PROPOSED ALLEPAD PV THREE SOLAR ENERGY FACILITY, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

Produced for:

ILEnergy Development (Pty) Ltd

On behalf of:

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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 - previously PLATO), 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 book 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).

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To whom it may concern

DECLARATION OF INDEPENDENCE

I, Lourens Martinus du Plessis (t/a LOGIS), hereby confirm my independence as a specialist and declare that I don't have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal relating to the proposed Allepad PV Solar Energy Facility (SEF) project.

I further declare that I was appointed as a Visual Impact Assessment (VIA) specialist by Savannah Environmental (Pty) Ltd and will not, other than fair remuneration for work performed, benefit from the outcome of the project decision-making.

_____
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1. INTRODUCTION

ILEnergy Development proposes the development of Allepad PV Three, a commercial solar PV energy generation facility and associated infrastructure on a site near Upington, in the Northern Cape Province. The project is intended to be bid into the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating power generated by the project into the Eskom national electricity grid.

The project is proposed on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington. The area under investigation is approximately 3,889ha in extent and comprises a single agricultural property. The project site can be accessed directly via the N10 national road which borders the southern boundary of the site.

Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of fixed-tilt, single-axis tracking, or double-axis tracking PV technology. The solar energy facility will comprise the following key infrastructure components:

- Arrays of PV panels with a generation capacity of up to 100MW.
- Mounting structures to support the PV panels.
- Combiner boxes, on-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and power transformers.
- An on-site substation up to 0.5ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line approximately 5km in length, between the on-site substation and Eskom grid connection point.
- Cabling between the project's components (to be laid underground where practical).
- Meteorological measurement station.
- Energy storage area of up to 2ha in extent.
- Access road and internal access road network.
- On-site buildings and structures, including a control building and office, ablutions and guard house.
- Perimeter security fencing, access gates and lighting.
- Temporary construction equipment camp up to 1ha in extent, including temporary site offices, parking and chemical ablution facilities.
- Temporary laydown area up to 1ha in extent, for the storage of materials during the construction.

Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV power line which will connect the on-site substation to the upgraded 132kV double circuit power line running between the new Upington Main Transmission Substation (MTS) (currently under construction approximately 15km south of the project site), and the Gordonia Distribution Substation (located in Upington town). The point of connection is located approximately 5km east of the project site, and will make use of a loop-in and loop-out configuration. The proposed power line required for the project will be constructed within a 150m wide power line corridor which has been identified immediately north of, and which runs parallel to, the N10 national road.

The full extent of the project site (i.e. 3 889ha) is being assessed as part of the EIA process, of which an area of approximately 250ha (equivalent to 6.4% of the total project area) would be required for the development of the solar energy facility and associated infrastructure.

The proposed project requires Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA) subject to the completion of a full Scoping and EIA process in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA) and the 2014 EIA Regulations (GNR 326).

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

Figure 2: Aerial view of PV arrays. (*Scatec Solar South Africa*).

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact.

The study area for the visual assessment encompasses a geographical area of 679km² (the extent of the maps displayed in this report) and includes a 10km buffer zone (area of potential visual influence) from the boundaries of the proposed property identified for the solar energy facility. It includes the town of

Upington (western section), sections of the N10 and N14 national roads, and a section of the R360 arterial road.

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 NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) 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 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.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Allepad PV Three Solar Energy Facility from a desktop level.

4. THE AFFECTED ENVIRONMENT

The project is proposed on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington, in the Dawid Kruiper Local Municipality, of the ZF Mgcawu District, in the Northern Cape Province.

The property has a surface area of 3,889ha, but the final surface area (development footprint) to be utilised for the facility will be smaller, and will depend on the type of technology selected, the final site layout and the placement of ancillary infrastructure. The site is located between the N10 national and the R360 arterial roads which form respectively the southern and eastern boundaries of the property. Access to the site is provided directly from the N10 national road.

The N14, N10 and R360 are the primary roads in the region and are the main link between Gauteng and Namibia, the Augrabies Falls National Park and the Kgalagadi Trans-frontier National Park.

The N10 national road also forms the northern boundary of the Upington Renewable Energy Development Zone (REDZ). Refer to **Figure 3** for the regional locality of the site in relation to the Upington REDZ. REDZ are described as:

"areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country."

Source: https://redzs.csir.co.za

Figure 3 also indicates the status of Renewable Energy Environmental Applications (REEA) within and around this REDZ (as at 2018 2nd quarter). Applications that have been approved include the Eskom Concentrating Solar Park (CSP) and the Khi Solar One SEF (already operational), with a number of applications still in process.

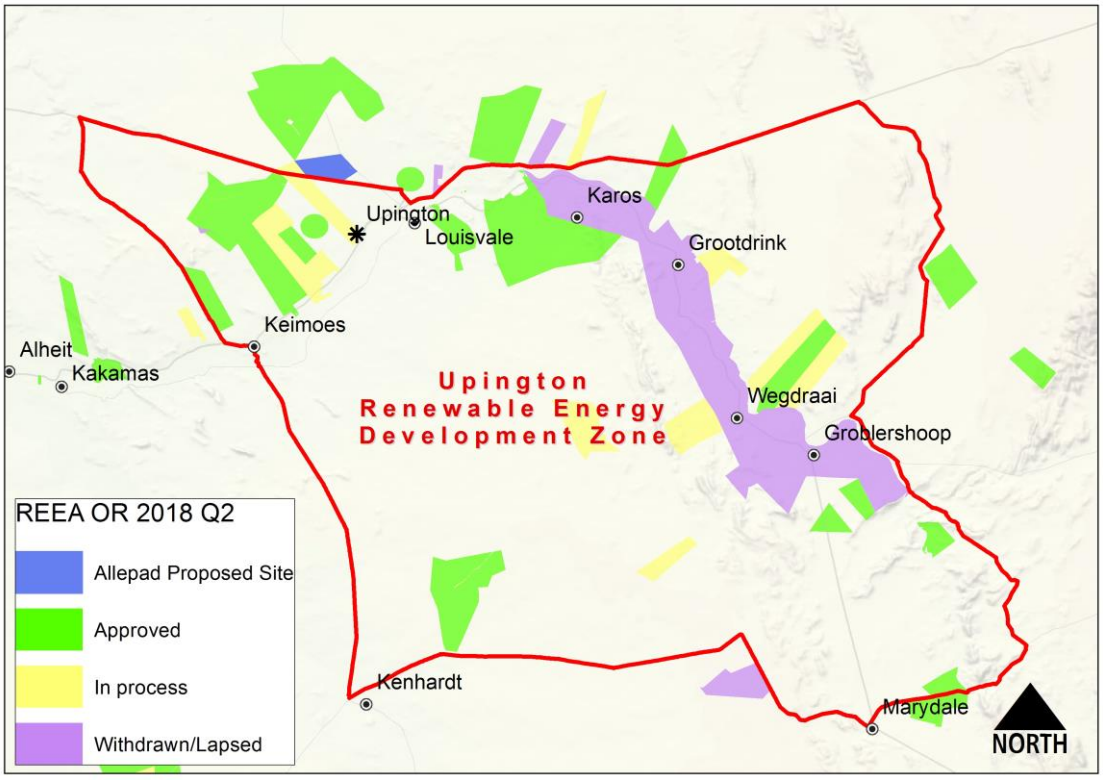


Figure 3: Regional locality of the Allepad PV Three SEF in relation to the Upington Renewable Energy Development Zone (REDZ).

The topography of the region is relatively homogenous and is described predominantly as *lowlands with hills, dune hills* and *irregular or slightly irregular plains*. Relatively prominent hills occur towards the north-east of the study area. See **Map 1** for the shaded relief/topography map of the study area.

The terrain surrounding the property is predominantly flat with an even south-eastern slope towards the Orange River valley that forms a distinct hydrological feature in the region. The Orange River has, to a large degree, dictated the settlement pattern in this arid region by providing a source of perennial water for the cultivation of grapes and other irrigated crops. This and the associated production of wine is the primary agricultural activity of this district.

Cattle and game farming practises also occur, although less intensive. An example of this is the Spitskop Farm east and adjacent to the proposed site. This farm is indicated on Google Earth as a private game farm. It is not a designated protected area in the South African Protected Areas Database (SAPAD) and it is not expected to be accessible to the public. Indications are that the farm is in the property market and not operating as a tourist lodge/destination, but rather as a private cattle and game ranch. The farm does have a rocky outcrop that appears to be (or have been) a favourite viewpoint from which to look out over the generally flat expanse surrounding it. The status and nature of operations of this farm and its facilities need to be investigated during the EIA phase of the project in order to determine its status as potential sensitive visual receptor. It is expected that this viewpoint (see **Figure 5**) would be quite exposed to the

proposed Allepad PV Three SEF, the other larger solar energy facilities (e.g. Khi Solar One SEF) and structures at the Upington Airport located within the region.

Another potential sensitive visual receptor may be the Kalahari Monate Lodge (see **Figure 4**) located virtually within the proposed development site. This lodge provides self-catering and camping facilities and will also need to be investigated in terms of its perception of or visual sensitivity to the proposed Allepad PV Three SEF during the EIA phase of the project.

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open expanses and vast desolation. The scarcity of water and other natural resources has dictated the settlement patterns of this region. The population distribution is primarily concentrated in Upington and the smaller towns/settlements along the Orange River. There are a very limited number of farm residences or homesteads within the remaining part of the study area.

Vegetation cover in this semi-desert region is predominantly restricted to *low shrubland*, described as *Kalahari Karroid Shrubland* and *Gordonia Duneveld*. Planted vegetation in the form of vineyards and cotton fields is found along the Orange River floodplain. See **Map 2** for the broad land cover types map of the study area. Of note is the occurrence of a dry riverbed or seasonal wetland (pan) on the eastern section of the proposed development site.

Linear infrastructure, besides the previously mentioned roads, includes a railway line traversing south of the property and a number of 132kV overhead power lines. Some of these include:

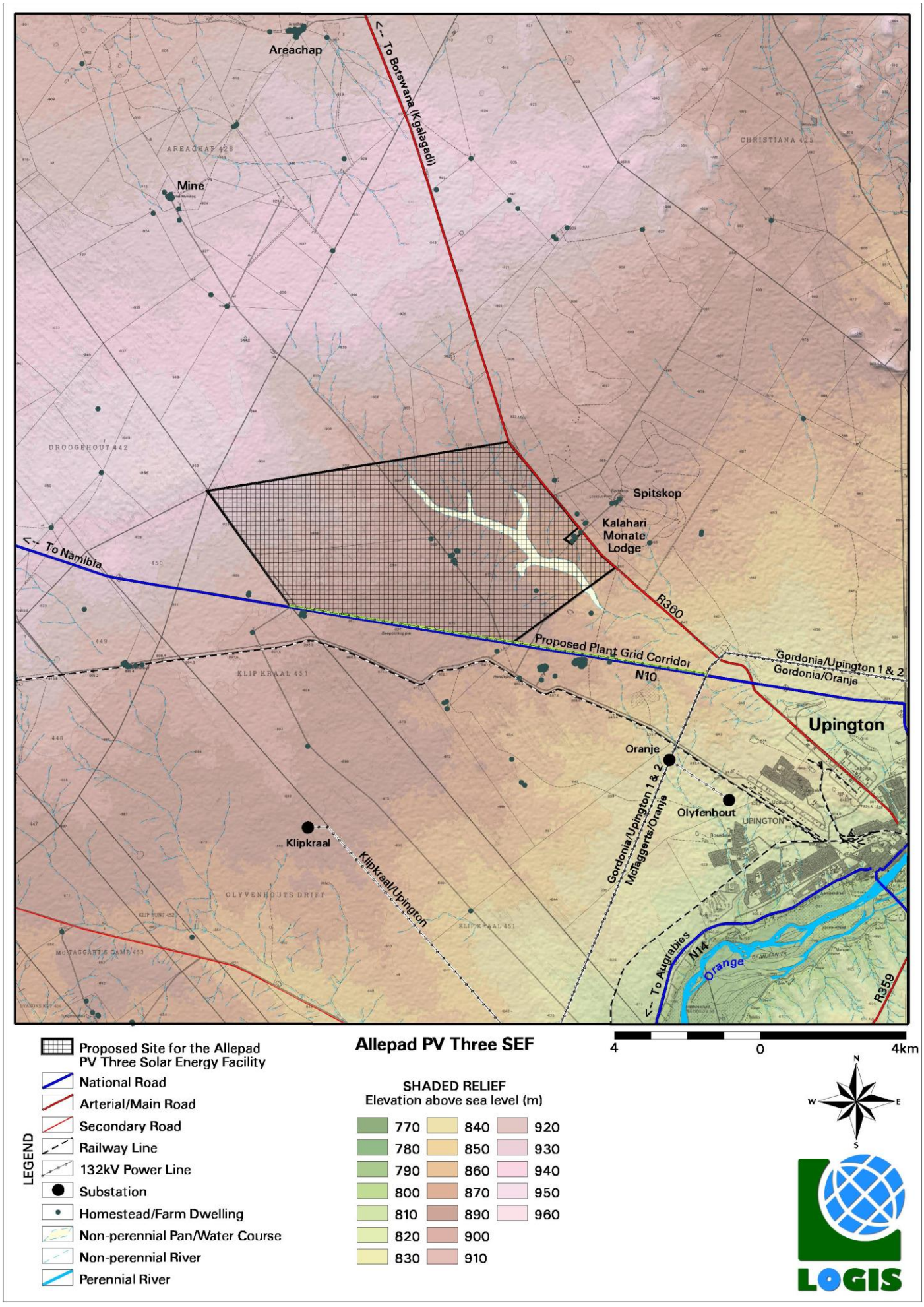
- Gordonia to Upington 1 and 2
- Gordonia to Oranje
- Gordonia to Upington
- McTaggerts to Oranje
- Klipkraal to Upington

Sources: DEA (ENPAT Northern Cape), NLC2013-14, the South African Renewable Energy EIA Application Database and NBI (Vegetation Map of South Africa, Lesotho and Swaziland).

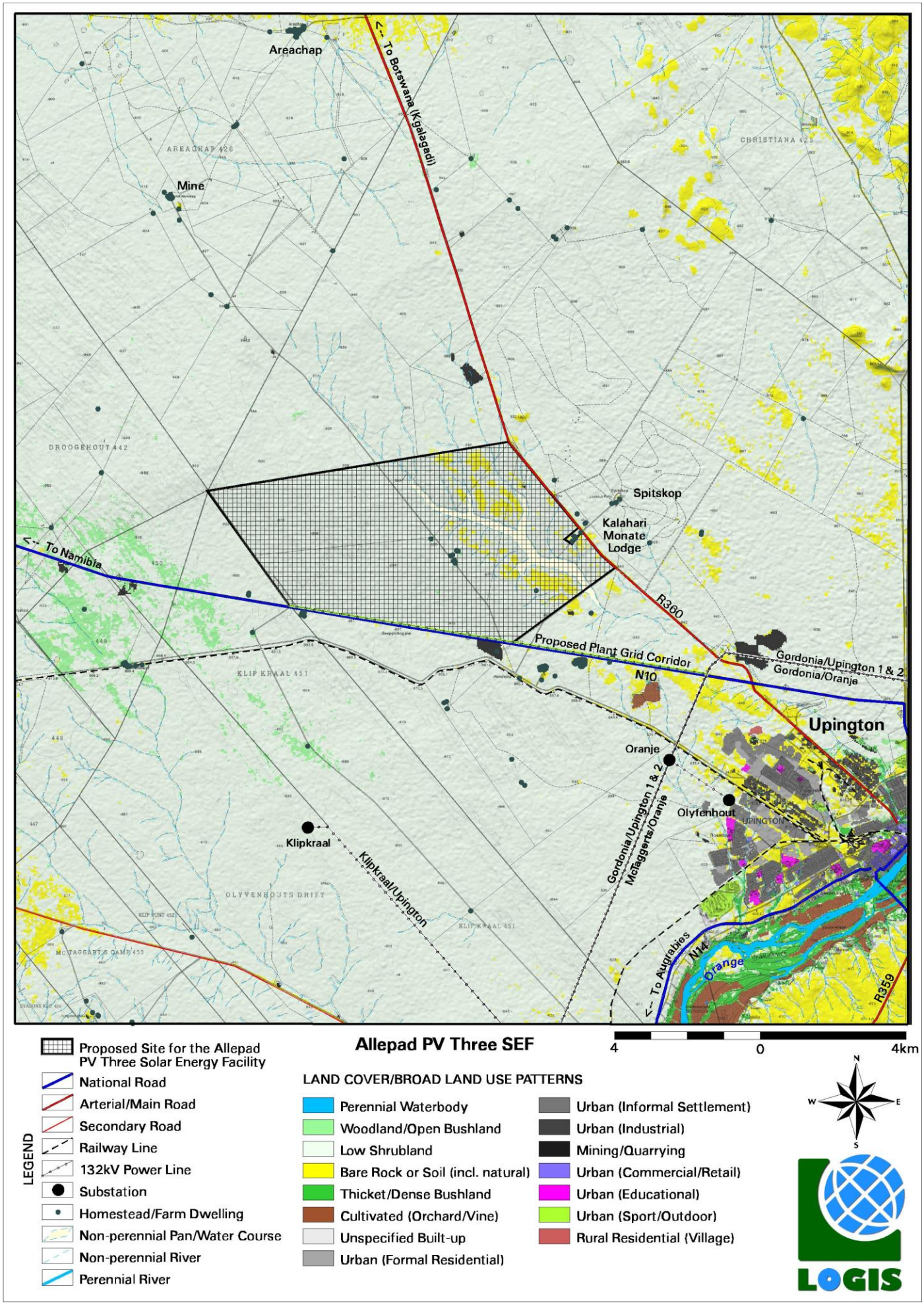
Figure 4: Accommodation and antelope at the Kalahari Monate Lodge. (Source and photo credit: Google Earth, Kobus du Toit).

Figure 5: View from the Spitskop Farm viewpoint looking to the south-west (Source and photo credit: Google, Ibrahim Jarad).

Figure 6: Spitskop farm, with koppie (hill) and cattle watering point (photo supplied by project proponent).



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 preliminary viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The initial viewshed analysis was undertaken from 976 vantage points within the proposed development area at an offset of 4m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels) associated with the facility.

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

Map 3 also indicates proximity radii from the proposed site boundaries of the proposed facility 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 or existing structures on the exposure of the proposed SEF, therefore signifying a worst-case scenario.

Results

The proposed Allepad PV Three Solar Energy Facility is expected to have a fairly contained core area of visual exposure, generally restricted to a 2km radius of the site. Receptors located within this zone include observers at Monate Lodge, visitors to the lookout point on Spitskop Farm and observers travelling along the N10 national and R360 arterial roads.

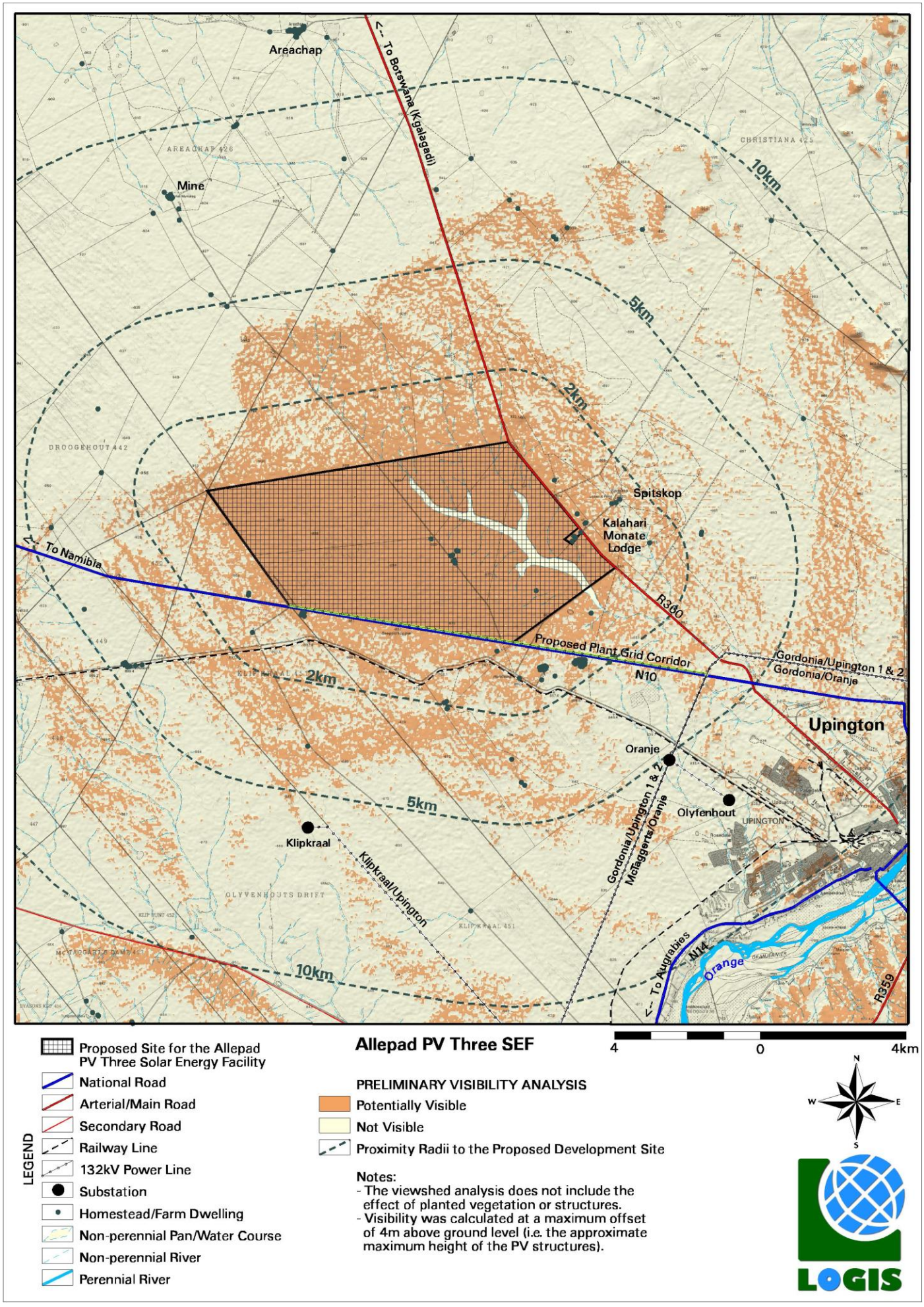
Visibility beyond 2km is more scattered and interrupted due to the undulating nature of the topography and the generally constrained height of the PV panel structures. The exposure of the facility is largely restricted to vacant land and natural open space.

The intensity of visual exposure is expected to subside beyond a 5km radius with the predominant visibility expected to the east. This zone includes limited potentially sensitive visual receptors and comprises mainly vacant land and natural open space. The SEF may theoretically be visible from the north-western outskirts of Upington, but this exposure will be at distances exceeding 7.5km.

Visibility beyond 10km from the proposed development is expected to be negligible and highly unlikely due to the distance between the object (development) and the observer.

Conclusion

It is envisaged that the structures, where visible from shorter distances (e.g. less than 2km), may constitute a high visual prominence, potentially resulting in a high visual impact.



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

6. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed PV Solar Energy Facility include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the N10 national and R360 arterial roads traversing adjacent to the proposed facility.

- The visibility of the facility to, and potential visual impact on sensitive receptors (such as guests residing at the Kalahari Monate Lodge, and potentially residents of farm residences located within close proximity of the site).

- Potential cumulative visual impacts (or alternately, consolidation of visual impacts) with specific reference to the potential construction of up to four PV SEFs on the site and other existing or authorised SEFs within close proximity to the development site and within the Upington REDZ.

- The potential visual impact of the construction of ancillary infrastructure (i.e. the substation at the facility, associated power line and access roads) on observers in close proximity of the facility.

- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.

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

- Potential visual impacts associated with the construction phase.

- The potential to mitigate visual impacts.

It is envisaged that the issues listed above may constitute a significant visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project. A detailed Visual Impact Assessment is required to be undertaken to confirm the presence of sensitive receptors and assess the significance of the potential visual impact.

Table 1: Impact table summarising the potential primary visual impacts associated with the Allepad PV Three Solar Energy Facility.

Impact

Visual impact of the SEF on observers in close proximity to the proposed structures. Potential sensitive visual receptors include:

- Observers travelling along the N10 national and R360 arterial roads
- Visitors to the Monate Lodge
- Residents of homesteads and farm dwellings (if present in close proximity to the facility – see *Extent of Impact* below)

Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the PV arrays and associated infrastructure	The potential negative experience of viewing the structures within a relatively natural setting	Predominantly observers situated within a 2km radius of the structures	The dry water course/seasonal wetland on site should be avoided (this water feature may, for a part of rainy season, attract birds that may by be a visual attraction to visitors to the Monate Lodge)

Description of expected significance of impact

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

Gaps in knowledge & recommendations for further study

A layout of the SEF and proposed solar technology are required for further analysis.

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
- Viewer incidence/viewer perception (sensitive visual receptors)
- Visual absorption capacity of the environment surrounding the structures

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.

7. CONCLUSION AND RECOMMENDATIONS

The fact that some components of the proposed facility may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 2-5km 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 facility as well as for the ancillary infrastructure, as these structures (e.g. the substation and power line) 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:

- **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 5m contour interval digital terrain model of the study area.

The first step in determining the significance of 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 must be 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 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 would be exposed to the project infrastructure.

This is done in order to focus attention on areas were 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, national parks, 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 discernable 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 will be used to perform the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Site visit**

Undertake a site visit in order to verify the results of the spatial analyses, verify the present of sensitive receptors, and to identify any additional site specific issues that may need to be addressed in the VIA report.

- **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 is displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred layout 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.

8. REFERENCES/DATA SOURCES

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