PROPOSED RIET FOUNTAIN SOLAR PV1 FACILITY AND ASSOCIATED GRID CONNECTION INFRASTRUCTURE, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

Produced for:

Riet Fountain Solar PV1 (Pty) Ltd

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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.

1. INTRODUCTION

Riet Fountain Solar PV1 (Pty) Ltd is proposing the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure on Portion 4 of the Farm Riet Fountain No. 6, located approximately 10km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province. The facility will have a contracted capacity of up to 100MW and will be known as Riet Fountain Solar PV1.

The project is planned as part of a cluster of renewable energy facilities known as Pixley Park, which includes three (3) additional 100MW Solar PV Facilities (Wagt Solar PV1, Carolus Solar PV1, and Fountain Solar PV1), and grid connection infrastructure connecting the facilities to the existing Hydra Substation. The projects will all connect to the new Vetlaagte Main Transmission Substation (MTS) via the Wag 'n Bietjie MTS.

Infrastructure associated with the Solar PV Facility will include the following:

- Solar PV array comprising bifacial PV modules and mounting structures, using single axis tracking technology
- Inverters and transformers
- Cabling between the panels
- Battery Energy Storage System (BESS)
- Laydown areas, construction camps, site offices
- 12m wide Access Road and entrance gate to the project site and switching station
- 6m wide internal distribution roads
- Operations and Maintenance Building, Site Offices, Ablutions with conservancy tanks, Storage Warehouse, workshop, Guard House
- Onsite 132kV IPP Substation, including the HV Step-up transformer, and MV Interconnection building
- 132kV Overhead Power Line (OHPL) – 30m height from the switching station to the Main Transmission Substation (MTS) located on farms Vetlaagte and Wagt, which is to be handed back to Eskom (a separate EA is being applied for in this regard)
- Extension of the 132kV Busbar at the MTS
- 132kV Feeder Bay at the MTS
- Extension of the 400kV Busbar at the MTS
- Installation of a new 400/132kV Transformer and bay at the MTS

A development footprint of approximately 300ha has been identified within the broader project site (approximately 8 200ha in extent), by the developer for the development of the Riet Fountain Solar PV1 Facility, which is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes.

It is the developer's intention to bid the proposed project under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme (or similar 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, in line with the objectives of the Integrated Resource Plan (IRP), with Riet Fountain Solar PV1 set to inject up to 100MW into the national grid.

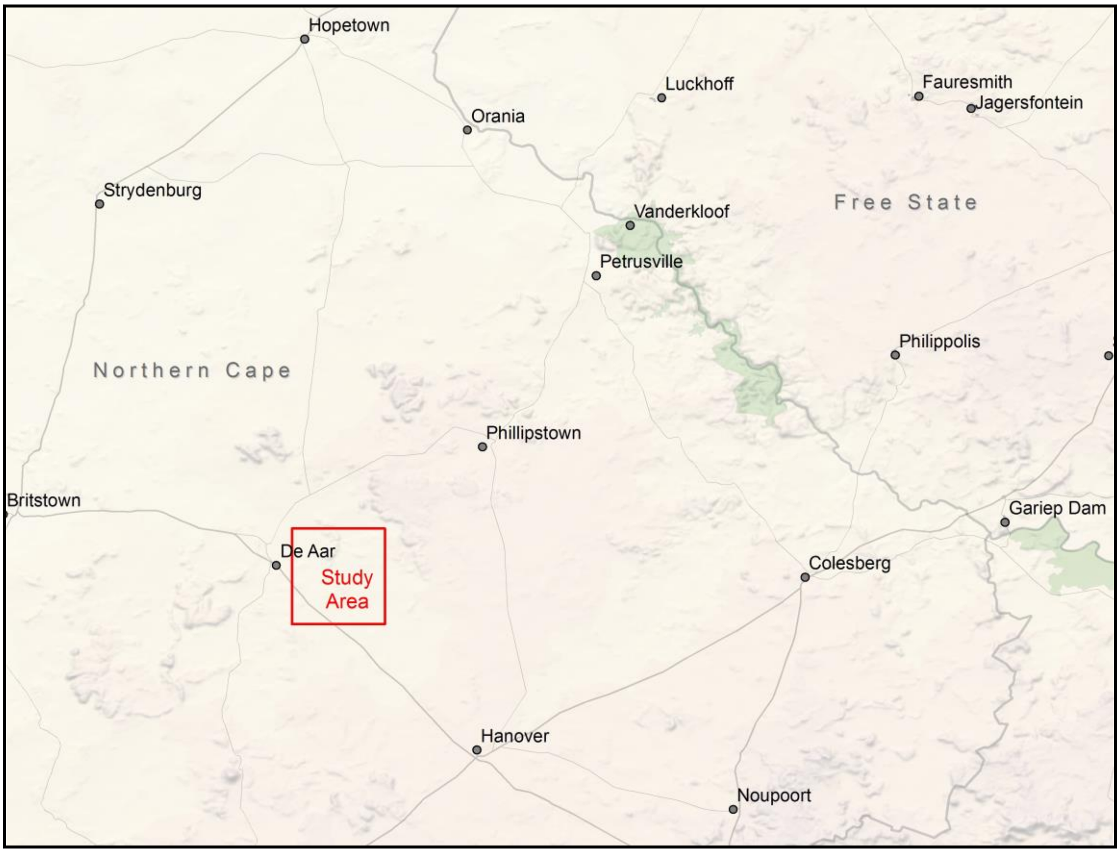


Figure 1: Regional locality of the study area.

The PV facility will take approximately four months to construct and the operational lifespan of the facility is estimated at up to 30 years.

The proposed properties identified for the PV facility and associated infrastructure are indicated on the maps within this report. Sample images of similar PV technology and Battery Energy Storage System (BESS) 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*).

Figure 4: Aerial view of a BESS facility (*Photo: Power Engineering International)*.

Figure 5: Close up view of a BESS facility *(Photo: Greenbiz.com).*

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 382km² (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 proposed project site.

The study area includes the Hydra Substation, a section of the N10 national road, and a number of farm dwellings or homesteads.

3. 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.

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

- The creation of a detailed digital terrain model of the potentially affected environment.

- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.

- The identification of sensitive environments or receptors upon which the proposed facility could have a potential impact.

- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures and activities.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Riet Fountain Solar PV1 Facility from a desktop level.

4. THE AFFECTED ENVIRONMENT

The properties for the Pixley Park Cluster of Renewable Energy Facilities are located about 10km east of the town of De Aar within the Emthanjeni Local Municipality. Regionally, the study area is located about 44km east of Britstown, 37km north-west of Hanover and about 67km north of Richmond within the Northern Cape Province.

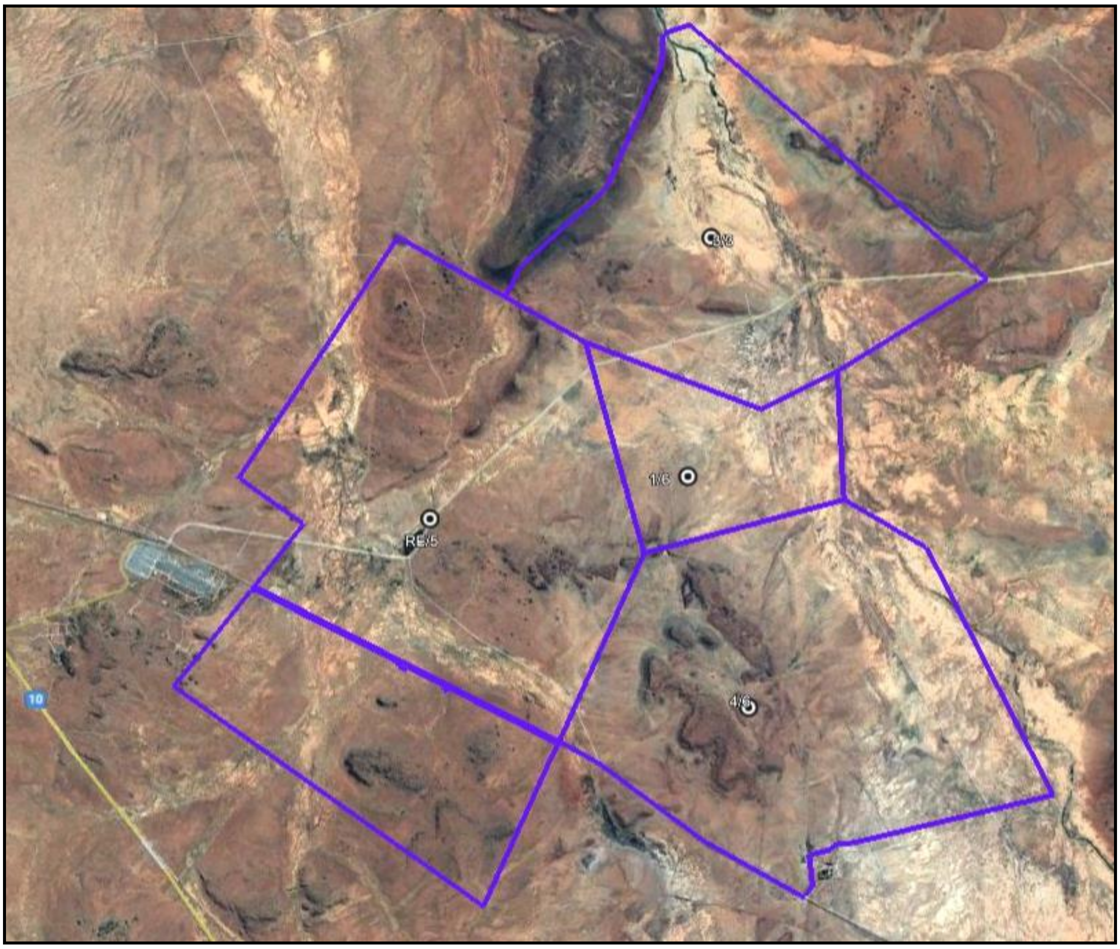


Figure 6: Pixley Park Cluster of Renewable Energy Facilities properties.

The study area occurs on land that ranges in elevation from approximately 1,230m above sea level (along the Brak River to the north-west) to 1,560m at the top of the hill north west of the properties. The terrain surrounding the proposed properties is generally flat, sloping gently to the north and south-west towards the Brak River. A few farm dams are present in the broader area.

The Brak River bisects the north-eastern part of the properties, and two water bodies are located within or near the property boundaries. The terrain type of the region is relatively homogenous and is described as predominantly *lowlands with hills*. Some prominent hills and ridges occur in the study area - a small range of hills lies along the north-western border of the properties, refer to **Map 1**.

De Aar is a primary commercial distribution centre for a large area of the central Great Karoo. Major economic activities of the area include wool production and livestock farming. The area is also popular for hunting.

The study area is sparsely populated outside of the De Aar urban area (i.e. less than two people per km^2 within the district municipality). De Aar is the third largest town in the Northern Cape with a population density of 30-100 people per km^2. In addition to De Aar, a number of isolated homesteads occur throughout the study area. Some of these in the study area include:

- Hartebeeshoek[1]
- Rietfontein
- Riet
- Bloemhof
- Rusoord
- Merino
- Caroluspoort
- Vetlaagte
- Ebenezer
- Wag-'n-Bietjie

Figure 7: Topography and vegetation of the region.
Note the hills in the background and flat landscape in the middle and foreground.

The N10 national road traverses the study area from the N1 national road (near Hanover) to De Aar. Rail infrastructure is prominent in the area, with De Aar representing the second most important railway junction in South Africa. Lines run from the north, west, south and the south east, converging in the town. These lines include both freight and passenger lines.

Other industrial infrastructure within the study area includes the Hydra (to the west of the proposed Pixley Park properties) and Bletterman Substations. The Hydra Substation road provides access to the Pixley Park properties from the N10

[1] The names listed below are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

national road. There is a significant network of power lines extending in all directions from these substations. Some of these include:

- Hydra/Perseus 2 and 3 400kV
- Beta/Hydra 1 400kV
- Hydra/Ndhlovu 1 132kV
- Hydra/Roodekuil 1 132kV
- Hydra/Roodekuil 2 220kV
- Hydra/Ruigtevallei 1 and 2 220kV
- Bletterman/Taaibos 1 132kV
- Hydra/Poseidon 1 and 2 400kV

Figure 8: The Hydra Substation in the west of the study area.

Figure 9: Power line infrastructure along the N10 national road.

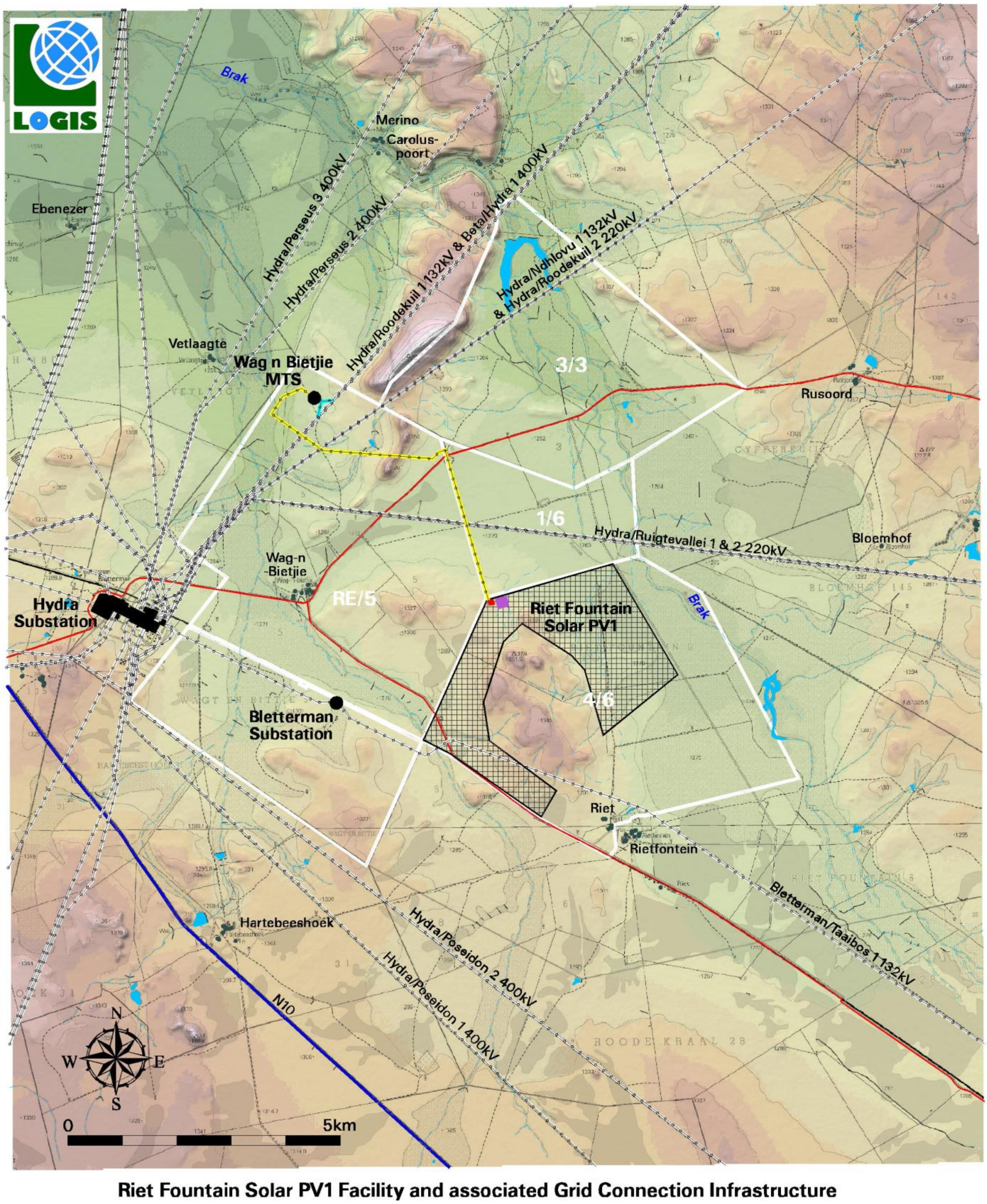
The climate within the region is semi-arid, with the study area receiving between 320mm and 433mm of rainfall per annum. Land cover is primarily *shrubland* with patches of *grassland* and *bare rock and soil* in places. Some *wetland* and *degraded land* is evident along the water courses. Vegetation types include

Northern Upper Karoo on the flat terrain within the study area, and *Besemkaree Koppies Shrubland* on the more elevated terrain and hills. Refer to **Map 2.**

Despite the significant industrial type infrastructure in and around the town of De Aar and at the Hydra Substation, the greater landscape of the study area is characterised by wide-open spaces and otherwise very limited development. It should however be noted that there are a number of authorised (and current) renewable energy applications within the study area and the greater region, that may change the landscape to some degree in the future. There are no formally protected or conservation areas within the study area. [2]

Figure 10: Landscape character of the study area showing undeveloped wide open spaces interspersed with power lines.

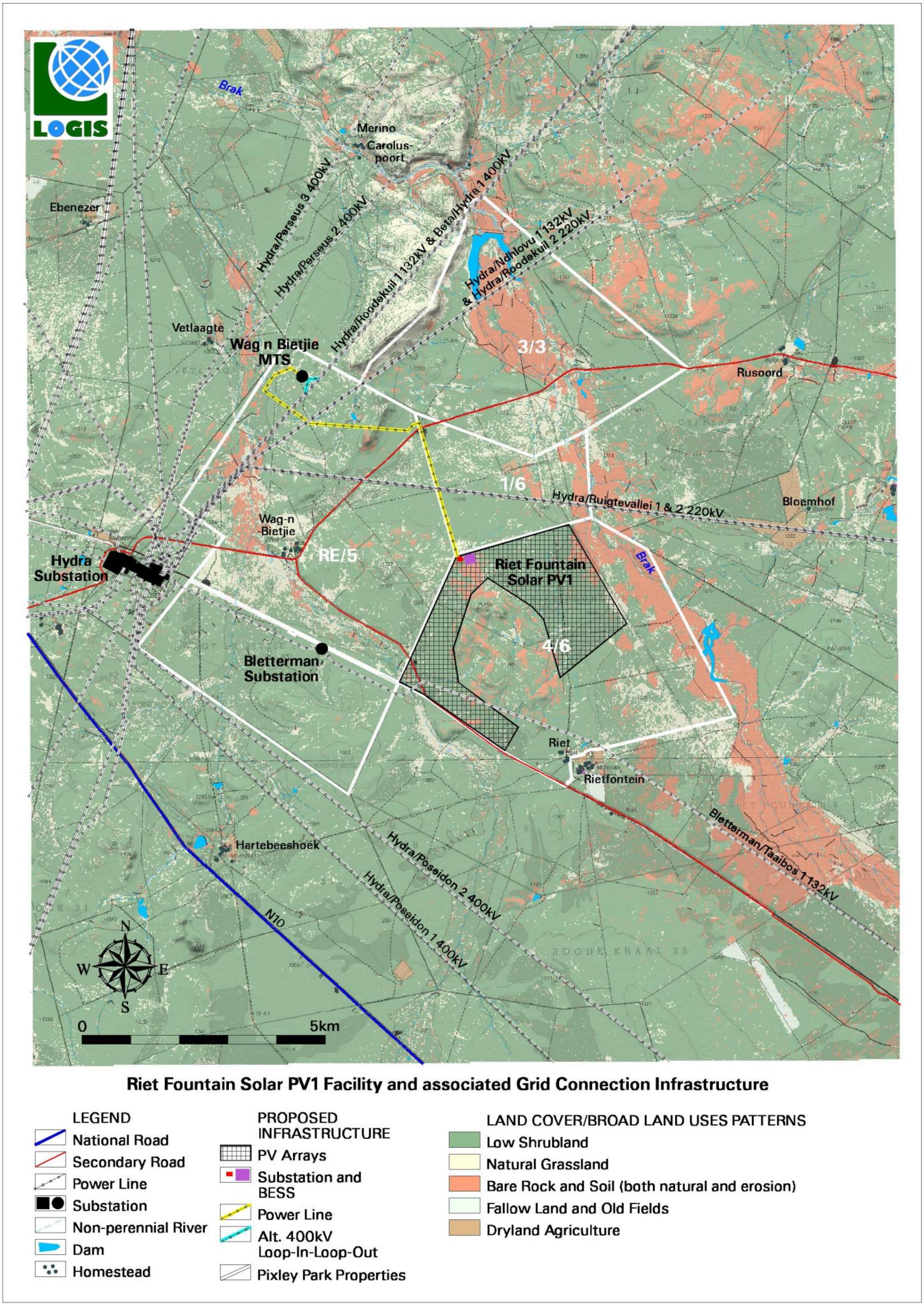
[2] Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021 (DFFE), Wikipedia.



Riet Fountain Solar PV1 Facility and associated Grid Connection Infrastructure

LEGEND	PROPOSED INFRASTRUCTURE	SHADED RELIEF Elevation above sea level (m)
National Road	PV Arrays	1230, 1240, 1250, 1260, 1270
Secondary Road	Substation and BESS	1280, 1290, 1300, 1310, 1320
Power Line	Power Line	1330, 1340, 1350, 1360, 1370
Substation	Alt. 400kV Loop-In-Loop-Out	1380, 1390, 1400, 1410, 1420
Non-perennial River	Pixley Park Properties	1430, 1440, 1450, 1460
Dam		
Homestead		

Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

5. VISUAL EXPOSURE/VISIBILITY

The result of the viewshed analysis for the proposed Riet Fountain Solar PV1 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 and BESS) associated with the facility.

The viewshed analysis will be further refined once a preliminary and/or final layout is completed and will be regenerated for the actual position of the infrastructure on the site and actual proposed infrastructure during the EIA phase of the project.

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.

Results

The Riet Fountain PV facility is expected to have a large area of visual exposure, due to the placement of the proposed infrastructure on more elevated terrain, surrounding a hill. Longer distance visual exposure to the north is shielded by the hills and ridges located north of the proposed development footprint. Exposure to the north-east is similarly obstructed by higher–lying ground.

The following is evident from the viewshed analyses:

0 – 1km

The PV facility may be highly visible within a 1km radius of the proposed development. There are no residences (homesteads) located within this zone, just a section of secondary road traversing along the south-western perimeter of the proposed PV facility. Observers travelling along this road will be highly exposed to the project infrastructure.

1 – 3km

This zone contains two homesteads and sections of the abovementioned secondary road. Other than these homesteads and sections of road, the rest of the visually exposed areas fall within vacant farmland or natural open space. It is expected that the PV facility would be clearly visible from both the homesteads and the exposed sections of road.

3 - 6km

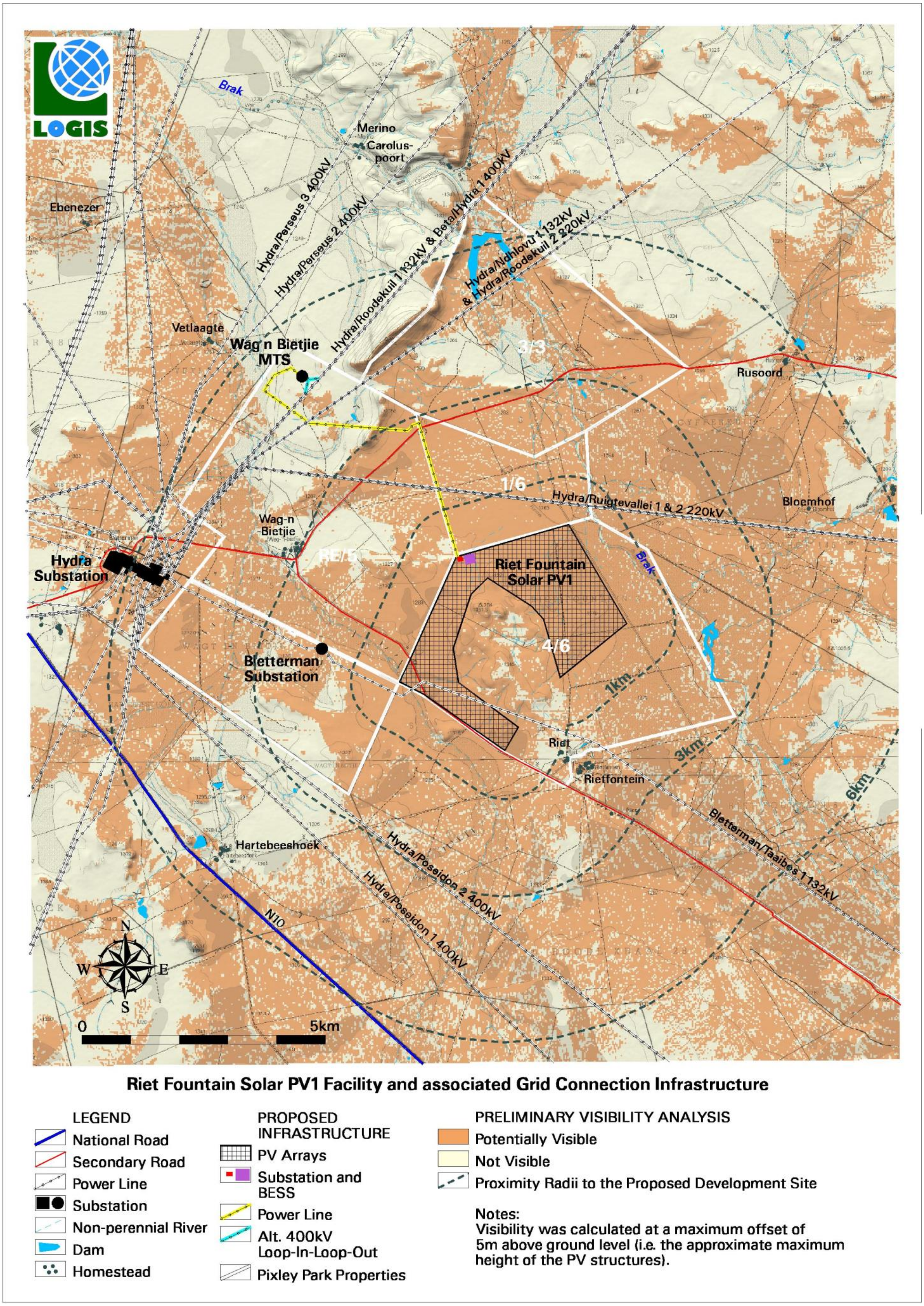
Within a 3 – 6km radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography. Most of this zone falls within vacant open space and agricultural land, but does include the Rusoord and Bloemhof homesteads. The PV facility may be visible from these homesteads. The N1 national road, located almost 6km south-west of the proposed development site, may have brief *in transit* visual exposure of the PV facility.

> 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. This zone contains the Vetlaagte homestead to the north-west.

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 farm dwellings mentioned above, as well as observers travelling along the roads in closer proximity to the facility.



Map 3: Map indicating the potential (preliminary) visual exposure of the proposed PV facility.

6. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

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 road in closer proximity to the proposed infrastructure.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the farm residences in closer proximity to the proposed development.
- 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/facilities (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e. internal access roads, buildings, power line, 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 placement of the PV facility within an area where various solar energy generation applications have been authorised, or are still being assessed.
- 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 potentially constitute a visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

Table 1: Impact table summarising the potential primary visual impacts associated with the proposed PV facility.

Impact
Visual impact of the facility on observers in close proximity to the proposed PV facility infrastructure and activities. Potential sensitive visual receptors include: • Residents of homesteads and farm dwellings (in closer proximity to the facility)

<table>
<tr><td colspan="4">

- Observers travelling along the secondary roads traversing near the proposed developments

</td></tr>
<tr><th>Issue</th><th>Nature of Impact</th><th>Extent of Impact</th><th>No-Go Areas</th></tr>
<tr><td>The viewing of the PV facility infrastructure and activities</td><td>The potential negative experience of viewing the infrastructure and activities within a predominantly undeveloped setting</td><td>Primarily observers situated within a 3km radius of the facility</td><td>N.A.</td></tr>
<tr><td colspan="4">

Description of expected significance of impact

Extent: Local
Duration: Long term
Magnitude: Moderate to High (depending on observer proximity)
Probability: Probable
Significance: Moderate to High
Status (positive, neutral or negative): Negative
Reversibility: Recoverable
Irreplaceable loss of resources: No
Can impacts be mitigated: Yes

</td></tr>
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Gaps in knowledge & recommendations for further study

A finalised layout of the PV facility and ancillary infrastructure are required for further analysis. This includes the provision of the dimensions of the proposed structures and ancillary equipment.

Additional spatial analyses are required in order to create a visual impact index that will include the following criteria:

- Visual exposure
- Visual distance/observer proximity to the structures/activities
- Viewer incidence/viewer perception (sensitive visual receptors)
- Visual absorption capacity of the environment surrounding the infrastructure and activities

Additional activities:

- Identify potential cumulative visual impacts
- Undertake a site visit
- Recommend mitigation measures and/or infrastructure placement alternatives

Refer to the Plan of Study for the EIA phase of the project below.

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7. CONCLUSION AND RECOMMENDATIONS

The fact that some components of the proposed Riet Fountain Solar PV1 Facility and associated infrastructure may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 3km buffer zone from the facility need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the core PV facility as well as for the ancillary infrastructure, as these structures (e.g. the BESS structures) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows:

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 must be 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 detailed 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 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 the VIA report.

- **Site visit**

Undertake a site visit in order to collect a photographic record of the affected environment, 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.

8. REFERENCES/DATA SOURCES

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