PROPOSED
ERGO MINING SOLAR ENERGY (PV) PROJECTS
PHASE 2: 40MW

EKURHULENI METROPOLITAN MUNICIPALITY, GAUTENG

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

Produced for:

Tshedza 3 Investments (Pty) Ltd

On behalf of:

Produced by:

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

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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. 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 Gauteng Province).

1. INTRODUCTION

Tshedza 3 Investments (Pty) Ltd (Hereafter referred to as Tshedza 3) is proposing the construction of a photovoltaic (PV) solar energy facility (SEF) at the Ergo Mining Brakpan Plant located in the Ekurhuleni Metropolitan Municipality of the Gauteng Province. The site is located approximately 6km south of the Brakpan central business district (see **Figure 1**). The SEF will comprise arrays of PV panels and will have a contracted capacity of up to 40MW. The electricity generated is intended to supply the Ergo Mining Brakpan Plant and the Brakpan/Withok Tailings Dam facility, but surplus electricity may be provided to other mines in the area.

The properties identified for the PV Plant include:

- Remaining Extent of Portion 183 of the Farm Witpoortjie 117;
- Portion 283 of the Farm Witpoortjie 117;
- Portion 272 of the Farm Witpoortjie 117;
- Portion 9 of the Farm Withok 131; and
- Holdings 203-208, 240-245, 296-303 and 348-355 Withok Estates T0IR0737.

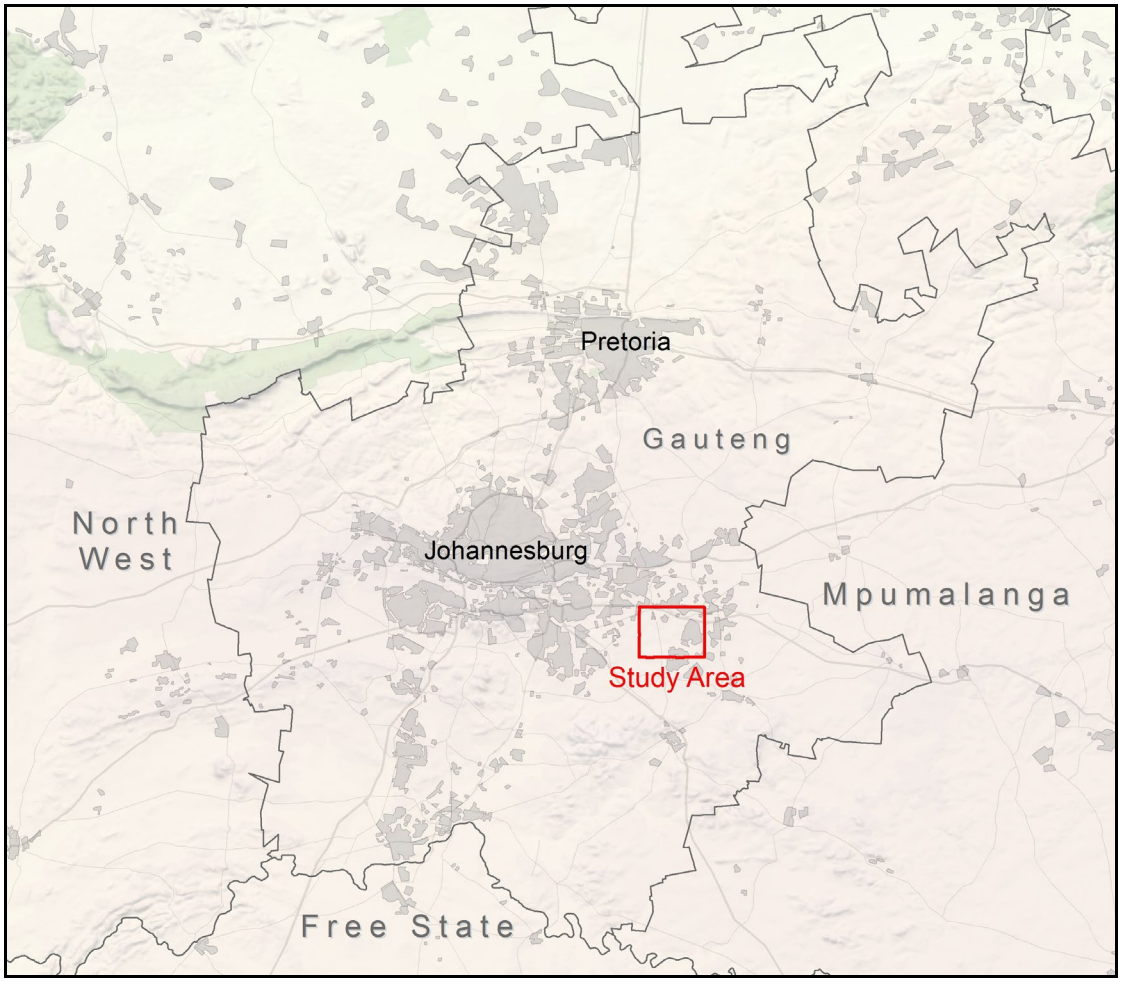


Figure 1: Regional locality of the study area.

The proposed project will have a contracted capacity of up to 40MW, and will make use of PV solar technology for the generation of electricity. The project will comprise a solar field, with a solar PV array footprint with the following key infrastructure and components:

- PV modules and mounting structures
- Inverters and transformers
- Onsite substation
- Cabling between the project components
- Internal access roads

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

Admin block comprising of:

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

The PV Plant 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 Plant 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*).

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the potential visual impact of the Tshedza 3 Solar Energy (PV) Projects, Phase 2: 40MW as described above.

The study area for the visual assessment encompasses a geographical area of approximately 135km² (the extent of the full page maps displayed in this report) and includes a 6km buffer zone (area of potential visual influence) from the proposed development footprint.

The study area includes mixed mining (ERGO Mining), industrial (Vulcania), agricultural and residential land uses (Sunair Park, KwaThema, Geluksdal, etc.), and sections of the N17 national and R23 arterial roads.

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 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 Tshedza 3 Solar Energy (PV) Projects, Phase 2: 40MW from a desktop level.

4. THE AFFECTED ENVIRONMENT

The properties identified for the proposed PV Plant is located approximately 6km south of Boksburg, within the ERGO Mining property. The properties are located within an area with a mixed land use character that includes mining, industrial areas, high density residential areas, as well as low density small holdings and farm land.

The entire proposed project site is currently zoned as mining or agriculture.

Refer to **Figure 4** below for the properties identified for the proposed PV Plant.

The topography of the study area is relatively flat and homogenous, consisting predominantly of *plains*. The elevation ranges from 1,540m above sea level (a.s.l.) in the south-west to 1,670m a.s.l. north of the ERGO Mining Brakpan Plant. The proposed PV Plant site is located at an average elevation of 1,614m a.s.l. and has an even slope to the south-west. There are no prominent hills within the study area and the most prominent topographical features are the slimes dams (tailings dams) associated with the mining activity in the area.

The most prominent hydrological features are the Rietspruit perennial river to the west and the non-perennial Withokspruit traversing from east to west across the study area. Other than these rivers there are a number of mine and farm dams located within the region, as well as wetlands along the floodplains of these rivers.

Land use within the study area is indicated as *mixed use*, with a varied urban (residential), mining, industrial and agricultural character. The main populated places include KwaThema (White City, Masimini and Thembilisha), Minnebron, Sunair Park, Dal Park and Geluksdal. The Withok Agricultural Holdings (or small holdings) are located immediately south and west of the proposed PV Plant properties and the Witpoort Estate Agricultural Holdings to the north of the properties. Existing industrial areas include the Vulcania industrial area and Vulcania South industrial area east of the mine. The Labore industrial area is located north of Geluksdal near the Ergo Transfer Pumps Substation.

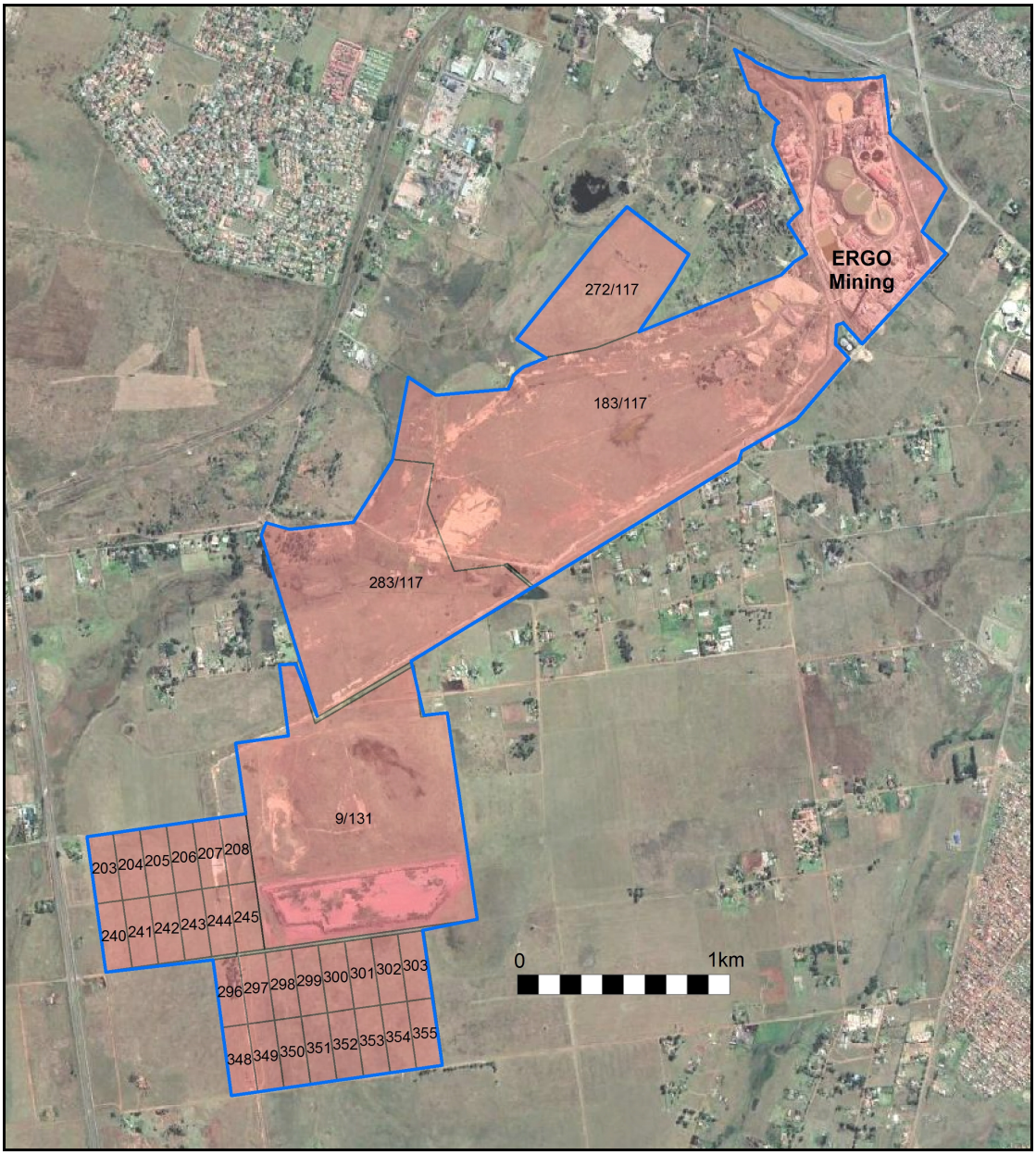


Figure 4: Aerial view of the properties identified for the proposed PV Plant.

The study area is largely transformed by human settlements, industrial activities, and agricultural and mining land uses. The natural land cover is grassland (*Tsakane Clay Grassland* and *Soweto Highveld Grassland* vegetation types) that is in varying stages of degradation, i.e. it could include recovering grassland on old agricultural fields (to be read with flora specialist report). Besides the grassland and agricultural fields there are also a variety of planted pastures or grass, associated with the small holdings in the area.

The main access routes to the region include the N17 national road, the R23 and R554 arterial roads, and a number of lower order secondary roads and streets. Access to the site, from the N17, is along the Ergo Road, 17th road and 10th Street. These roads will lead you to the Withok Small Holdings immediately south of the proposed development site. The latter road traverses adjacent to the slurry pipeline that traverses between the mine and the tailings dam.

There are no protected areas or identified tourist attractions or destinations within the study area and the visual quality of the receiving environment is largely

considered to be compromised by human activities and structures. In spite of this, the study area, especially to the south-west, still has a rural character that could be considered aesthetically pleasing.[1]

Refer to **Maps 1** and **2** for the topography and land cover maps of the study area.

Figure 5: Topography and general environment of the proposed PV Plant site and surrounds.

Figure 6: General environment along the slurry pipeline.

[1] Sources: DEAT (ENPAT Gauteng), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021_Q1 (DEA).

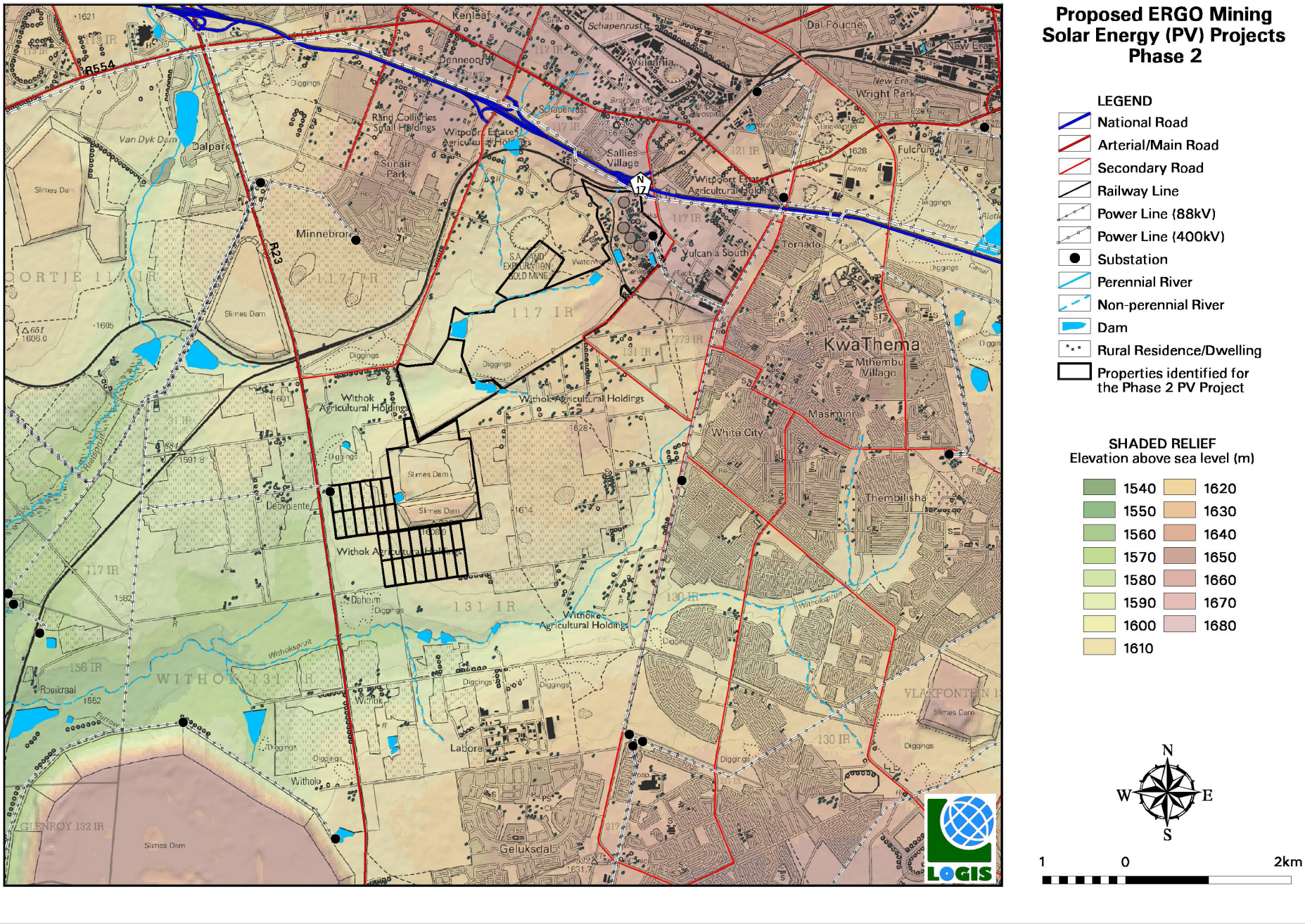
Figure 7: Withok Small Holdings (left) and the proposed PV Plant project site (right).

Figure 8: Existing tailings dam at the Ergo Transfer Pumps Substation.

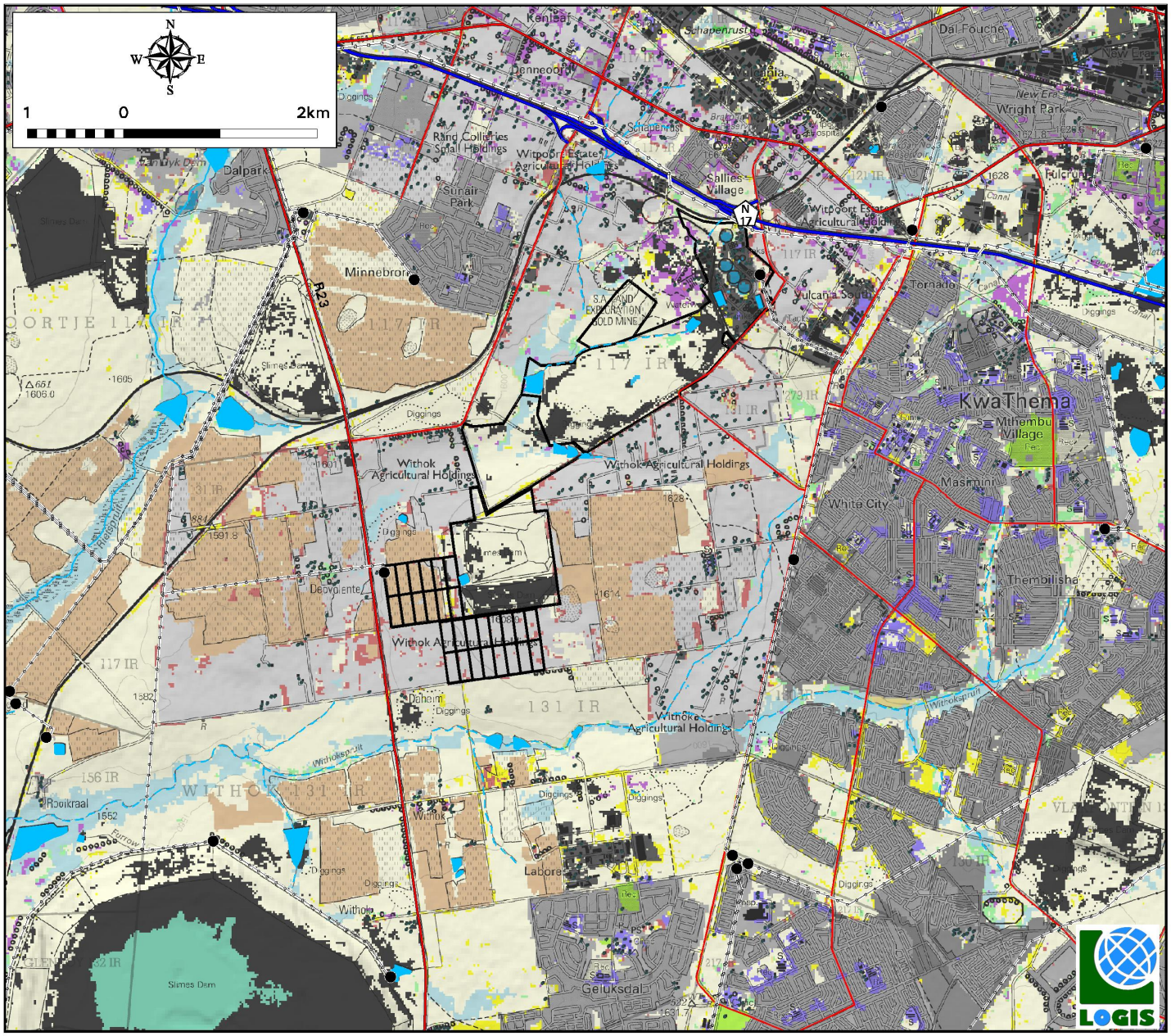
Figure 9: ERGO Gold Mine.

Figure 10: Existing slurry pipeline near the R23 arterial road.

Figure 11: Industrial/commercial land use within the study area.



Map 1: Shaded relief map of the study area.



Proposed ERGO Mining Solar Energy (PV) Projects Phase 2

LEGEND

- National Road
- Arterial/Main Road
- Secondary Road
- Railway Line
- Power Line (88kV)
- Power Line (400kV)
- Substation
- Perennial River
- Non-perennial River
- Dam
- Rural Residence/Dwelling
- Properties identified for the Phase 2 PV Project

LAND COVER/BROAD LAND USE PATTERNS

- Grassland/Old Fields
- Woodland
- Wetland
- Cultivated (Rainfed)
- Plantation
- Bare Land
- Grass (Outdoor Recreation)
- Commercial/Retail
- Rural Residential
- Small Holdings
- Residential (Formal)
- Residential (Informal)
- Industrial
- Mining
- Artificial Flooded Mine Area

Map 2: Land cover and broad land use patterns.

5. VISUAL EXPOSURE/VISIBILITY

The result of the viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The viewshed analysis was undertaken from 1,830 vantage points within the identified properties at an offset of 4m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels and inverters) associated with the facility.

It must be borne in mind that the viewshed analyses were done from vantage points distributed across all the properties, which represent a larger area (558ha) than the actual proposed development footprint (approximately 80-100ha). The viewshed area on Map 3 therefore provides a worst case scenario in terms of the visual exposure of the proposed PV Plant. It is anticipated that the ultimate visual exposure may be less, if the viewshed analyses were recreated from the more restricted development footprint area alone.

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 properties identified for the proposed structures/activities in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds.

The viewshed analysis includes the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

The development would be quite easily visible within a 1km radius of the site. This area (0 – 1km) includes sections of public roads (secondary roads, streets and the R23 arterial road) traversing within this zone. The facility is also expected to be visible from the Withok Small Holdings east, south and west of the proposed development site, as well as the Witpoort Estate Small Holdings to the north. Besides the small holdings, two additional farmsteads (Daheim and Deovolente) were also identified. These are located respectively south and west of the properties identified for the PV Plant.

Within a 1 – 3km 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/mining land, but does include some farm dwellings and residences on the abovementioned small holdings.

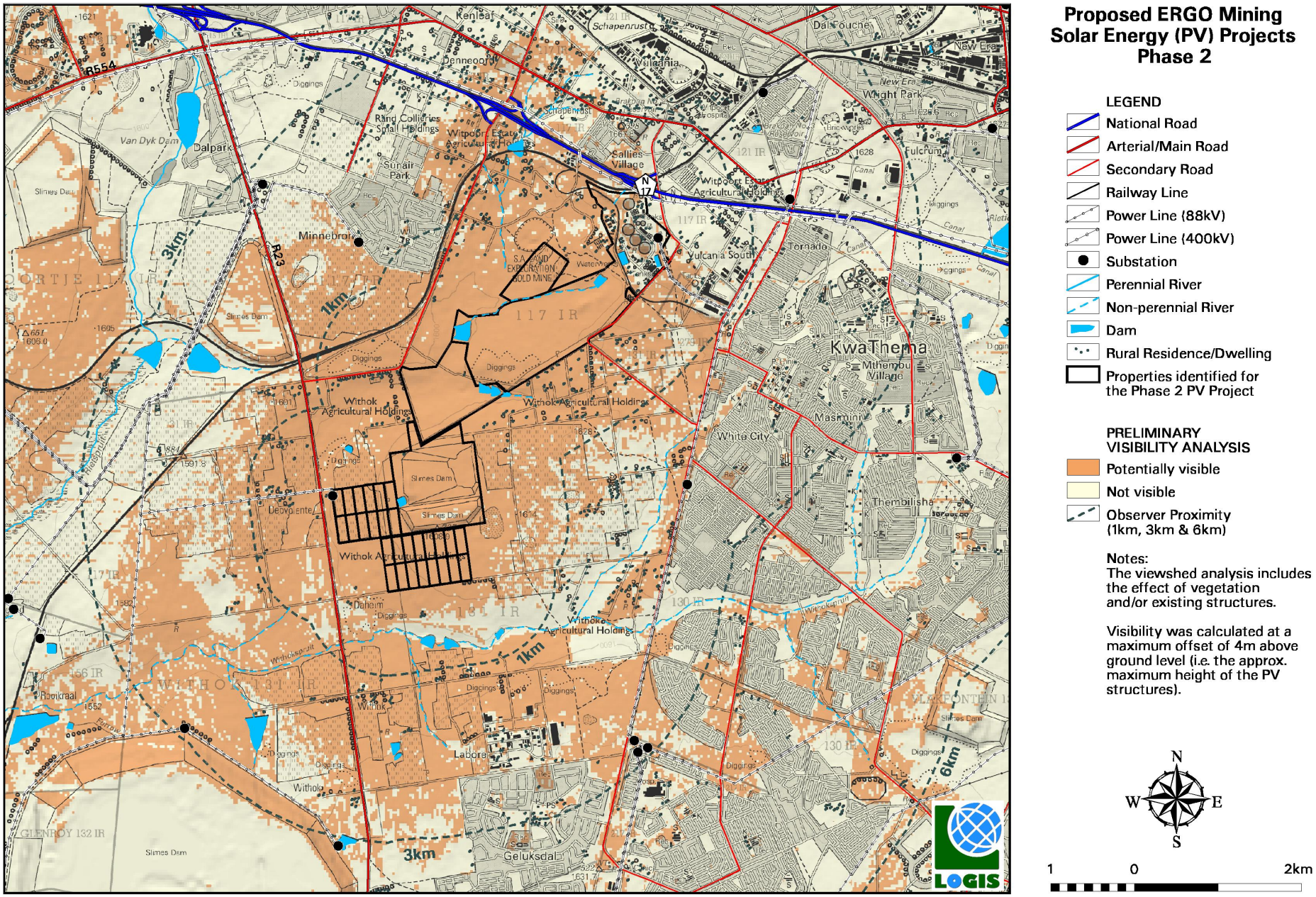
Visibility within 3 - 6km is greatly reduced and is primarily expected from higher ground (e.g. the north-facing slopes of the tailings dam) or vacant open space to the north-west.

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.

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 residing at the Withok Small Holdings (east, west and south) and at the Witpoort Estate Small Holdings, as well as observers travelling along the roads in close proximity to the facility.



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

6. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

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

- The visibility of the facility to, and potential visual impact on, observers travelling along the secondary or arterial roads within the study area.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the agricultural or small holdings 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, 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 Plant within a predominantly mining area with existing industrial structures.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential visual impact of solar glint and glare as a visual distraction and possible air travel hazard.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may potentially 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.

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

Impact

Visual impact of the facility on observers in close proximity to the proposed PV Plant infrastructure and activities. Potential sensitive visual receptors include:

- Residents of the Withok and Witpoort Estate Small Holdings
- Residents of homesteads and farm dwellings (if present in close proximity to the facility)
- Observers travelling along the secondary roads, streets and the R23 arterial road

Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the PV Plant infrastructure and activities	The potential negative experience of viewing the infrastructure and activities within a predominantly undeveloped setting	Primarily observers situated within a 3km radius of the facility	N.A.

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 finalised layout of the PV Plant 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.

7. CONCLUSION AND RECOMMENDATIONS

The fact that some components of the proposed ERGO Mining Solar Energy (PV) Projects, Phase 2: 40MW 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 Plant as well as for the ancillary infrastructure, as these structures (e.g. the substation, inverters and transformers) 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 this VIA report.

- **Site visit**

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

8. REFERENCES/DATA SOURCES

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