PV development includes:

Solar PV array footprint comprising of:

- PV modules and mounting structures
- Inverters and transformers
- Integrated Energy Storage System (IESS)
- Cabling between the project components
- Internal access roads

Access roads, internal distribution roads and fencing around the development footprint.

Admin block comprising of:

- Site offices and maintenance buildings, including workshop areas for maintenance and storage
- Assembly plant
- Laydown areas

The assessment of the PV facility on the site is to support the technology change from the previously authorised CSP project infrastructure to PV project infrastructure. In this regard, the following previously authorised infrastructure will be retained for use for the planned PV facility, and the associated footprint areas of the following previously authorised infrastructure have not been reassessed in this EIA:

Complete grid connection to Aries Substation:

- Grid connection via a previously authorised grid connection solution, which consists of internal grid reticulation, a collector substation, switching substation and a power line to the Eskom Aries Substation located north-east of the project site.

Other associated infrastructure:

- Facility man camp (including on-site accommodation),
- All water reservoirs and pipelines,
- Power block and thermal storage solution.

---

associated infrastructure (including the man camp (including on-site accommodation), all water reservoirs and pipelines, the power block and thermal storage.

The Kotulo Tsatsi Energy PV1 facility will take approximately two years to construct and the operational lifespan of the facility is estimated at 20 years.

The proposed position of the facility and associated infrastructure are indicated on the maps within this report. Sample images of similar PV technology facilities are provided below.

Figure 2: Photovoltaic (PV) solar panels. (Photo: *SunPower Solar Power Plant – Prieska*).

Figure 3: Aerial view of PV arrays. (Photo: *Scatec Solar South Africa*).

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed Kotulo Tsatsi Energy PV1 facility as described above.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual impact assessment encompasses a geographical area of 796km² (the extent of the full page maps displayed in this report) and includes a minimum 6km buffer zone (area of potential visual influence) from the development footprint of the facility.

Other than a number of homesteads or farm residences and the Aries to Helios 400kV power line, there are no towns or built-up areas within the study area.

Anticipated issues related to the potential visual impact of the proposed PV facility include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the secondary roads within the study area.

- The visibility of the facility to, and visual impact on residents of homesteads within the study area.

- The potential visual impact of the facility on the visual character or sense of place of the region.

- The potential visual impact of the facility on tourist routes or tourist destinations (if present).

- The potential visual impact of the construction of ancillary infrastructure (i.e. internal access roads, buildings, etc.) on observers in close proximity to the facility.

- The visual absorption capacity of the natural vegetation (if applicable).

- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the authorised Kotulo Tsatsi PV2 facility, and the authorised CSP2 and CSP3 facilities in close proximity to the proposed development site.

- 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 impact of solar glint and glare as a visual distraction and possible air travel hazard.

- Potential visual impacts associated with the construction phase.

- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The site for the proposed PV1 facility is located about 10km west of the R27, and roughly halfway between Brandvlei and Kenhardt. These towns lie more than 65km to the south west and north east of the site respectively, and fall within the Namakwa District Municipality. Kenhardt is the largest town in the region, and lies on the Hartbees River.

The entire proposed project site is located in a rural area, currently zoned as agriculture.

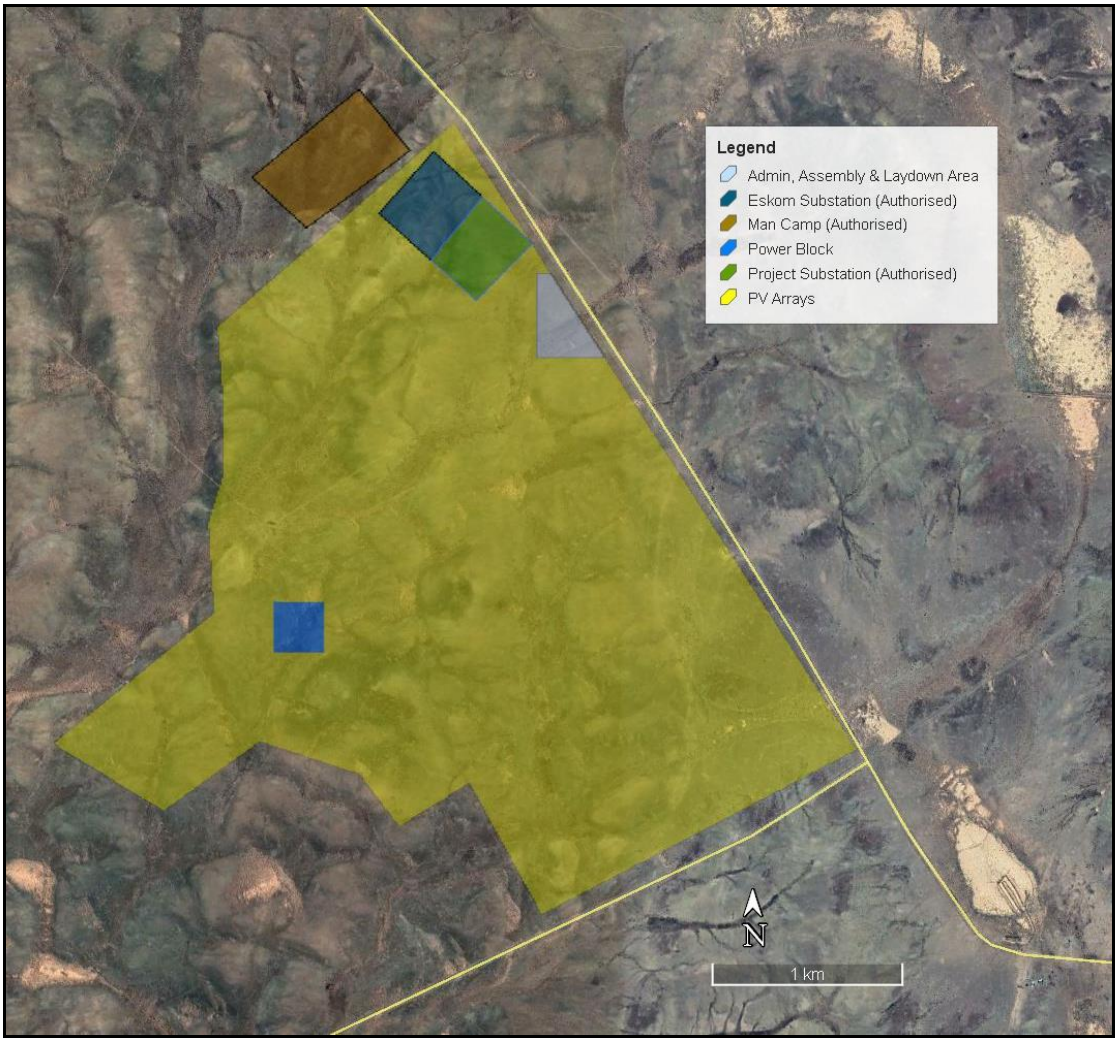


Figure 4: Aerial view of the proposed project site and associated infra-structure.

The topography of the study area is flat and homogenous, consisting of *lowlands with hills*. Elevation ranges from 870m above sea level (a.s.l.) in the south and north to 970m a.s.l. in the central study area. There are no prominent hills within the study area, but the proposed site is located on a local high lying area.

No prominent permanent drainage lines are present in the study area, but a large number of non-perennial streams and wetlands are to be found, draining from the higher lying areas to the flatter, lower lying parts of the study area. Refer to **Map 1**.

Land use within the study area is limited to grazing (sheep), and land cover consists mostly of grassland and *shrubland*. Very limited *woodland* and *thicket and shrubland* areas are present in the north and south of the study area respectively. Patches of *bare rock and soil* are also present in the centre of the study area. The study area is located within the *Nama Karoo* biome, with rainfall at 153 mm per annum. The vegetation type is classified as *Arid Karoo and Desert False Grassveld*. Refer to **Map 2**.

Figure 5: Topography of the site and surrounds.

The majority of the study area is sparsely populated (less than ten people per km2 within the Namakwa District Municipality) and consists of a landscape of wide-open expanses and extreme isolation. The scarcity of water and other natural resources has influenced settlement patterns within this region, keeping numbers low, and distribution limited to the availability of permanent water. Settlements, where they occur, are usually rural homesteads and farmsteads.

A single main road (i.e. the R27) services the study area. Other roads are secondary roads linking with one another and with the R27, giving access to the farmsteads.

Figure 6: The R27 arterial road.

Figure 7: Access road to the site.

There are no built up areas, towns or mining land uses within the study area.

Infrastructure within the study area includes the Aries/Helios 1 400kV overhead power line and a freight railway line. Both the railway line and the power line traverse the study area from the south-west to the north-east at distances of respectively 13km and 4.4km from the proposed development site.

Figure 8: Existing Aries/Helios 1 400kV overhead power line.

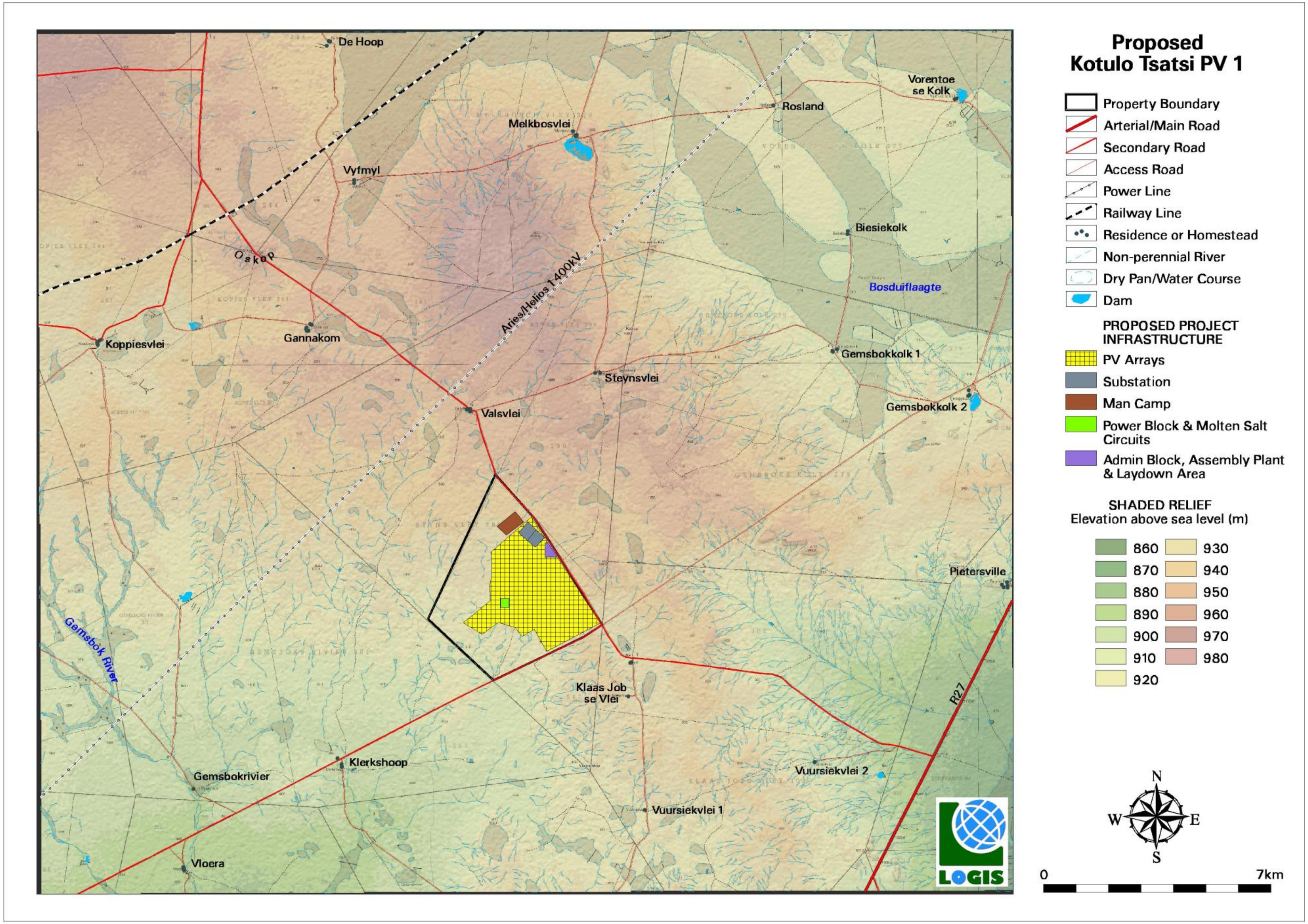
Figure 9: Freight railway line.

There are no formally protected or conservation areas or major tourist attractions or resorts present within the study area, but the pans in the area are home to large flocks of birds when they contain water. The greater environment has a largely natural and undeveloped character.

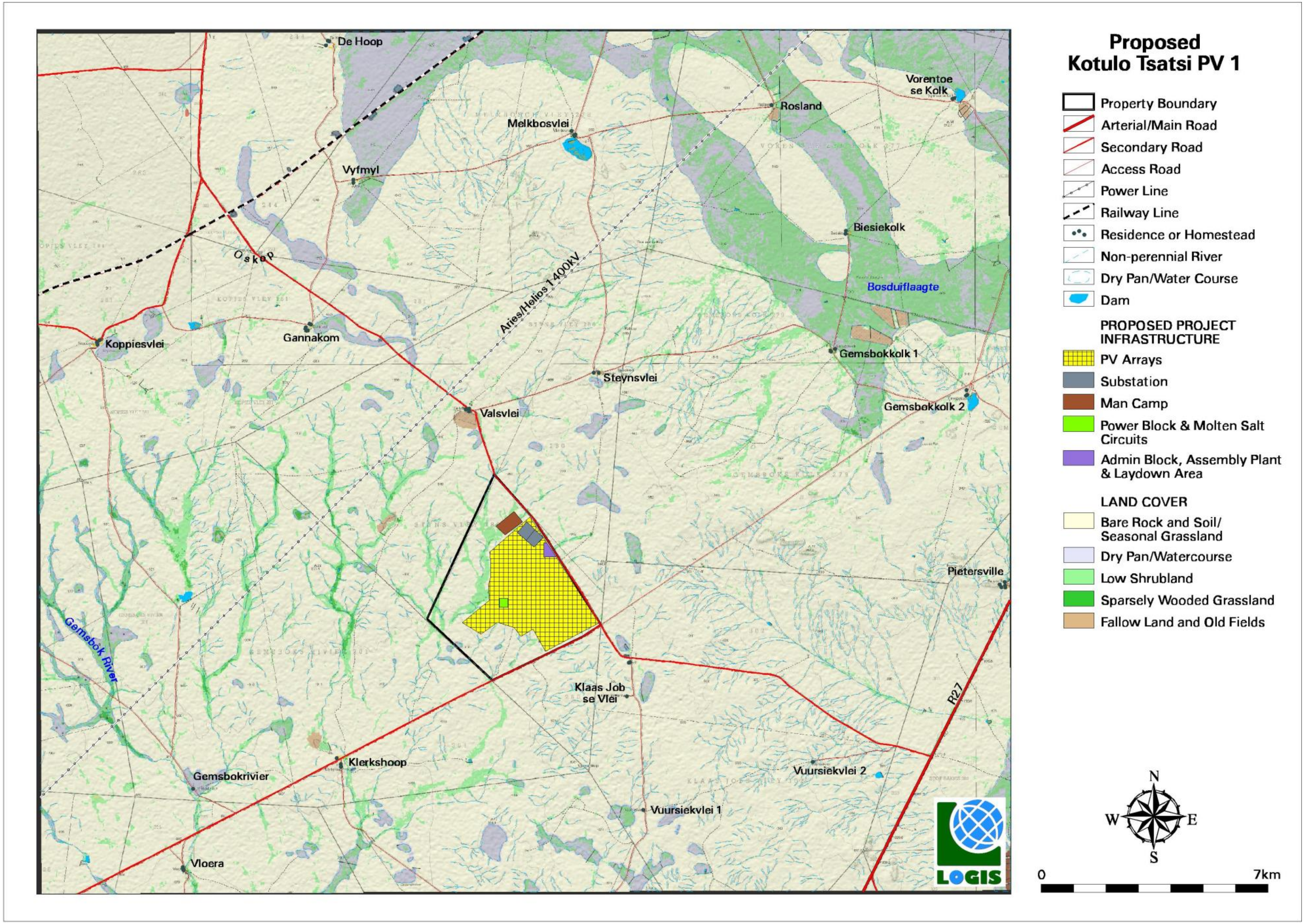
The visual quality of the receiving environment within the study areas is high, by virtue of the vast and undeveloped nature of the environment. This lends a distinct sense of place to the area, but the landscape is not unique.[4]

Figure 10: Typical example of a homestead within the study area.

[4] Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2020_Q3 and SAPAD2019-20 (DEA).



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure

The result of the viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The viewshed analysis was undertaken from 874 vantage points within the proposed development footprint at an offset of 4m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels and inverters) associated with the facility.

The viewshed analyses include the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

The development would be quite easily visible within a 1km radius of the site. This area (0 – 1km) includes sections of public roads (secondary roads) traversing south and east of the proposed development site. There are no homesteads within this zone.

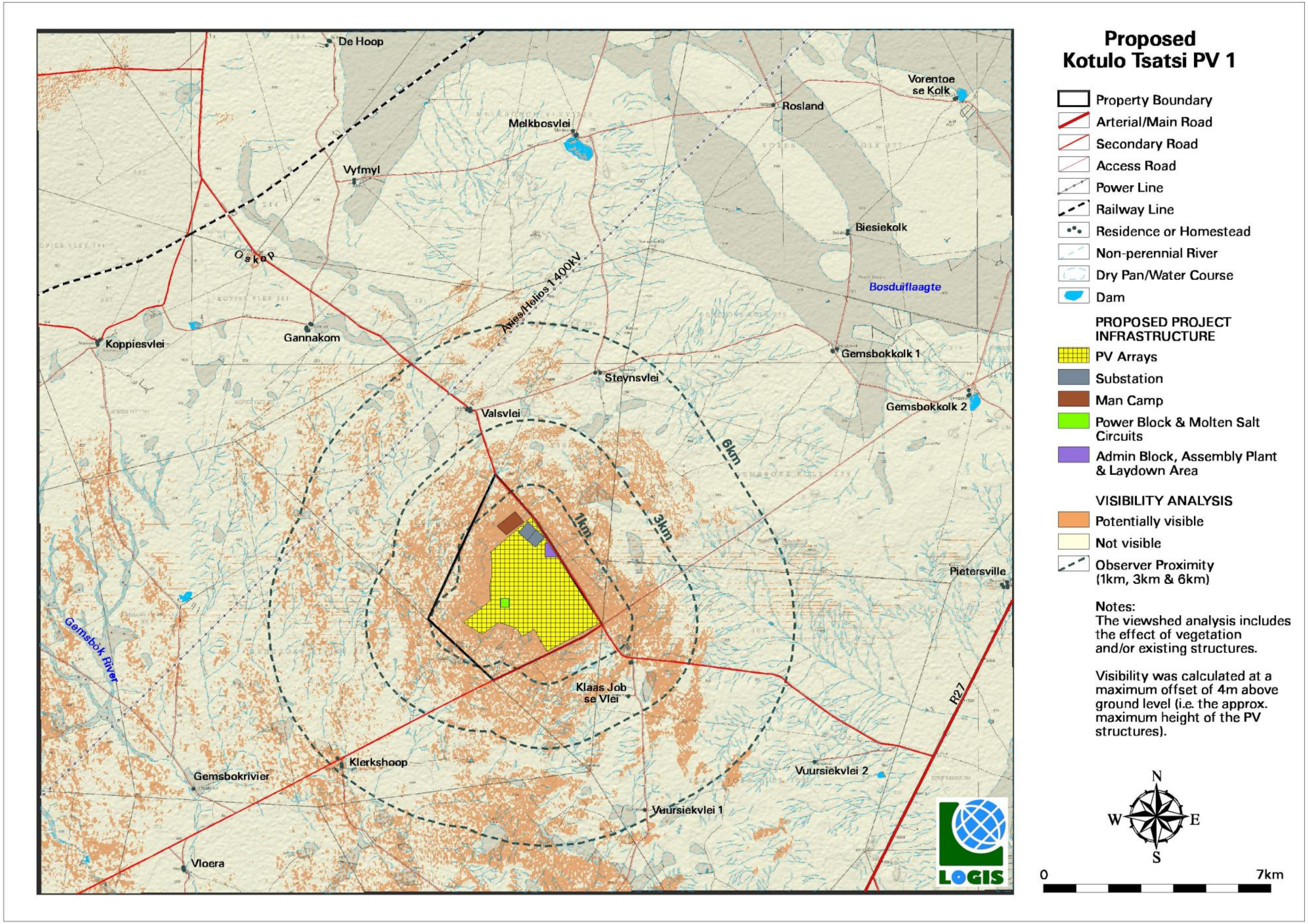
Within a 1 – 3km radius the visual exposure is more scattered and interrupted due to the undulating nature of the topography. There is one homestead within this zone (Klaas Job se Vlei), but the proposed facility is not expected to be visible from this residence. The facility may however be visible from sections of the previously mentioned secondary roads.

Visibility within 3 - 6km is greatly reduced and is primarily expected from the south and south-west. It may be visible from the Klerkshoop homestead from a distance of just under 6km.

At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. Overall, most of the areas of visual exposure, not just beyond a 6km radius but within the entire study area, fall within vacant open space, generally devoid of potential observers.

Conclusion

In general terms it is envisaged that the structures, where visible from shorter distances (e.g. less than 1km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. The incidence rate of sensitive visual receptors is however still expected to be quite low, due to the remote location of the proposed development and the low number of potential observers.



Map 3: Viewshed analysis of the proposed PV1 facility.

6.2. Potential cumulative visual exposure

The study area may ultimately encompass four solar energy facilities, namely the proposed Kotulo Tsatsi Energy PV1, and the authorised PV2, CSP2 and CSP3 facilities.

Map 4 indicates the potential cumulative visual exposure of the four solar energy facilities. A visibility analysis of the PV facilities was undertaken from a representative number of vantage points per development footprint at 4m above ground level. The CSP facilities' visibility analysis was undertaken at 250m (the maximum height of the central receivers) and 15m for the heliostat fields.

The results of these two analyses were merged in order to calculate the combined visual exposure of the PV and CSP infrastructure (indicated in red), compared to the additional visual exposure of CSP infrastructure alone (indicated in orange).

Results

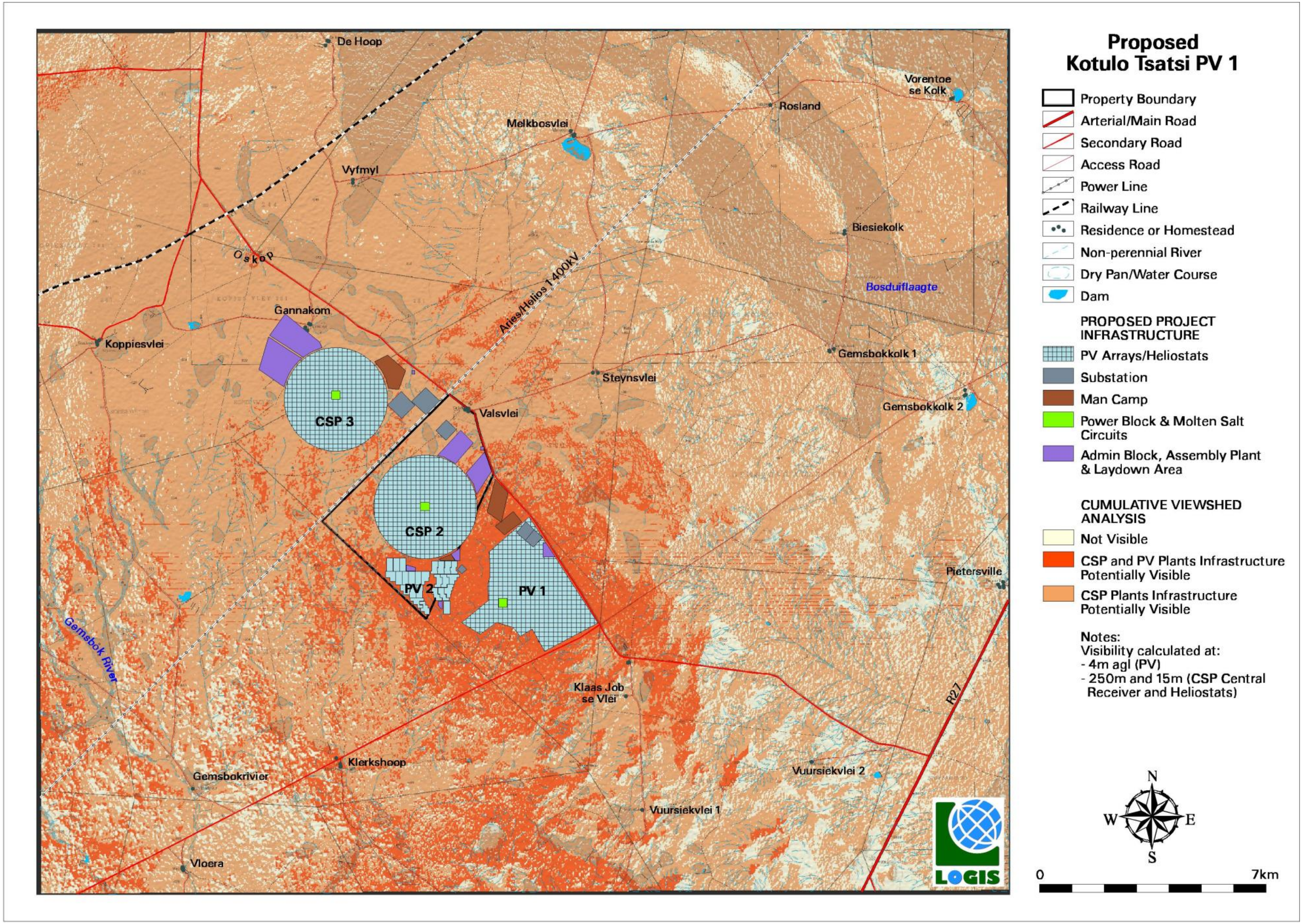
It is clear that the combined area of visual exposure will be significantly smaller than the expansive visual exposure of the heliostats and CSP towers. The area of highest cumulative exposure i.e. where both PV and CSP infrastructure would be visible, is predominantly located to the south of the development site. It is however expected that the CSP structures would be much more prominent than the PV structures, due to their considerably larger dimensions. The PV infrastructure will in all likelihood be dwarfed by the CSP infrastructure and will be much less conspicuous than the latter.

Cumulative visual exposure will furthermore, occur at varying distances from the respective facilities, with some structures appearing in the foreground, and others further away in the distance. It is also possible that structures from one of the solar energy facilities closer to the observer may obstruct views of structures located further away, thereby negating the potential cumulative visual impact.

Conclusion

The above statement should however not distract from the fact that there may ultimately be a large amount of solar energy generation structures and ancillary infrastructure (e.g. overhead power lines) within this area that currently have limited built structures besides the existing power line and railway line.

Alternatively, it is preferable to concentrate future solar energy infrastructure within this area, considering the fact that the Kotulo Tsatsi Energy PV2, and CSP2 and CSP3 facilities have already been authorised. Locating the proposed PV2 plant in closer proximity to the authorised solar plants will largely help to prevent the scattered proliferation of solar energy generation infrastructure throughout the greater region.



Map 4: Cumulative viewshed analysis.

6.3. Visual distance / observer proximity

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger solar plants (e.g. more extensive infrastructure associated with power plants exceeding 200MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the 200MW PV1 facility). This methodology was developed in the absence of any known and/or accepted standards for South African solar energy facilities.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the PV facility were 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 proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 5**, and include the following:

- 0 - 1km. Very short distance view where the PV facility would dominate the frame of vision and constitute a very high visual prominence.
- 1 – 3km. Short distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 3 - 6km. 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 moderate visual prominence.
- > 6km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

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 potentially negative visual perception of the proposed facility.

6.4. Viewer incidence / viewer perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed solar energy 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, purpose of sighting, etc. which would create a myriad of options.

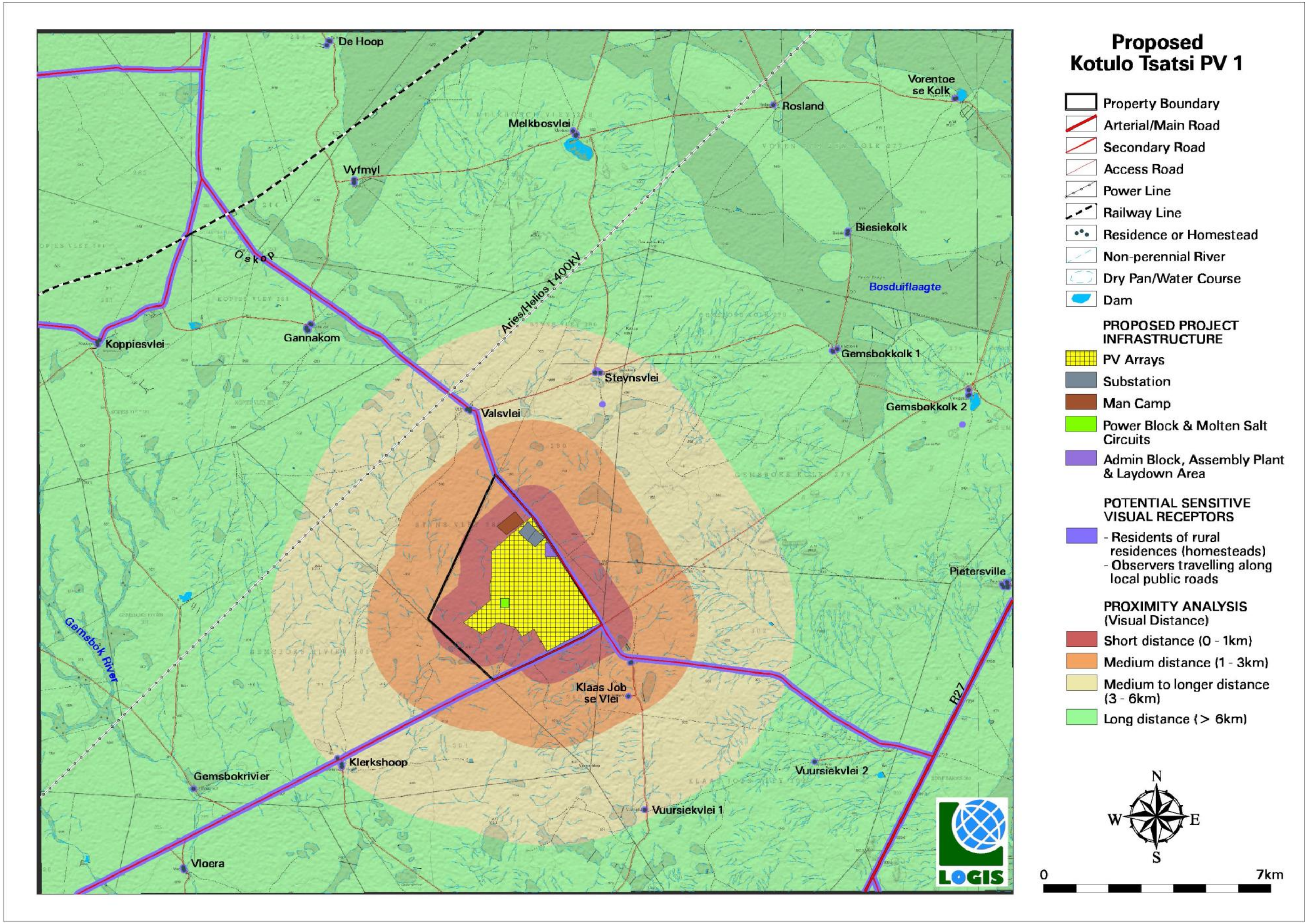
Viewer incidence is calculated to be the highest along the secondary roads within the study area. Travellers using these roads may be negatively impacted upon by visual exposure to the PV facility.

Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the solar energy facility, would generally be negative.

Due to the remote location of the proposed PV facility, there are only a few potential sensitive visual receptors located within a 6km radius of the proposed facility. These are residents of, or visitors to:

- Klaas Job se Vlei
- Vuursiekvlei 1
- Klerkshoop
- Valsvlei
- Steynsvlei

Refer to **Map 5** below.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The broader study area is located within the Nama-Karoo biome characterised by large open plains with *low shrubland*, grassland and bare soil in places (**Figure 11**).

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the vegetation and the low occurrence of urban development. In addition, the scale and form of the proposed structures mean 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 the visual absorption capacity (i.e. shielding the observers from the facility). 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.

Figure 11: *Low shrubland*, grassland and bare soil within the study area – low VAC.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed PV1 facility are displayed on **Map 6**. 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 to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a **higher** value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

The index indicates that **potentially sensitive visual receptors** within a 1km radius of the power plant may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 1– 3km radius (where/if sensitive receptors are present) and **moderate** within a 3 – 6km radius (where/if sensitive receptors are present). Receptors beyond 6km are expected to have a **low** potential visual impact.

The PV1 facility may have a **very high** visual impact on the following observers:

Observers travelling along the:

- Secondary roads south and east of the proposed facility

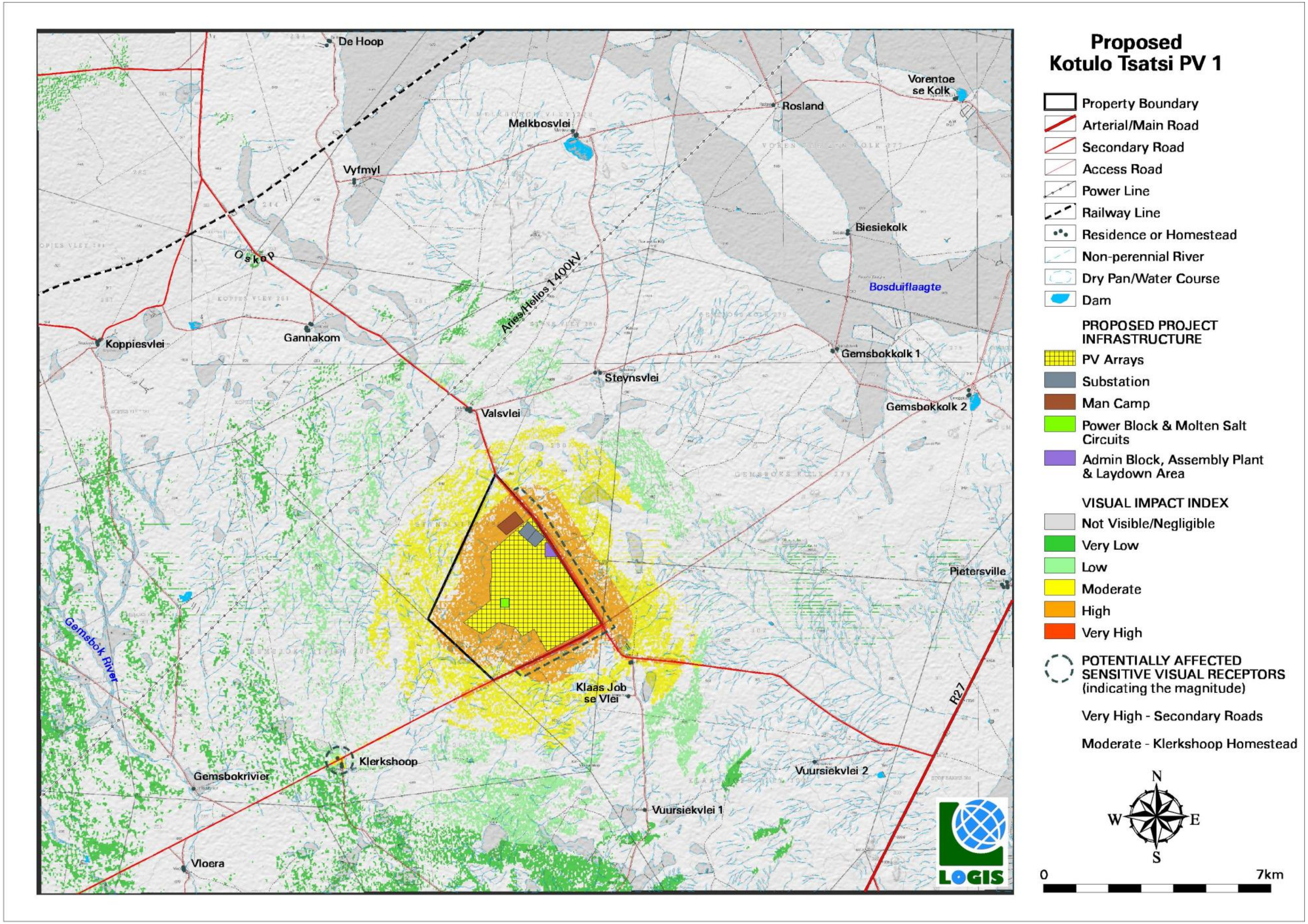
The facility may have a **moderate** visual impact on the following observers:

Residents of/or visitors to:

- The Klerkshoop homestead south-west of the proposed facility

Notes:

Where homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.



Map 6: Visual impact index and potentially affected sensitive visual receptors.

6.7. Visual impact assessment: impact rating methodology

The previous section of the report identified specific areas where likely visual impacts would occur and indicate the expected **magnitude** of potential impact. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see **Section 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 low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[5].
- **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)[6].
- **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)

---

[5] Local = within 1km of the development site. Regional = between 1-3km (and potentially up to 6km) from the development site.

[6] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

6.8. Visual impact assessment

The primary visual impacts of the proposed Kotulo Tsatsi Energy PV1 facility are assessed below.

6.8.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility and ancillary infrastructure.

During construction, there may 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 landowners in the area.

Construction activities may potentially result in a **moderate** (significance rating = 40), temporary visual impact, that may be mitigated to **low** (significance rating = 24)

Table 2: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(40)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction phase. ➢ Plan the placement of laydown 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 using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Residual impacts: None, provided rehabilitation works are carried out as specified.

6.8.2. Potential visual impact on sensitive visual receptors located within a 1km radius of the PV facility structures.

The PV facility is expected to have a **moderate** visual impact (significance rating = 42) on observers traveling along the secondary roads within a 1km radius of the operational PV structures, both before and after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended. The table below illustrates this impact assessment.

Table 3: Visual impact on observers in close proximity to the proposed PV plant structures.

Nature of Impact: Visual impact on observers travelling along the roads within a 1km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(36)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. ➢ Consult adjacent landowners (if present) in order to inform them of the development and to identify any (valid) visual impact concerns. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

6.8.3. Potential visual impact on sensitive visual receptors within the region (1 – 6km radius)

The operational PV facility could have a **low** visual impact (significance rating = 26) on observers located between a 1 – 6km radius of the PV facility structures, both before and after the implementation of mitigation measures.

Table 4: Visual impact of the proposed PV facility structures within the region.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 6km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(26)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, however best practice measures are recommended.	
Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

6.8.4. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the proposed PV facility.

Lighting impacts relate to the effects of glare and sky glow. The source of glare light is unshielded luminaries which emit light in all directions and which are visible over long distances.

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. It is possible that the PV facility may contribute to the effect of sky glow within the environment which is currently undeveloped.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the PV facility and the ancillary infrastructure (e.g. workshop and storage facilities) will go far to contain rather than spread the light.

The following table summarises the assessment of this anticipated impact, which is likely to be of **moderate** significance, and may be mitigated to **low**.

Table 5: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed PV facility.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make 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.
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.

6.8.5. Solar glint and glare impacts

Potential visual impact of solar glint and glare as a visual distraction and possible air travel hazard

Glint and glare occur when the sun reflects of surfaces with specular (mirror-like) properties. Examples of these include glass windows, water bodies and potentially some solar energy generation technologies (e.g. parabolic troughs and CSP heliostats). Glint is generally of shorter duration and is described as "a momentary flash of bright light", whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. residents of neighbouring properties), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, military airbases, etc.). It is generally possible to mitigate the potential glint and glare impacts through the design and careful placement of the infrastructure.

PV panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark-coloured materials, and are covered by anti-reflective coatings. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels (i.e. such as those proposed for the 200MW PV1 facility).

Sources: Blue Oak Energy, FAA and Meister Consultants Group.

The proposed PV facility is not located near any airports or airfields and is very remote in terms of exposure to other potentially sensitive visual receptors. As such, the potential visual impact related to solar glint and glare is expected to be of **low** significance (significance rating = 20).

Table 6: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction and possible air travel hazard.

Nature of Impact: The visual impact of solar glint and glare as a visual distraction and possible air travel hazard		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	N.A.
Duration	Long term **(4)**	N.A.
Magnitude	Low **(4)**	N.A.
Probability	Improbable **(2)**	N.A.
Significance	Low **(20)**	N.A.
Status (positive or negative)	Negative	N.A.
Reversibility	Reversible **(1)**	N.A.
Irreplaceable loss of	No	N.A.

resources?		
Can impacts be mitigated?	N.A.	
Mitigation: N.A.		
Residual impacts: N.A.		

6.8.6. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes smaller substations (inverters), 33kV cabling between the PV arrays, meteorological measurement station, internal access roads, workshop, office buildings, etc.

No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the PV arrays. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 7: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/power line servitude. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.9. Visual impact assessment: secondary impacts

The potential visual impact of the proposed PV facility on the 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, 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.), plays a significant role.

An 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 greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development represents existing visual disturbances.

The anticipated visual impact of the proposed PV facility on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development site.

Table 8: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(22)**	Low **(22)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. <u>Operations:</u> ➢ Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

The study area may ultimately encompass four solar energy facilities, namely the proposed Kotulo Tsatsi Energy PV1 and the authorised PV2, CSP2 and CSP3 facilities. The construction of all of these renewable energy facilities is expected to increase the cumulative visual impact of industrial type infrastructure within the region. Details of these applications are indicated in the table below and are displayed on **Map 4**.

Alternatively, it is preferable to concentrate future solar energy infrastructure within this area, considering the fact that the Kotulo Tsatsi Energy PV2 facility have already been authorised. Locating the proposed PV infrastructure in closer proximity to the authorised PV plant will largely help to prevent the scattered proliferation of solar energy generation infrastructure throughout the greater region.

Table 9: Renewable energy applications.

Project Name	Location	Approximate closest distance from Kotulo Tsatsi PV1	Project Status
Kotulo Tsatsi Energy PV2	Portion 2 of Farm Styns Vley 280	~1km west	Authorised
Kotulo Tsatsi Energy CSP2	Portion 2 of Farm Kopjes Vley 281	~1km north-west	Authorised
Kotulo Tsatsi Energy CSP3	Portion 2 of Farm Styns Vley 280	~ 5km north-west	Authorised

The anticipated cumulative visual impact of the proposed Kotulo Tsatsi Energy PV1 facility is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the proposed development sites. See **Table 10** below.

Table 10: The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation (with mitigation)	***Cumulative impact of the project and other projects within the area (with mitigation)***
Extent	Local **(2)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(36)**	Moderate **(45)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

6.10. The potential to mitigate visual impacts

The primary visual impact, namely the layout and appearance of the PV panels is not possible to mitigate. The functional design of the PV panels cannot be changed in order to reduce visual impacts.

The following mitigation is however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) immediately adjacent to the development footprint be maintained, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. The construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

- Mitigation of lighting impacts includes the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed PV facility and 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 laydown 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 arrays and ancillary structures and infrastructure will ensure that the facility does not degrade, therefore avoiding aggravating the 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 and when required.

- Once the facility 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.

- Secondary impacts anticipated as a result of the proposed PV facility (i.e. visual character and sense of place) are not possible to mitigate.

- Where sensitive visual receptors (if present), are likely to be affected it is recommended that the developer enter into negotiations with the property owners regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed 200MW Kotulo Tsatsi Energy PV1 facility and its associated infrastructure, may have a visual impact on the study area, especially within (but not restricted to) a 1km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of up to four solar energy facilities (i.e. Kotulo Tsatsi Energy PV1, and the authorised PV2, CSP2 and CSP3 facilities) is expected to increase the area of potential visual impact within the region. The intensity of visual impact to exposed receptors, especially those located within a 3km radius, is expected to be greater than it would be for a single solar energy facility. It is however still more preferable that these renewable energy developments are all concentrated within this area rather than being spread further afield.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally undeveloped character of the landscape and the remote location of the project infrastructure. There are a very limited number of potentially sensitive visual receptors within a 6km radius of the PV1 facility, although the possibility does exist for visitors to the region to venture in to closer proximity to the solar power generating structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

Potential mitigation factors for the 200MW PV1 facility include the fact that the facility utilises a renewable source of energy (considered as an international priority) to generate electricity 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.

A number of mitigation measures have been proposed (**Section 6.10.**). Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the PV facility would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

8. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed 200MW PV1 facility is that the visual environment surrounding the site, especially within a 1 - 3km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

This impact is applicable to the individual PV facility and to the potential cumulative visual impact of the facility in relation to the authorised Kotulo Tsatsi PV2, CSP2 and CSP3 facilities, where the combined frequency of visual impact may be greater. The potential area of cumulative visual exposure is however still deemed to be within acceptable limits, considering their close proximity to each other.

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

- During construction, there may 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 landowners in the area. Construction activities may potentially result in a **moderate**, temporary visual impact that may be mitigated to **low**.

- The PV facility is expected to have a **moderate** visual impact on observers traveling along the secondary roads, residents of homesteads and visitors to the region within a 1km radius of the operational PV facility structures. This is due to the generally limited number of potentially sensitive visual receptors brought about by the remote location of the plant.

- The PV Facility is expected to have a **low** visual impact within the region (1 – 6km radius of the PV facility), both before and after the implementation of mitigation measures.

- The anticipated impact of lighting at the PV facility is likely to be of **moderate** significance, and may be mitigated to **low**.

- The potential visual impact related to solar glint and glare is expected to be of **low** significance.

- The anticipated visual impact resulting from the construction of on-site ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The anticipated visual impact of the proposed PV facility on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development.

- The anticipated cumulative visual impact of the proposed PV1 facility is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the proposed developments.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **moderate** to **low** significance. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility.

Considering all factors, it is recommended that the development of the facility as proposed be supported; subject to the implementation of the recommended mitigation measures (**Section 6.10.**) and management programme (**Section 9.**).

9. MANAGEMENT PROGRAMME

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

Table 11: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed 200MW PV1 facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, meteorological metering station, security lighting, workshop, etc.).	
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 3km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise the visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent / contractor	Early in the planning phase.
Retain and maintain natural vegetation immediately adjacent to the development footprint/servitude.	Project proponent/ design consultant	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ 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 PV Facility and the ancillary infrastructure. The following is recommended: o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). o Limit mounting heights of fixtures, or use foot-lights or bollard lights. o Make use of minimum lumen or wattage in fixtures. o Making use of down-lighters or shielded fixtures. o Make use of Low Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.	Project proponent / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 3km) and within the region.	
Monitoring	Not applicable.	

Table 12: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed 200MW PV1 facility.		
Project Component/s	Construction site and activities	
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.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate construction work areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction phase.	Project proponent / contractor	Early in the construction phase.
Reduce the construction phase through careful logistical planning and productive implementation of resources.	Project proponent / contractor	Early in the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent / 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.	Project proponent / 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).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes, etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent / 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 programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed 200MW PV1 facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, meteorological metering station, workshop, etc.).	
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.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the PV panels, servitudes and the ancillary structures.	Project proponent / operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent / operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent / operator	Throughout the operation phase.
Investigate and implement (should it be required) the potential to screen visual impacts at affected receptor sites.	Project proponent / operator	Throughout the operation 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 14: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed 200MW PV1 facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, workshop, transformers, etc.).	
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.	
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.	Project proponent / operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent / 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.	

10. REFERENCES/DATA SOURCES

Blue Oak Energy, 2016. *https://www.blueoakenergy.com/blog/glint-and-glare-studies-for-commercial-and-industrial-solar-*

Chief Directorate National Geo-Spatial Information, varying dates. *1:50 000 Topo-cadastral Maps and Data.*

CSIR, 2017. *Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment.*

CSIR, 2015. *The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.*

DEA, 2014. *National Land-cover Database 2018 (NLC2018).*

DEA, 2019. *South African Protected Areas Database (SAPAD_OR_2019_Q4).*

DEA, 2020. *South African Renewable Energy EIA Application Database (REEA_OR_2020_Q3).*

DEA&DP, 2011. Provincial Government of the Western Cape. *Guideline on Generic Terms of Reference for EAPS and Project Schedules.*

Department of Environmental Affairs and Tourism (DEA&T), 2001. *Environmental Potential Atlas (ENPAT) for the Northern Cape Province.*

FAA, 2015. *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.*

Meister Consultants Group, 2014.
http://solaroutreach.org/wp-content/uploads/2014/06/Solar-PV-and-Glare-_Final.pdf

NASA, 2018. *Earth Observing System Data and Information System (EOSDIS).*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.*

The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr. 33306, 18 June 2010.