PROPOSED HIGHVELD PHOTOVOLTAIC (PV) SOLAR FACILITY, NORTH WEST PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

WKN Windcurrent SA (Pty) Ltd

On behalf of:

savannah environmental

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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 modeling 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. 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. within the Northern Cape Province).

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.

[1] Adapted from Oberholzer (2005).

  - 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 the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) 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 facility layout/position.

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 resolution AW3D30 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 facility.

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 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.

2. BACKGROUND

The development of a solar photovoltaic (PV) facility with a generating capacity of up to 240MW is proposed by WKN Windcurrent SA (Pty) Ltd on a site located near Stilfontein in the North West Province. The solar PV development will be known as the Highveld Solar PV Facility. The Highveld Solar PV Facility is located within the Klerksdorp Renewable Energy Development Zone (REDZ).

The infrastructure associated with the 240MW solar PV facility will include:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads and fencing around the development area
- Temporary and permanent laydown areas and O&M buildings.

The proposed property identified for the PV facility and associated infrastructure is indicated on the maps within this report. Sample images of similar PV technology are provided below.

Figure 1: Photovoltaic (PV) solar panels. (*Photo: SunPower Solar Power Plant – Prieska)*.

Figure 2: 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 PV 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 includes a 6km buffer zone (area of potential visual influence) from the proposed development footprint.

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 national, arterial or 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 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).
- 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/road travel hazard.
- Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility.

- 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:

- National Environmental Management Act 107 of 1998 (NEMA);
- 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); and
- Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

5. THE AFFECTED ENVIRONMENT

The Highveld PV Solar Facility is located north of the N12 national road approximately 20km west of Potchefstroom, in the Tlokwe City Council Local Municipality in the North West Province. The region has a strong mining character, interspersed with agricultural activities (dryland and livestock production) and human settlements. The south western and to a lesser extent northern portion of the study area are home to a number of operational and old gold mines and other industrial activities. These activities, especially the expansive mining and quarrying are rapidly changing the once rural and agricultural character to that of a predominantly industrial nature. Mining activities in close proximity to the proposed Highveld PV Solar Facility include the Stilfontein Gold Mine to the south west.

Figure 3: Stilfontein Gold Mine located south-west of the proposed Highveld PV Solar Facility, view from the N12

Figure 4: Example of livestock agricultural activities in the region.

The topography or terrain morphology of the region is broadly described as slightly undulating plains dissected by prominent rocky chert ridges. The slope of the entire study area is generally even with very gradual drops towards the watercourses traversing the study area (hence the term undulating). The highest points above sea level within the study area are located on the ridgelines of the Buffelsrug (1519 m), Machavierug (1527.5 m) and Britzkop (1479.5 m) outcrop, located east of the proposed Highveld PV Facility. Refer to **Map 1** for the shaded relief/topography map of the study area.

Figure 5: General topography of the study area – undulating plains dissected with rocky ridges.

Prominent rivers or streams include the Kromdraaispruit and Koekemoerspruit to the west, as well as the Droëspruit to the east.

A host of power lines criss-cross the study area, these include, but are not limited to:

- Pluto – Hermes 1 400kV
- Pluto – Hermes 2 400kV
- Potchefstroom DS – Machavie 1 88kV
- Potchefstroom DS – Buffels East 1 132kV
- Hermes DS – Potchefstroom DS 1 132kV

Figure 6: Existing power lines in the study area

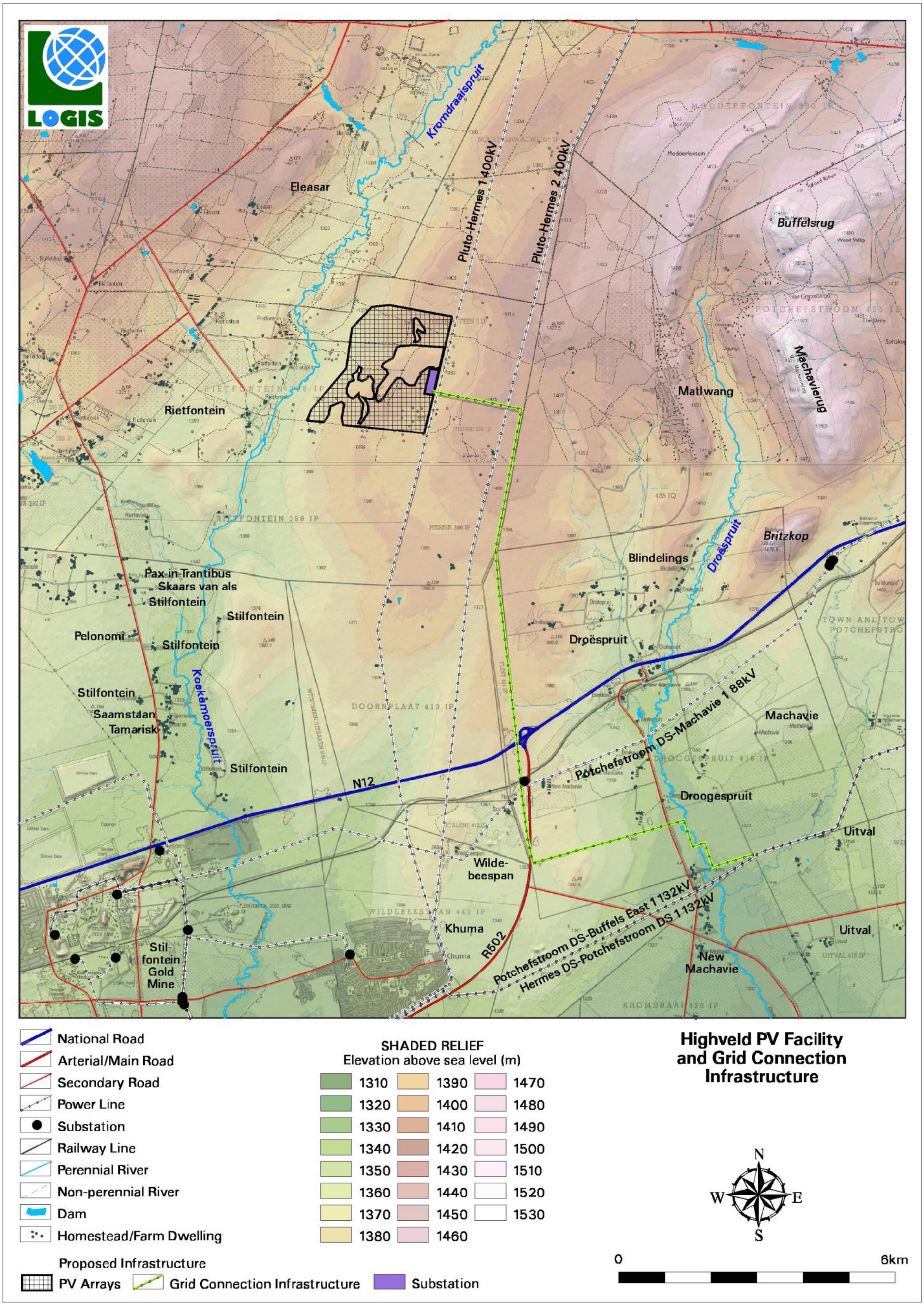
The north-western and central portions of the study area still have a largely agricultural and rural character where predominantly dryland agriculture (maize), livestock agricultural and limited irrigated agriculture activities are practised. Matlwang to the east and Kuma to the south of the Highveld PV Solar Facility are generally associated with the mining activities, where employees of these mines are housed.

The natural vegetation or land cover types of the region (where intact) are described as Grassland. This vegetation cover type is under increased pressure from both mining and township development and are often subject to varying levels degradation. It may also include old agricultural fields that are regenerating. The majority of the remaining natural vegetation within the study area is indicated as Carletonvile Dolomite Grassland. Refer to **Map 2**.

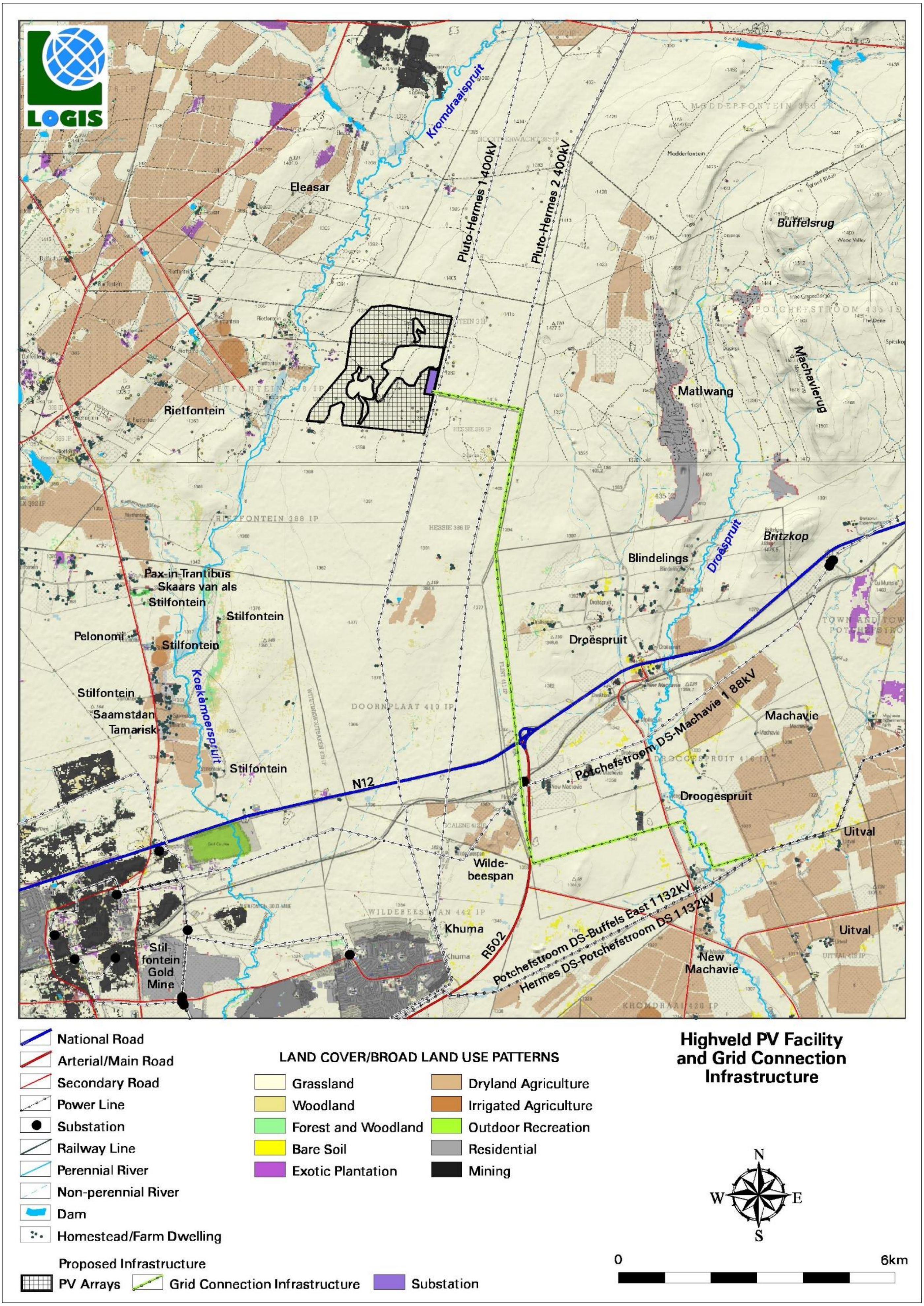
Farm settlements or residences found within the study area include:

- Eleasar
- Matlwang
- Rietfontein
- Stilfontein
- Saamstaan
- Tamarisk
- Pelonomi

No formally protected or conservation areas were identified within the study area. The Khora Lion Park and Club Louico, located to the south west of the site, were identified as known tourist attractions and resorts within the study area.



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 a representative number of vantage points within the development footprint at an offset of 5m 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, inverters, etc.) associated with the facility.

Map 3 also indicates proximity radii from the development footprint in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds.

The viewshed analysis does not include the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

It is clear that the relatively constrained dimensions of the PV facility would amount to a fairly limited area of potential visual exposure. The visual exposure would largely be contained within a 6km radius of the proposed development site, with the predominant exposure to the west and north-west.

The following is evident from the viewshed analyses:

0 – 1km

The potential visual exposure of the facility is contained to a core area on the site itself and within a 1 km radius thereof. Sensitive visual receptors within this zone include residents of the homesteads located to the west of the site. No national, arterial or secondary roads occur in this area.

1 – 3km

Potential visual exposure in the short to medium distance (i.e. between 1 and 3km), is largely contained to the south west, west and north west of the proposed site. Sensitive visual receptors within this zone include observers travelling along a secondary road, as well as, residents of agricultural holdings and homesteads located to the west of the site. Visual exposure of the proposed Solar PV Facility from the south, east and north is scattered.

3 - 6km

Within a 3 – 6km radius, the intensity of visual exposure is expected to subside and becomes very scattered and interrupted due to the undulating nature of the topography. Observers or sensitive visual receptors in this zone consists mainly of residents of agricultural homesteads (i.e Ostrich Farm and Chicken Batteries), visitors to the Khora Lion Park and Club Louico, as well as, observers travelling along various secondary roads in the western portion of this zone. Visual exposure is limited in the south, and east with the exception of residents on the outskirt of the settlement of Matlwang.

> 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. Sensitive visual receptors are not likely to be visually exposed to the proposed facility, despite lying within the viewshed.

Conclusion

In general terms it is envisaged that the structures, where visible from shorter distances (e.g. less than 1km and potentially up to 3km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. This may include residents of the agricultural homesteads mentioned above, as well as observers travelling along the various secondary roads in closer proximity to the facility.

6.2. Visual distance/observer proximity to the PV facility

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger solar energy facilities/technologies (e.g. more extensive infrastructure associated with power plants exceeding 100MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity). 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 predominantly mining / industrial character of the immediate area surrounding the proposed Solar PV Facility would result in a reduced facility visibility and recognisability from greater distances.

The proximity radii for the proposed 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.

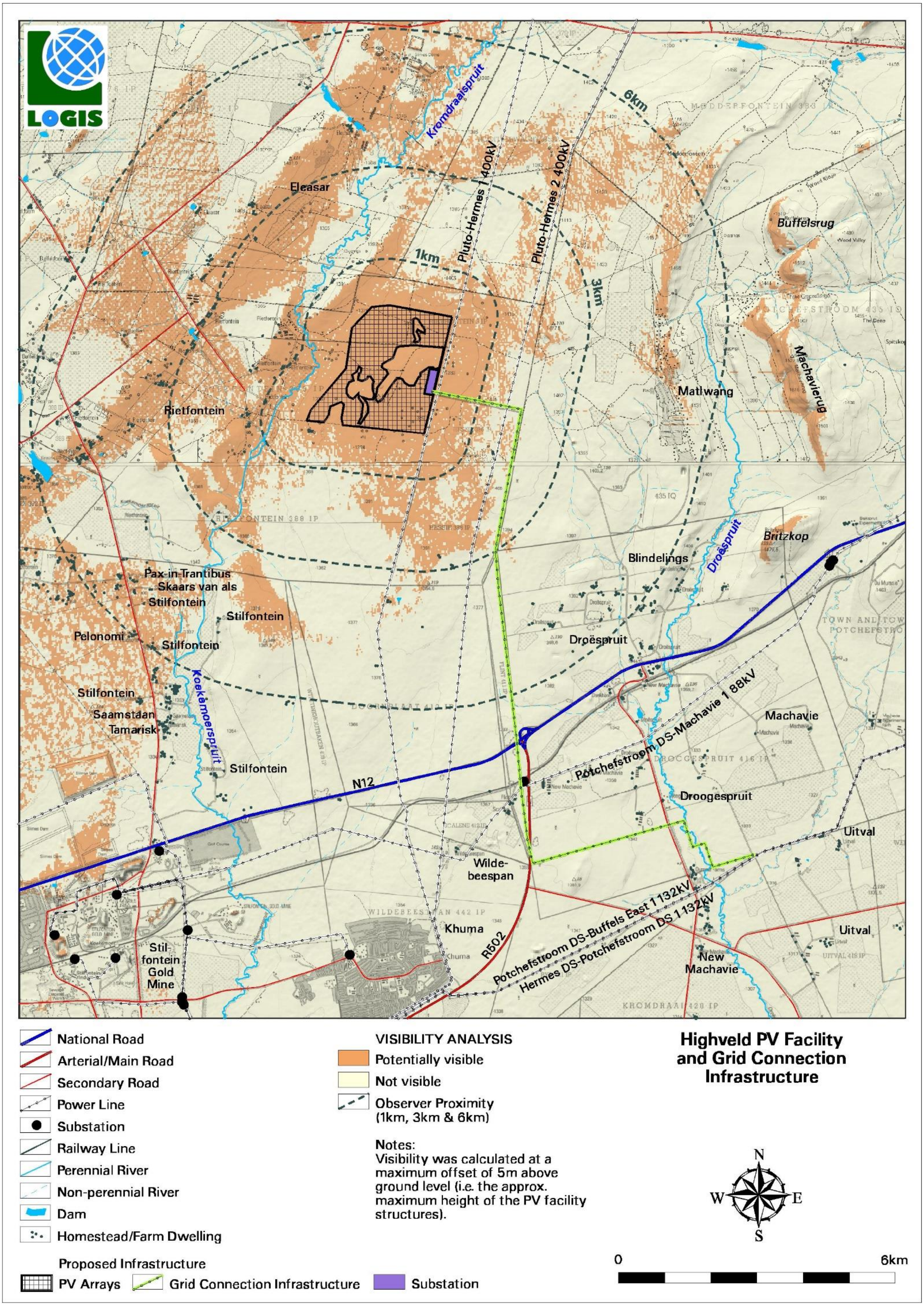
The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 4**, and include the following:

- 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.



Map 3: Viewshed analysis of the proposed Highveld PV Solar 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.

6.3. 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 PV Facility. 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 N12 national road, the R502 arterial road (both located south of the proposed Solar PV Facility) and various secondary roads located to the west of the proposed facility. Commuters using these roads may be exposed to relatively short to long distance views of the proposed Solar PV Facility and ancillary infrastructure and could be negatively impacted upon.

Additional high viewer incidence (and expected negative viewer perception) will be residents of homesteads/rural settlements. Residents and visitors to this area are identified as potential sensitive visual receptors.

The potential sensitive visual receptor sites and areas of higher viewer incidence are indicated on **Map 4**.

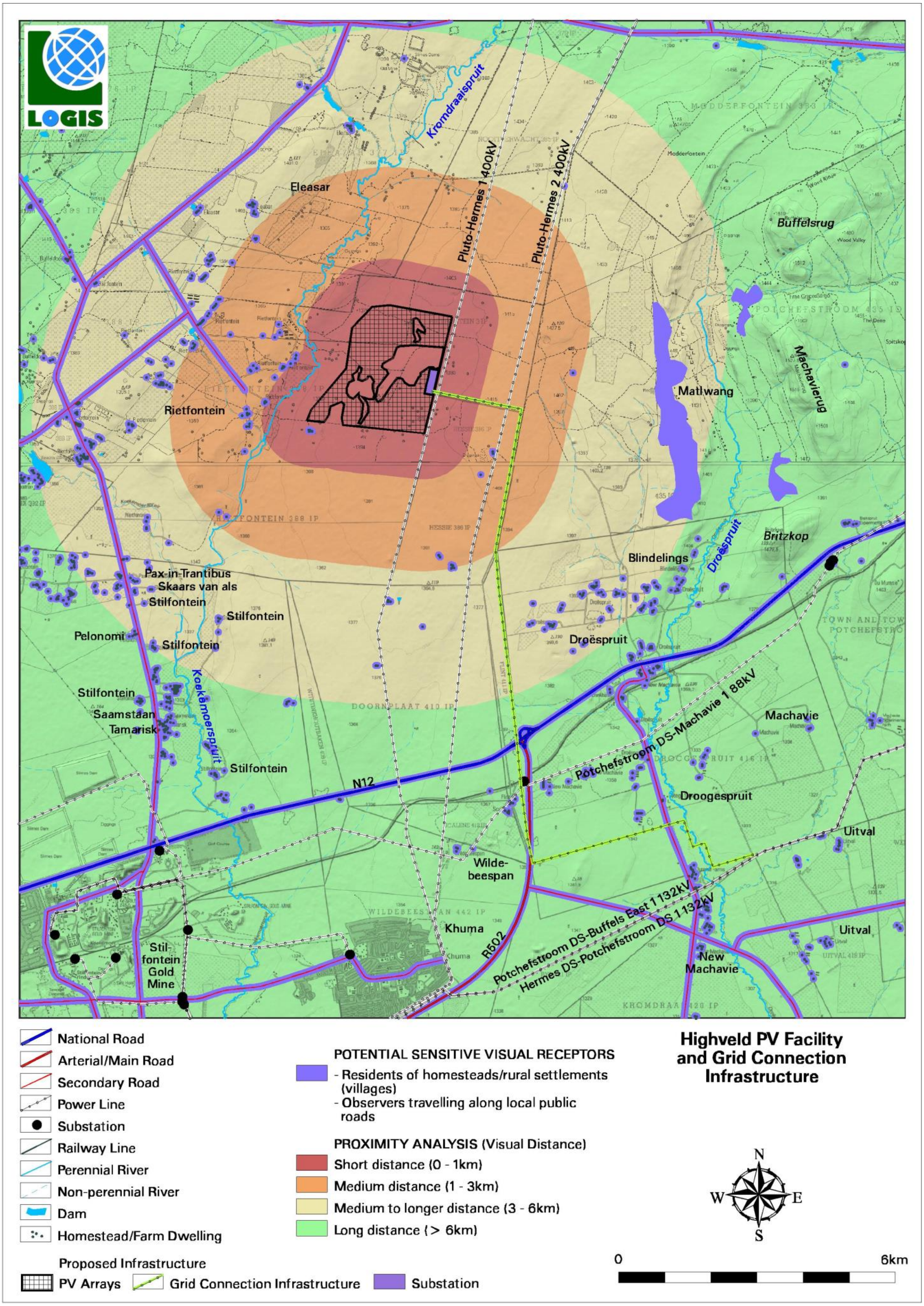
The author (at the time of the compilation of this report) is not aware of any objections raised against the proposed Highveld PV Solar Facility.

6.4. Visual absorption capacity

Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. 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 also generally increases with distance, where discernible detail in visual characteristics of both environment and development decreases.

The broader study area is located within the Grassland biome characterised by the occurrence of grassland and the absence of natural trees, shrubs and bushes.

Grassland is generally described as: "*All areas of grassland with < 10% tree and/or shrub canopy cover, and >0.1% total vegetation cover. Dominated by grass-like, non-woody, rooted herbaceous plants. Essentially indigenous species growing under natural or semi-natural conditions.*"



Map 4: Proximity analysis and potential sensitive visual receptors.

It is clear that the natural vegetation within the study area has a low visual absorption capacity (VAC). Where planted trees occur, the VAC is higher (see **Figure 7** below). This may be a common occurrence at homesteads and settlements, but does not apply as a rule. Similar high VAC may be found along maize fields, although that is strictly dependent on the time of the growing season. Within built-up areas (e.g. residential or industrial areas) the VAC is high due to the presence of built structures and visual clutter.

Figure 7: Grassland with low Visual Absorption Capacity (VAC)

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is moderate to high on the site itself and low in areas where transformation has occurred due to mining and agricultural activities. In addition, the scale and form of the proposed PV structures mean that it is likely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics. The powerline should be absorbed by the visual clutter in the built up and industrial areas. Therefore, within this area the VAC of vegetation will be taken into account.

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 infrastructure). 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.

6.5. Visual impact index

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

Magnitude of the potential visual impact

0 – 1km

The majority of the exposed areas in this zone fall within the Highveld property itself, generally devoid of observers or potential sensitive visual receptors.

The following sensitive visual receptors may experience visual impacts of **very high** magnitude:

- Residents at an unknown homestead located to the immediate south (site 1)
- Resident at Rietfontein East homesteads located to the west of the proposed facility (site 2)

1 – 3km

The majority of the exposed areas in this zone falls within open grasslands or dryland agriculture to the west which is generally devoid of observers or potential sensitive visual receptors.

The following sensitive visual receptors may experience visual impacts of **high** magnitude:

- Resident at Rietfontein East homesteads located to the west of the proposed facility (site 3)
- Observers travelling along the secondary road in the west (site 4)

3 – 6km

Most of the visual exposure falls within grassland or vacant agricultural land to the north and west of the site.

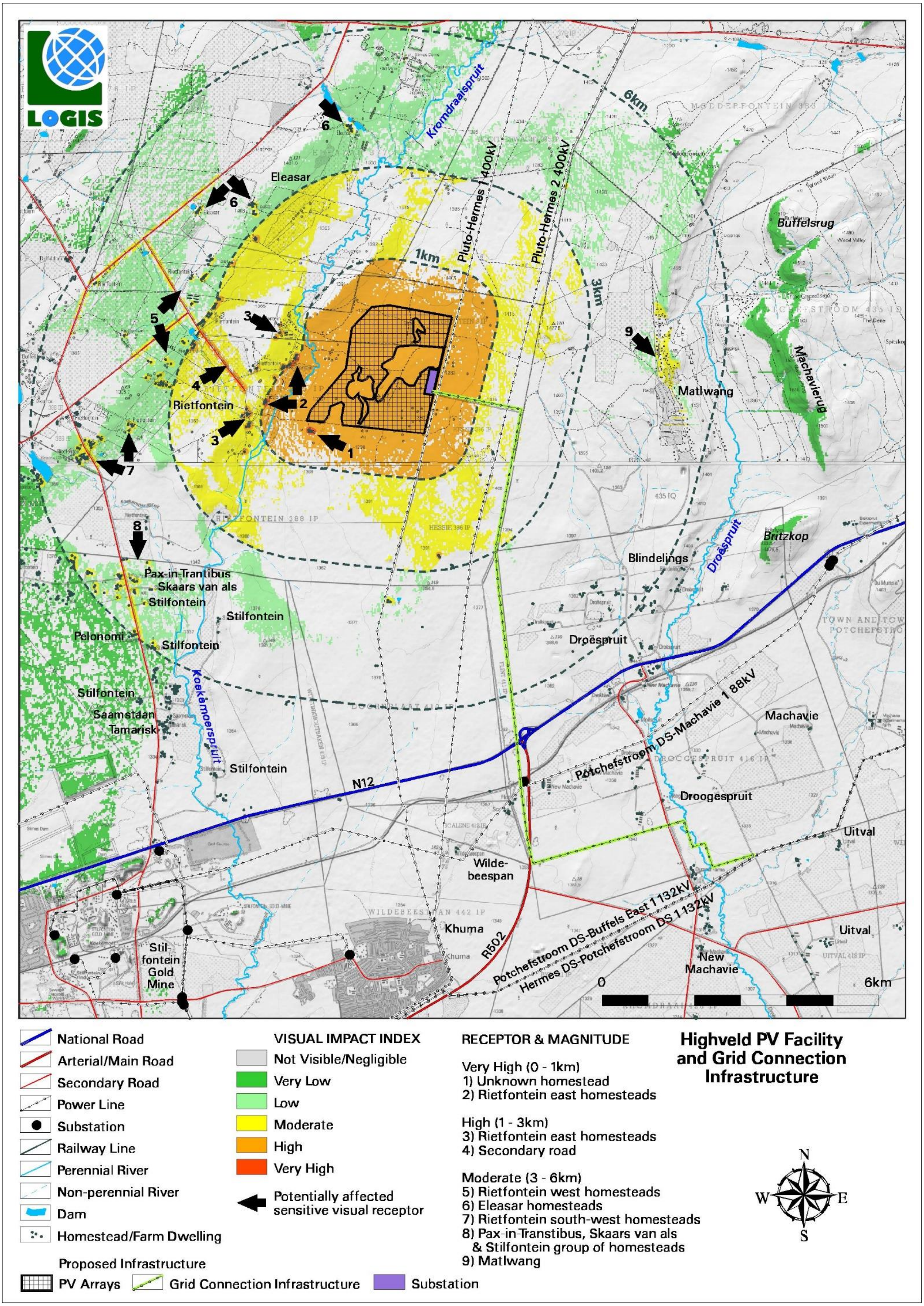
The following sensitive visual receptors may experience visual impacts of **moderate** magnitude:

- Resident at Rietfontein west homesteads located to the west of the proposed facility, this includes the identified Ostrich Farm (site 5)
- Eleasar homesteads (site 6)
- Khora Lion Park - Rietfontein south-west homesteads (site 7)

- Pax-in-Transitbus, Skaars van als and Stilfontein group of homesteads (site 8)
- Matlwang (site 9)
- Club Louico

>6 Km

Visibility beyond 6km from the proposed development is expected to have a negligible or very low visual impact.



Map 5: Visual impact index and potentially affected sensitive visual receptors.

6.6. 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** - long distance (very low = 1), medium to longer distance (low = 2), short distance (medium = 3) and very short distance (high = 4)[2].
- **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)[3].
- **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)
- 30-60 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)

[2] Long distance = > 6km. Medium to longer distance = 3 – 6km. Short distance = 1 – 3km. Very short distance = < 1km (refer to Section 6.3. Visual distance/observer proximity to the PV facility).

[3] 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.

6.7. Visual impact assessment

The primary visual impacts of the proposed PV facility infrastructure are assessed below.

6.7.1. Construction impacts

6.7.1.1. 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 close proximity (< 1 km) to the construction activities.

Construction activities may potentially result in a **high** (significance rating = 64), temporary visual impact, that may be mitigated to **moderate** (significance rating = 56).

A mitigating factor within this scenario is the low occurrence of receptors within the receiving environment. Residents of Rietfontein east and one unknown homestead to the south are expected to be visually impacted upon the most.

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 residents in close proximity to the proposed PV facility.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very High **(10)**	High **(8)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	High **(64)**	Moderate **(56)**
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 (if present) immediately adjacent to the development footprint. Construction: ➢ Ensure that vegetation cover adjacent to the development footprint (if present) is not unnecessarily removed during the construction phase, where possible. ➢ 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 (if present/if required) immediately after the completion of construction works.
Residual impacts: None, provided rehabilitation works are carried out as specified.

6.7.2. Operational impacts

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

The PV facility is expected to have a **high** visual impact (significance rating = 72) pre-mitigation and a **moderate** visual impact (significance rating = 48) post mitigation on residents of the Rietfontein East homesteads and one unknown homestead.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

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

Nature of Impact: Visual impact on residents of Rietfontein East homesteads within a 1km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(72)**	Moderate **(48)**
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 (if present) immediately adjacent to the development footprint, where possible. ➢ Consult adjacent landowners (if present) in order to inform them of the development and to identify any (valid) visual impact concerns. ➢ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover. 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.

6.7.2.2. Potential visual impact on sensitive visual receptors within a 1 – 3km radius

The operational PV facility could have a **moderate** visual impact (significance rating = 45) on residents of the Rietfontein East homesteads, as well as, observers travelling along the secondary road in the west. Observers traveling along this road will only be exposed to the visual intrusion for a short period of time. This reduces the probability of this impact occurring. This impact may be mitigated to **low** (significance rating = 26).

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 4: Visual impact of the proposed PV facility structures within a 1 – 3km radius.

Nature of Impact: Visual impact on sensitive receptors within a 1 – 3km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(45)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	yes, however best practice measures are recommended.	

Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation (if present) 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.

6.7.2.3. Potential visual impact on sensitive visual receptors within a 3 – 6km radius

The operational PV facility could have a **moderate** visual impact (significance rating = 36) on residents of various homesteads, visitors to the Khora Lion Park and Club Louico, as well as, observers travelling along secondary roads in the west. Observers traveling along these roads will only be exposed to the visual intrusion for a short period of time. This reduces the probability of this impact occurring. This impact may be mitigated to **low** (significance rating = 20).

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 5: Visual impact of the proposed PV facility structures within a 3 – 6km radius.

Nature of Impact: Visual impact on sensitive receptors within a 3 – 6km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Med to long distance **(2)**	Med to long distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(36)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	yes, however best practice measures are recommended.	

Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation (if present) 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.

6.7.2.4. 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 number 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 6: 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 PV facility.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very High **(10)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(54)**	Low **(28)**
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 PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

6.7.2.5. Solar glint and glare impacts

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

Glint and glare occur when the sun reflects off 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 relatively close proximity to the source (e.g. users of the N12 and other secondary roads), 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 Highveld PV Solar Facility) especially where the incidence angle (angle of incoming light) is smaller i.e. the panel is facing the sun directly. This is particularly true for tracker arrays that are designed to track the sun and keep the incidence angle as low as possible.[4]

There are no major roads within a 1km radius of the proposed PV facility. This approximate distance is recommended as a threshold within which the visual

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

impact of glint and glare (if there is visual line of sight from the road) may influence road users.[5]

The potential visual impact related to solar glint and glare as a road travel hazard is therefore expected to be of **negligible** significance both before and after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction to users of the roads

Nature of Impact: The visual impact of solar glint and glare as a visual distraction and possible road travel hazard		
	Without mitigation	**_With mitigation_**
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	None **(0)**	None **(0)**
Probability	Very Improbable **(1)**	Very Improbable **(1)**
Significance	Negligible **(8)**	Negligible **(8)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	Very short distance **(4)**
Can impacts be mitigated?	No, however best practice measures are recommended.	
Mitigation: Planning & operation: ➢ Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint. ➢ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ➢ Adjust tilt angles of the panels if glint and glare issues become evident, where possible. ➢ If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility

The only residences within a 1km radius of the proposed PV facility are the residents of the Rietfontein East homesteads to the west and one unknown homestead to the south. Since these residents are located to west and south of the site and it is assumed that the PV panels will be oriented to the north for maximum sun exposure it is unlikely that these receptors will be impacted upon by solar glint and glare.

[5] December 2020, Solar Photovoltaic Glint and Glare Guidance Third Edition.

The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of **low** significance, both before and after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 8: Impact table summarising the significance of the visual impact of solar glint and glare on static ground receptors.

Nature of Impact: The visual impact of solar glint and glare on residents of homesteads in closer proximity to the PV facility		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	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: ➢ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ➢ Adjust tilt angles of the panels if glint and glare issues become evident, where possible. ➢ If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

6.7.2.6. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes inverters, low voltage cabling between the PV arrays, internal access roads, BESS, 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 **moderate** significance pre-mitigation and **low** post mitigation.

Table 9: Visual impact of the ancillary infrastructure.

<table>
<tr><td colspan="3">Nature of Impact:
Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Very short distance (4)</td><td>Very short distance (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Moderate (42)</td><td>Low (24)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Reversible (1)</td><td>Reversible (1)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes, only best practise measures can be implemented</td></tr>
<tr><td colspan="3">Generic best practise mitigation/management measures:
<u>Planning:</u>
➢ Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint/power line servitude where possible.
<u>Operations:</u>
➢ Maintain the general appearance of the infrastructure.
<u>Decommissioning:</u>
➢ Remove infrastructure not required for the post-decommissioning use.
➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

6.7.2.7. 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.

Since the greater environment has a strong mining and industrial character, interspersed with agricultural activities and human settlements this highly developed landscape is not considered to have a high visual quality. Additionally, urban development and power generation/distribution infrastructure represents an existing visual disturbances.

The anticipated visual impact of the proposed PV facility on the regional visual quality (i.e. beyond 6km of the proposed infrastructure), and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance.

Table 10: 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	Medium to longer distance **(2)**	Medium to longer distance **(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 (if present) immediately adjacent to the development footprint/servitude, where possible. 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. 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 where possible. 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 adjacent to the development footprint (if present) is not unnecessarily cleared or removed during the construction period.
    - Reduce the construction period through careful logistical planning and productive implementation of resources wherever possible.
    - 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 wherever possible.
    - Rehabilitate all disturbed areas (if present/if required) immediately after the completion of construction works.

- Glint and glare impact mitigation measures include the following:

    - Use anti-reflective panels and dull polishing on structures, where possible and industry standard.

    - Adjust tilt angles of the panels if glint and glare issues become evident, where possible.
    - If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.

- 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, unless a new authorisation is granted for the plant to continue a new cycle. 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 Highveld PV Solar Facility and its associated infrastructure may have a visual impact on the study area, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The study area is considered to have a low visual and scenic quality owing to the presence of industrial areas, particularly mines, as well, as informal settlements to the north and south. There are also existing high voltage powerlines within the area.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally industrial and developed character of the landscape. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures, although the possibility does exist for visitors to the region to venture in to closer proximity to the PV facility structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

The Stilfontein Gold mine to the south and another mine to the north are the dominant industries in the area. It is generally acceptable, from a visual impact point of view, to place industrial infrastructure within existing industrial areas. The existing visual disturbances brought about by these mines and existing high voltage and other electrical infrastructure within the study area somewhat mitigates the visual impact of the proposed Highveld PV Facility. However, it is still preferable to consolidate the proposed infrastructure in areas of existing visual disturbance, rather than to spread it over larger areas.

A number of mitigation measures have been proposed (**Section 6.8.**). 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.

It is further highly advisable to engage with adjacent land owners (if required and where identified) in order to amiably and proactively address potential visual concerns. Site specific mitigation measures may be required in some cases and should be undertaken and maintained throughout the lifespan of the Highveld PV Solar 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 and associated infrastructure 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 Highveld PV Solar Facility is that the visual environment surrounding the site, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 30 years).

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 **high**, temporary visual impact, that may be mitigated to **moderate**.

- The PV facility is expected to have a **high** visual impact pre-mitigation and a **moderate** visual impact post mitigation on residents of the Rietfontein East homesteads and one unknown homestead., within a 1km radius of the proposed PV facility.

- The operational PV facility could have a **moderate** visual impact on sensitive receptors within a 1 – 3km radius of the PV facility structures. This impact may be mitigated to **low**.

- The operational PV facility could have a **moderate** visual impact on sensitive receptors within a 3 – 6km radius of the PV facility structures. This impact may be mitigated to **low.**

- 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 as a road travel hazard is expected to be of **negligible** significance before and after mitigation.

- The only residences within a 1km radius of the proposed PV facility are the residents of the Rietfontein East homesteads to the west and one unknown homestead to the south. Since these residents are located to west and south of the site and it is assumed that the PV panels will be oriented to the north for maximum sun exposure it is unlikely that these receptors will be impacted upon by solar glint and glare. Therefore, the potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of **low** significance, both before and after mitigation.

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

- The anticipated visual impact of the proposed PV facility on the regional visual quality (i.e. beyond 6km of the proposed infrastructure), and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance.

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 6.8.**) 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 the tables below.

Table 11: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Highveld PV Solar Facility.	
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, security lighting, workshop, power line, 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 1km 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
Use anti-reflective panels and dull polishing on structures where possible and industry standard.	Project proponent / contractor	Early in the planning 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.	Project proponent / contractor	Early in the planning phase.
Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.	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	Monitor the resolution of complaints on an ongoing basis (i.e. during all phases of the project).

Table 12: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Highveld PV Solar 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 cover adjacent to the development footprint (if present) is not unnecessarily removed during the construction phase, where possible.	Project proponent / contractor	Early in the construction phase.
Reduce the construction phase through careful logistical planning and productive implementation of resources wherever possible.	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, where possible.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas (if present/if required) immediately after the completion of construction works.	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 present 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 Highveld PV Solar Facility.

Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, 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**
Adjust tilt angles of the panels if glint and glare issues become evident where possible.	Project proponent / operator	Throughout the operation phase.

If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site.		
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 Highveld PV Solar 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

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