PROPOSED BUFFELSPOORT SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY AND ASSOCIATED GRID CONNECTION INFRASTRUCTURE, NORTH WEST PROVINCE

VISUAL IMPACT ASSESSMENT – INPUT FOR EIR

Produced for:

Buffelspoort Solar Project (Pty) Ltd

On behalf of:

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

Produced by:

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

September 2022 -

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. Introduction

This Visual Impact Assessment (VIA) report forms part of the Scoping and Environmental Impact Assessment (EIA) for the proposed Buffelspoort Solar Photovoltaic (PV) Energy Facility and Associated Grid Connection Infrastructure in the North West Province.

This VIA has been compiled for inclusion in the Environmental Impact Report (EIR) following the approval of the Scoping Report (SR).

1.3. Assumptions and limitations

This assessment was undertaken during the planning stage of the proposed Buffelspoort Solar Photovoltaic (PV) Energy Facility and Associated Grid Connection Infrastructure and is based on information available at that time.

1.4. 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.
    - 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**.

1.5. Scope of Work

During the Scoping Phase (i.e. first phase of the assessment) the scope of work included:

[1] Adapted from Oberholzer (2005).

- Creation a detailed Digital Terrain Model (DTM) for the potentially affected environment. This constituted the study area and area of analysis for the subsequent VIA (this report).
- Sourcing of relevant spatial data. This included cadastral features, land use categories, natural and topographical features, site placement, design, etc.
- Identification of sensitive environments or areas upon which the activities/infrastructure could have a potential visual impact. Critical areas were highlighted during this phase. These would be identified through, mainly (but not restricted to), the inputs from interested and affected parties.
- Undertake viewshed analyses from proposed site placement or alternatives in order to determine the visual exposure. The viewshed analyses will take into account the dimensions of the relevant structures.
- Stipulate the potential visual impacts of the Project and identify issues related to the visual impact that should be addressed during the visual impact assessment phase.
- Make recommendations to inform the design process or alternative selection.
- Provide a Plan of Study for the VIA to be undertaken during the EIA phase of the project.

During the Impact Assessment Phase (i.e. second phase of the assessment) issues that weren't resolved during Scoping phase and that required further investigation were taken forward. The determination of the potential visual impacts was undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

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

The study area for the visual assessment encompasses a geographical area of approximately 154 km² (the extent of the full-page maps displayed in this report) and includes a minimum 6 km buffer zone (area of potential visual influence) from the proposed Development Area.

The study area includes predominantly mining operations, farm land and sections of the N4 Bakwena National highway and R104 Old Rustenburg arterial road.

The scope of work for this report includes:

- Identify potentially sensitive visual receptors within the receiving environment.
- Determine the Visual Absorption Capacity of the landscape.
- Determine Visual Distance/Observer Proximity to the facility.
- Determine Viewer Incidence/Viewer Perception.
- Determine Significance of identified impacts.
- Propose mitigation to reduce or alleviate potential adverse visual impacts (to be structured as an EMPr).
- Assess the glint and glare of the PV panels
- Conclude with an Impact Statement of Significance and a project recommendation.

1.6. Methodology

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

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 VIA. It stands to reason that if (or where) the proposed Project 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 Project 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 proposed Project 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 Project 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 proposed Project 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 proposed Project 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 Project. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and structure decreases.

- **Calculate the visual impact index**

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

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

- **Determine impact significance**

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

- **Propose mitigation measures**

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

- **Reporting and map display**

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

- **Site visit**

A site visit was undertaken on 26 August 2022 in order to verify the results of the spatial analyses and to identify any additional site-specific issues that may need to be addressed in the VIA report.

2. BACKGROUND

Buffelspoort Solar Project (Pty) Ltd is proposing to develop a Solar Photovoltaic (PV) Energy Facility and associated infrastructure on Portions 75 and 134 of the Farm Buffelspoort 343JQ, located approximately 6 km west of Mooinooi, within the jurisdiction of the Rustenburg Local Municipality and the Bojanala Platinum District Municipality in the North-West Province (hereafter referred to as the "Project"). The proposed Project will have a contracted capacity of up to 40 MWp and will be known as the Buffelspoort Solar PV Energy Facility.

The purpose of the Project will be to supply power to a private offtaker via a newly proposed ~2.5 km long 88kV single circuit overhead power line that will be routed over privately-owned properties from the onsite Project substation to the point of interconnection, north of the N4. The construction of the Project aims to enable the private offtaker to diversify their energy mix and to reduce their reliance on Eskom supplied power and is a conscious effort for the offtaker to contribute to their sustainability targets and reduce their carbon footprint.

A grid connection corridor which varies in width from 200 m to 300 m and is up to 2.5 km in length has been identified for the assessment and suitable placement of the grid connection infrastructure within the corridor. This corridor will provide for the avoidance of sensitive environmental areas and features.

A Development Area of up to ~77 ha has been identified within the Project Site (~223 ha) by Buffelspoort Solar Project (Pty) Ltd for the development of the Buffelspoort Solar PV Energy Facility. Infrastructure associated with the Solar PV Energy Facility will include the following:

- Solar PV array comprising PV panels and mounting structures.
- Inverters and transformers.
- Cabling between the arrays.
- Onsite facility substation.
- 88kV single circuit overhead power line for the distribution of the generated power, which will be connected to an existing 88kV Substation just north of the proposed project site.
- Battery Energy Storage System (BESS)[2] – to be initiated at a later stage than the Solar PV Energy Facility.
- Temporary laydown area.
- Operations and Maintenance (O&M) building, which will include a site security office, warehouse, storage area and workshop.
- Main access road (existing – to be upgraded with hard surface) and internal (new) gravel roads.
- Fencing around the site, including an access gate.

[2] The BESS is included as part of the ESIA process albeit that the facility will only be installed after the Solar PV Energy Facility has come into operation. The total electricity requirements for the offtaker is currently under review and an energy master plan is being developed, which will only be finalised post implementation of the Solar PV Energy Facility to address all the electricity needs of the offtaker. The BESS has been included in this ESIA in order to ensure that should the energy master plan require this component to be included sooner than expected that it has already been authorised.

Figure 1: Regional locality of the study area.

The Solar PV Energy Facility will take up to 12 months to construct. The operational lifespan of the facility is estimated at up to 15 years, with the option to extend should this be required by the offtaker.

The proposed properties identified for the Solar PV Energy 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).*

3. 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.

4. THE AFFECTED ENVIRONMENT

The study area is situated within the Bojanala Platinum District, so called due to the predominantly platinum and chrome mining activities within the region. The region historically had a stronger agricultural economy (in the 1960s) with tobacco, maize, soya, and sunflower amongst some of the major crops produced. In the 1970s mining was introduced and grew to become the main economic driver of the area. The mining activities have since then greatly influenced the settlement patterns and socio-economic structure of the region.

Figure 6: Aerial view of the proposed Solar PV Energy Facility Development Area (yellow) and Grid Connection Corridor (red)

The proposed Project Site is located in between the N4 Bakwena National highway and R104 Old Rustenburg arterial road. The N4 Bakwena National highway very much divides the study area into two (2) distinct land use categories, with the area north of this highway predominantly given to large scale mining, and the southern section with a more agricultural and natural character. The topography of the region is similarly divided into two (2) distinct classes, where the northern parts are described as plains and undulating plains, and the southern parts consist of mountains and tall hills. The terrain elevation of the study area ranges from approximately 1,140m above sea level in the north and 1,560m to the south at the top of the mountains. These mountains are the northern foothills of the Magaliesberg Mountains, located further south of the study area. Refer to **Map 1** for the shaded relief (topography) map of the study area.

The Sterkstroom River traverses the study area from the south (from the Buffelspoort Dam), to the north towards the Beestekraal Dam, located north of the study area. Other than this river there are a number of non-perennial streams and farm or mining dams within the study area.

The vegetation type to the north of the study area, where intact and not transformed by mining, is described as *Marikana Thornveld.* This veld type consists of a combination of trees and bushes (open, closed and sparse) and grassland, with various levels of degradation. The level of vegetation transformation is clearly illustrated on the land cover map (**Map 2**) where the agricultural, mining and settlement patterns are shown. The vegetation types to the south are *Moot Plains Bushveld* (along the flatlands) and *Gold Reef Mountain Bushveld* along the mountains and hills.

The most prominent (and visible) land use within the region is the mining activities, mining infrastructure, tailings dams and waste rock dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture, dryland agriculture and citrus farming (orchards) predominantly to the south. Agricultural activities include the production of maize, wheat and sun flower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area. Homesteads located in closer proximity to the proposed Buffelspoort Solar PV Energy facility site include Buffelspoort, Mizpah, Maakiesaakie, Dassieklip and Elandsdrift.[3]

The largest residential area, or town, within the study area is the mining town of Mooinooi (population 4,733), located approximately 7 km east of the proposed Project Site.

The N4 Bakwena National highway provides motorised access to the region and is the main connecting route in between the Gauteng Province (Pretoria) and Rustenburg. The proposed Project Site is easily accessible from the N4 Bakwena National highway via the R104 arterial road.

Besides the large number of mines and mining infrastructure within the , there are numerous power lines and substations, predominantly associated with the mines. Some of these include:

- Bighorn / Pluto 1 275kV
- Lonmin Eastern Platinum Mine Middelkraal M/P 1
- Middelkraal / Spruitfontein 1 88kV
- Middelkraal / Tharisa 1 88kV
- Tharisa / Spruitfontein 1 88kV
- Tharisa / Tharisa Minerals MP1 88kV
- Bighorn / CCT Smelters 1 and 2 88kV
- Bighorn / Middelkraal 1 88kV
- Middelkraal / Modderspruit 88kV
- Middelkraal / Wonderkop 1 88kV

There are no airports or airfields within the study area. Additionally, in spite of the other authorised or operational solar energy facilities within the study area, the constrained visual exposure of the proposed Buffelspoort PV facility, the built-up and transformed nature of the study area (i.e. the presence of mining and industrial infrastructure especially to the north) is expected to absorb potential cumulative visual impacts (generally experienced in more natural settings). It is unlikely that the additional PV facilities would be visible from each other, or collectively from potential sensitive visual receptor sites.

The study area is not considered to be an "end destination" tourist attraction, but does provide a thoroughfare to tourist attractions to the west of the province, e.g. Sun City. However, one holiday resort, the Afrikaanse Taal en Kultuur Vereniging (ATKV) Buffelspoort holiday resort was identified approximately 2 km west of the proposed Project Site. Another facility, the Bosveld Paradys Bed and Breakfast, is located on the farm earmarked for the Project. The southern portion of the study area is located within the Magliesburg Biosphere Reserve, wherein the development footprint is located within the Transitional Zone. No additional tourist attractions were identified in closer proximity to the proposed Project[4]

---

[3] The names listed here 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.
[4] Sources: DEAT (ENPAT North West), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021 (DFFE), Wikipedia.

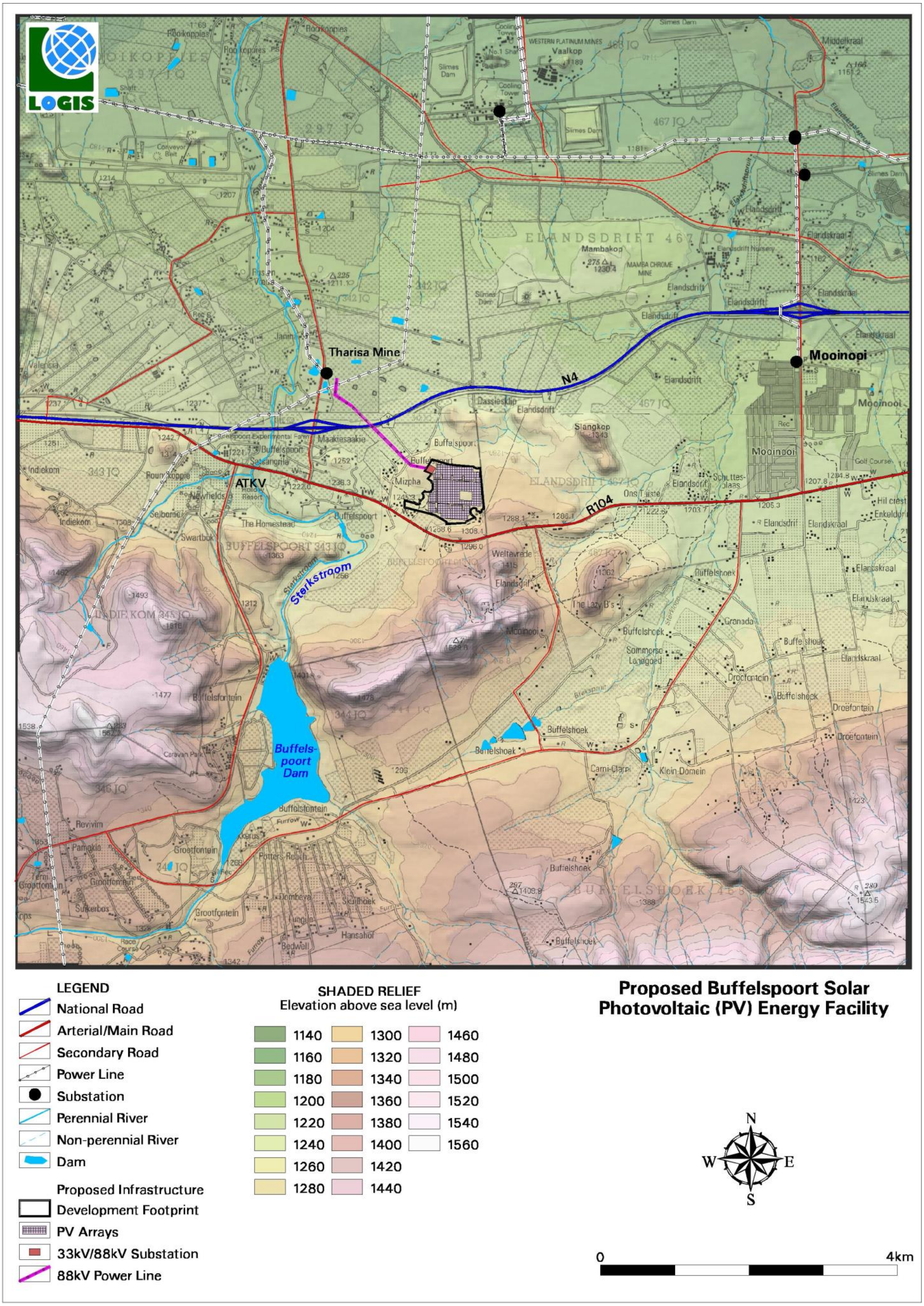
Figure 7: View of the proposed Grid connection corridor from the N4 national road.

Figure 8: View of the proposed site from the R104. Note the dense vegetation and high berm

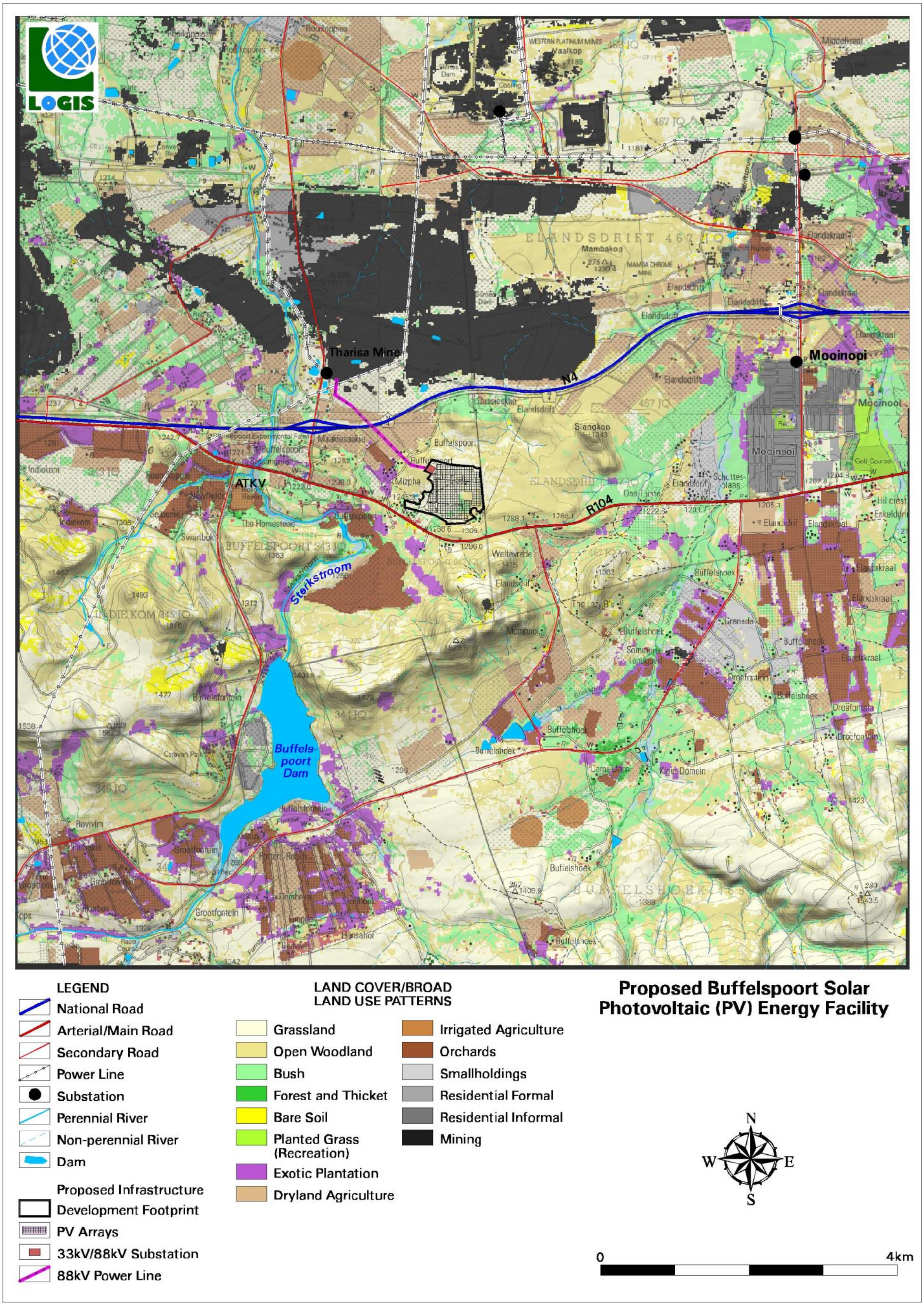
Figure 9: Bushland and woodland vegetation

Figure 10: Typical mining activity within the study area (Photo credit: Martin Politick).

Figure 11: Mine dumps, power lines and mining infrastructure within the Study Area.



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

5. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed PV facility were identified during the Scoping Phase and included the following:

- The visibility of the Solar PV Energy Facility to, and potential visual impact on, observers travelling along the N4 Bakwena National highway and R104 Old Rustenburg arterial roads in closer proximity to the proposed Project infrastructure.

- The visibility of the Solar PV Energy Facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the farm residences (to the west and north) in closer proximity to the proposed Project.

- The potential visual impact of the Solar PV Energy Facility on the visual character or sense of place of the region.

- The potential visual impact of the Solar PV Energy Facility on tourist routes or tourist destinations/facilities (e.g. the ATKV holiday resort and the Bosveld Paradys Bed and Breakfast).

- 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 proposed Project.

- The visual absorption capacity of the natural vegetation or built structures/mining infrastructure (if applicable).

- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the placement of the Solar PV Energy Facility within a predominantly mining area.

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

- Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard (if required).

- Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the Solar PV Energy Facility (if required).

- 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 have been assessed in greater detail in the sections below.

6. RESULTS

6.1. Potential visual exposure

The result of the viewshed analysis for the proposed facility is shown on the maps below (**Maps 3 and 4**). The viewshed analysis was undertaken from a representative number of vantage points within the Development Footprint at an offset of 3 m above ground level for the PV panels and 15 m above ground level for the overhead powerline. 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, BESS, powerline etc.) associated with the facility.

Maps 3 and 4 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 includes the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

The proposed Solar PV Energy Facility is located north of a group of ridges/mountains that greatly restricts the visual exposure to the south and south-east. Visual exposure to the north-east is similarly restricted by a weak ridgeline and the Slangkop hill (and other unnamed hill), located to the north-east. Some scattered visual exposure to the west (towards Mooinooi) may be possible, but is unlikely to expose the entire Solar PV Energy facility.

The most prominent visual exposure for the PV facility will be towards the north and the west. The northern visual exposure falls virtually entirely within mining land. Visual exposure to the west is likely to contain the most potential sensitive visual receptors in the form of residents of homesteads in that area and observers travelling along the N4 Bakwena National highway and R104 Old Rustenburg arterial roads.

The proposed powerline will potentially be visible within a core area around the alignment itself i.e. within 0-1 Km. The northern visual exposure falls virtually entirely within mining land, while the most sensitive visual receptors will be Buffelspoort homestead and a section of the N4 Bakwena Highway where the powerline will traverse directly overhead.

The following is evident from the viewshed analyses:

0 – 1km measured from the boundary of the development footprint

The PV facility may be highly visible within a 1 km radius. This zone predominantly falls within vacant open space, but does contain farm residences (especially to the west and north) and sections of the N4 and R104. It is expected that the Solar PV Energy Facility and ancillary infrastructure would be highly visible unless the observer is shielded by vegetation cover.

It should be noted that some land parcels surrounding the project site have been acquired by the Applicant thereby reducing the visibility on affected farm residences.

1 – 3km measured from the boundary of the development footprint

Visual exposure within this zone includes farm residences and sections of the N4 and R104 roads to the west. Visual exposure to the north falls within mining land with existing visual clutter and disturbances. The ATKV Buffelspoort holiday resort falls within this zone and may theoretically be exposed to the Solar PV Energy Facility infrastructure. It should once again be noted that visual exposure may only occur where the natural or planted vegetation cover is removed. Large visually screened areas can be found to the east, south east and south.

3 - 6km measured from the boundary of the development footprint

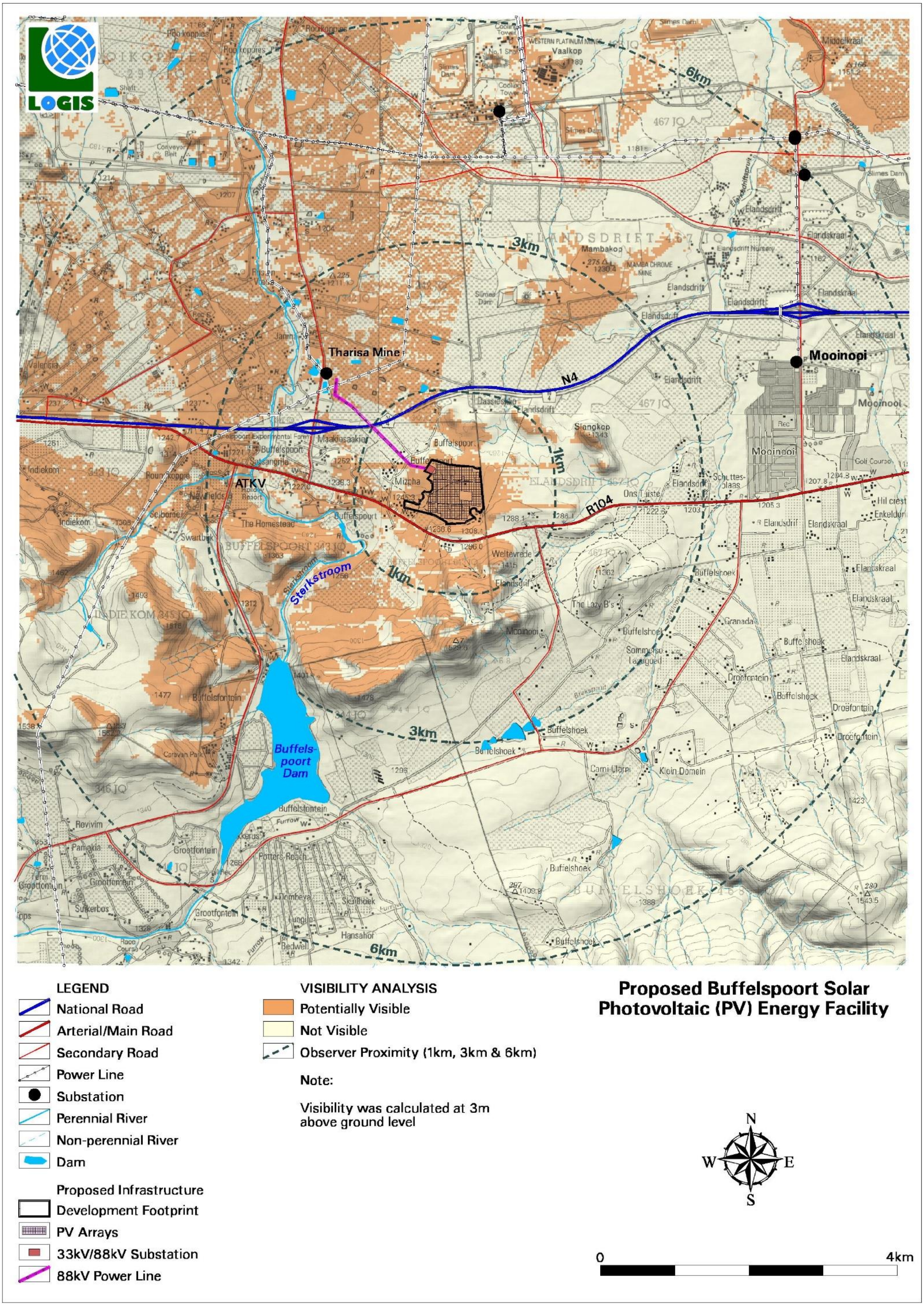
Within a 3 – 6km radius, the visual exposure, predominantly to the north and west, is scattered and interrupted due to the undulating nature of the topography. Most of the visual exposure will be within mining or vacant agricultural land.

> 6km

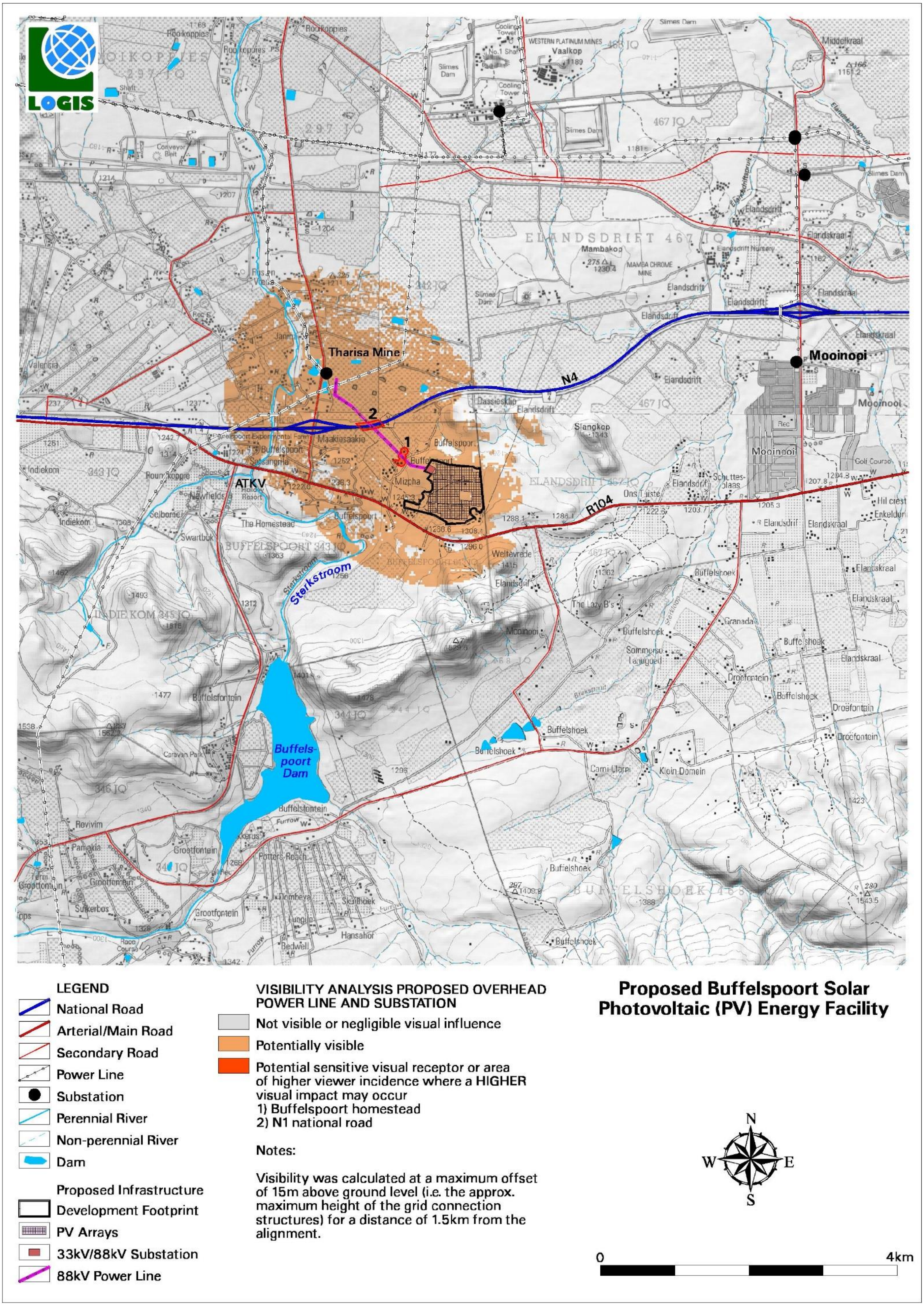
At distances exceeding 6km, the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (Solar PV Energy Facility) and the observer, and the developed nature of the study area.

Conclusion

In general terms, it is envisaged that the structures, where visible from shorter distances (e.g. less than 1 km and potentially up to 3 km), 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 observers travelling along the N4 Bakwena National highway and R104 Old Rustenburg arterial road, and from residences in closer proximity to the proposed Project.



Map 3: Viewshed analysis of the proposed PV Project



Map 4: Viewshed analysis of the proposed Buffelspoort Grid connection

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) 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 rural and natural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the 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 5**, and include the following:

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

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a potentially negative visual perception of the proposed facility.

6.3. 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 grid connection infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer: regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence within the study area is anticipated to be the highest along the R104 Old Rustenburg road located to the south of the proposed Project and the N4

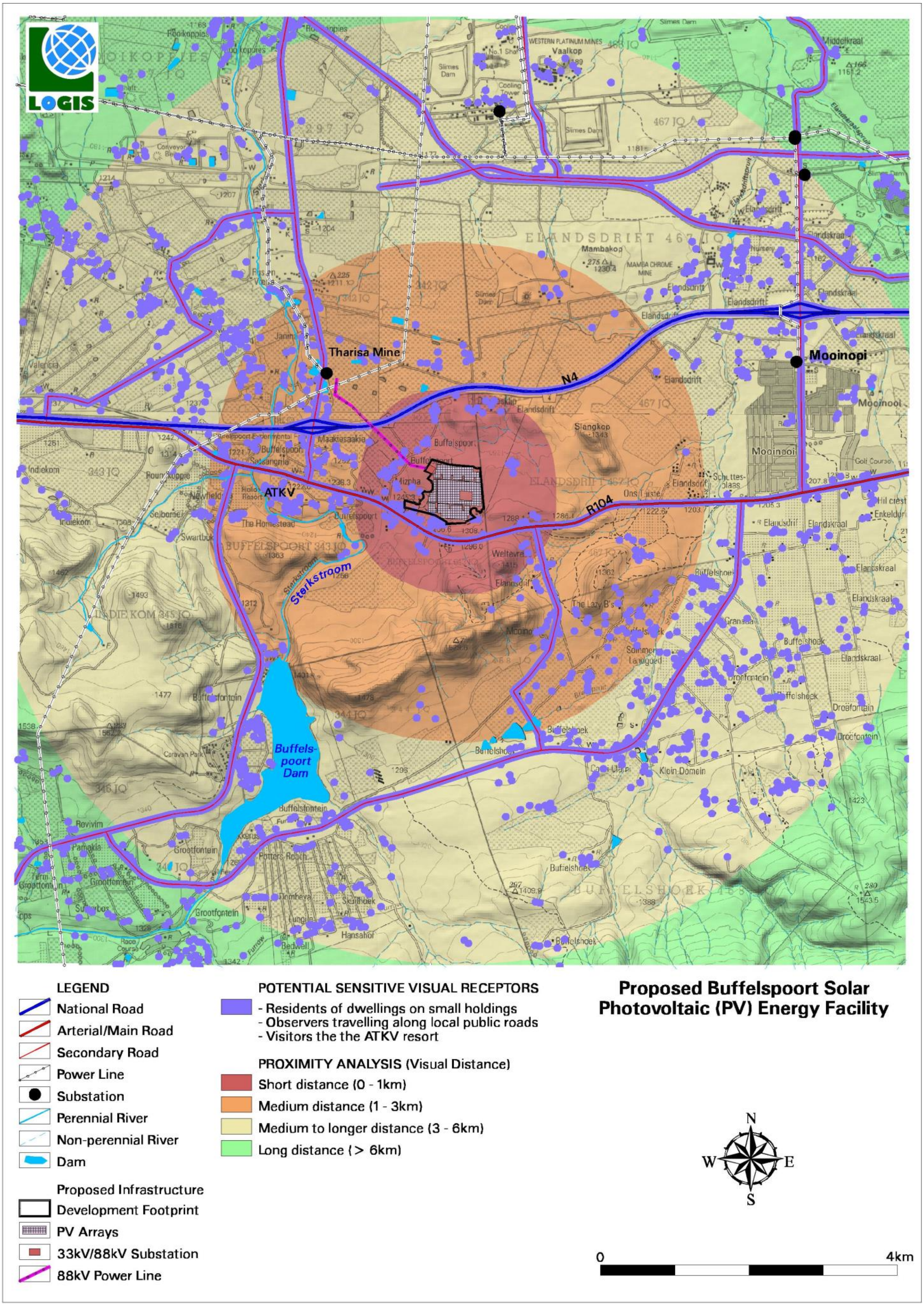
Bakwena National highway located to the north. Travellers using these roads may be negatively impacted upon by visual exposure to the PV facility infrastructure.

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

Due to the generally industrial nature of the receiving environment to the north and the relatively remote nature of the receiving environment, there are only a limited number of potential sensitive visual receptor sites within closer proximity to the proposed Project Site. These receptor sites were listed in **Section 6.1**.

The potential sensitive visual receptor sites and areas of higher viewer incidence are indicated on **Map 5**.

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



Map 5: Proximity analysis and potential sensitive visual receptors.

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.

Land cover is primarily *Marikana Thornveld.* This veld type consists of a combination of trees and bushes (open, closed and sparse) and grassland, with various levels of degradation. The most prominent (and visible) land use within the region is the mining activities, mining infrastructure, tailings dams and waste rock dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture, dryland agriculture and citrus farming (orchards) predominantly to the south

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 6**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged to calculate the visual impact index.

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

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

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

The index indicates that **potentially sensitive visual receptors** within a 1km radius of the Solar PV Energy 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 vacant open space but does contain farm residences (especially to the west and north) and sections of the N4 Bakwena National highway and R104 Old Rustenburg road.

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

- Observers travelling/residing along the R104 Old Rustenburg road (site 1)
- Observers travelling along a short section of the N4 Bakwena National highway (site 3)
- Residents at the Buffelspoort homestead (site 2)

It should be noted that all properties forming part of the Buffelspoort homestead have been acquired by the Applicant. This reduces the probability of this impact occurring and only visual impacts on observers travelling along roads in close proximity will be considered.

1 – 3km

Visual exposure within this zone includes farm residences and sections of the N4 and R104 roads to the west. Visual exposure to the north falls within mining land with existing visual clutter and disturbances.

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

- Observers travelling/residing along the R104 Old Rustenburg road (site 4)
- Residents at homesteads on small holdings north of the N4 Bakwena National highway (site 5)
- Residents at homesteads on small holdings south of the N4 Bakwena National highway including some hillside chalets at the AKTV resort (site 6)

3 – 6km

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

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

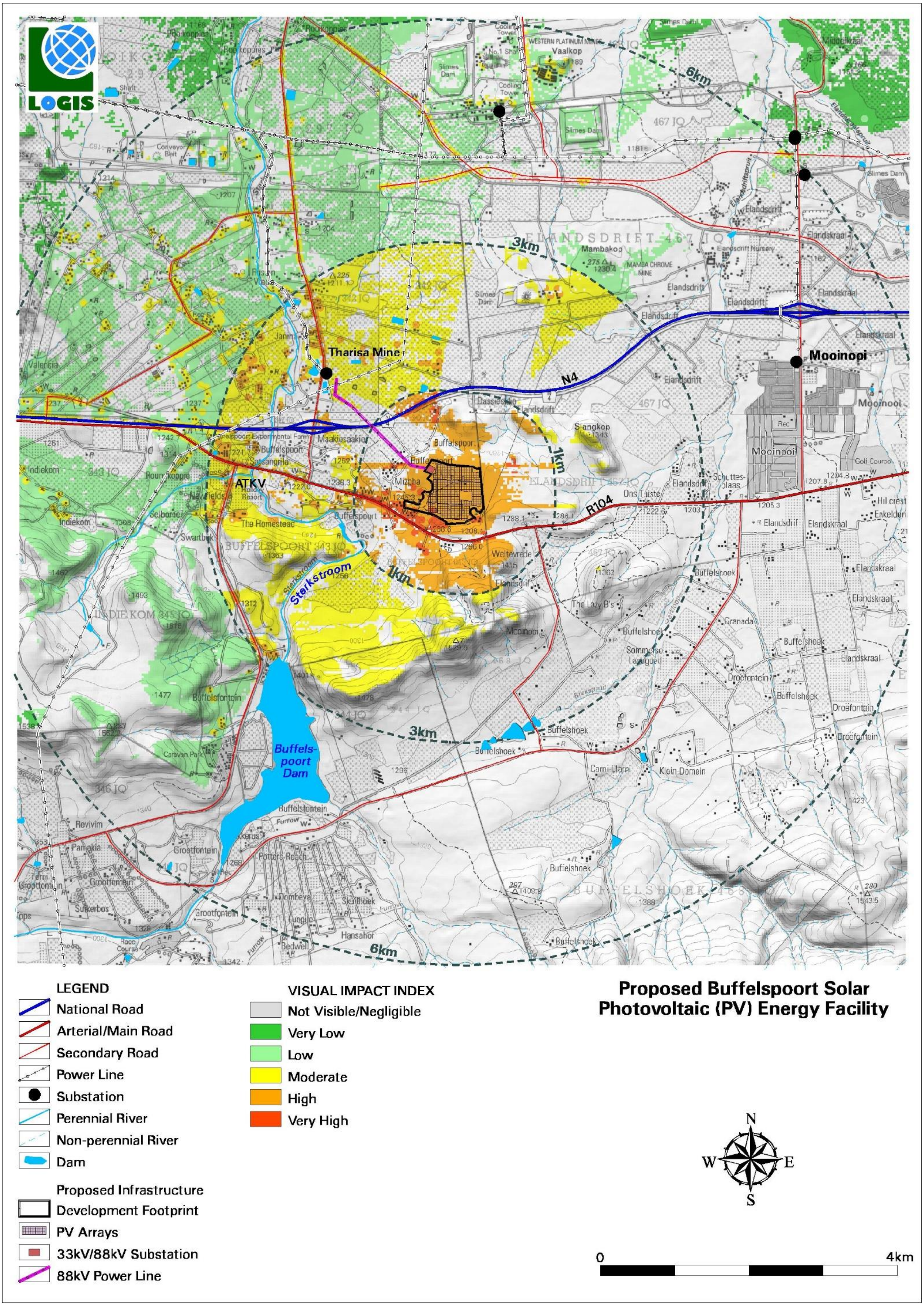
- Residents at homesteads on small holdings north of the N4 Bakwena National highway (site 7)
- Buffelsfontein homestead (site 8)
- Indiekom homestead (site 9)

>6 Km

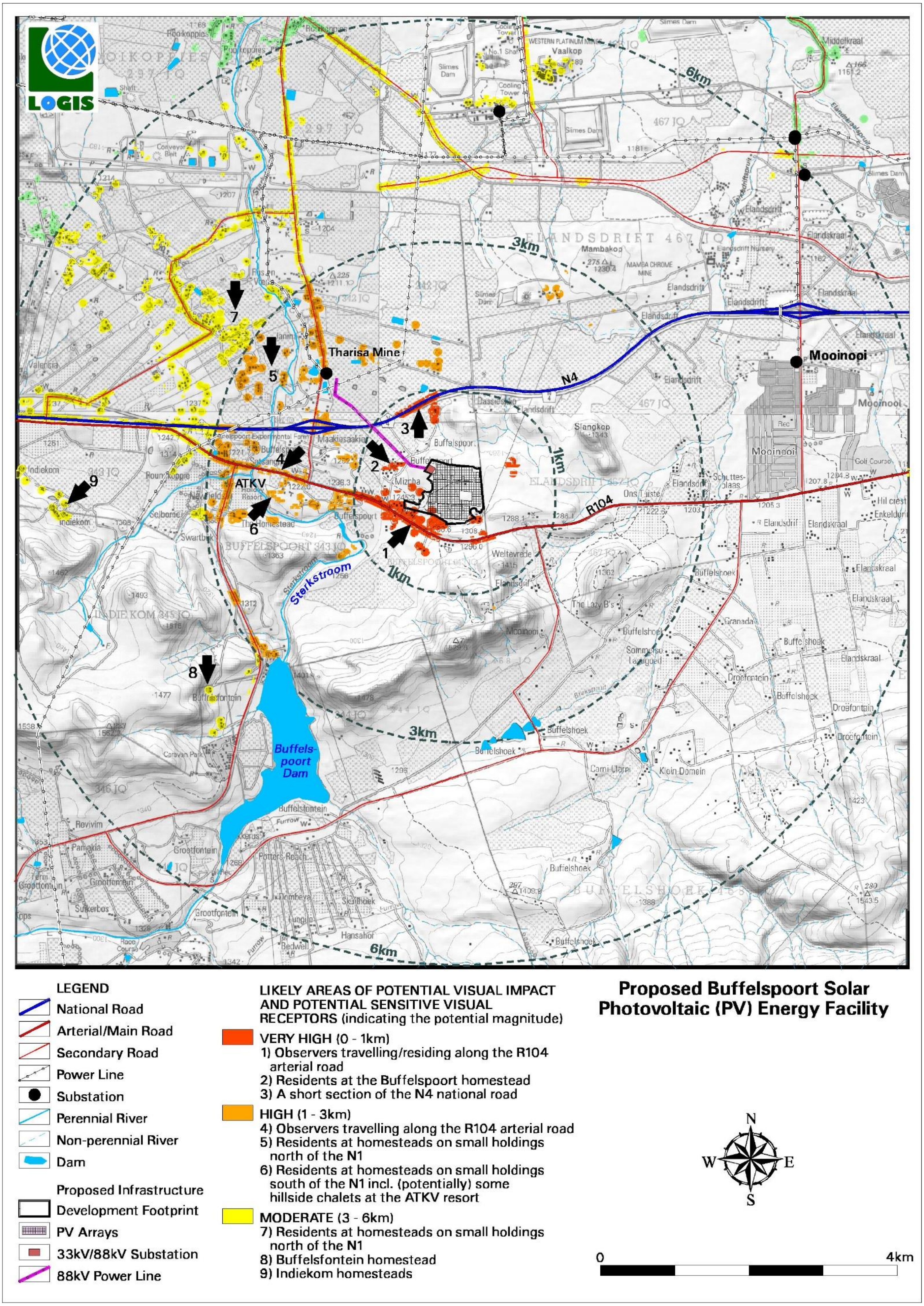
At distances exceeding 6km, the intensity of visual exposure is expected to be **low** and highly unlikely due to the distance between the object (Solar PV Energy Facility) and the observer, and the developed nature of the study area.

Notes:

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



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



Map 7: Likely areas of potential visual impact and potential 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)[5].
- **Duration** - very short (0-1 yrs. = 1), short (2-5 yrs. = 2), medium (5-15 yrs. = 3), long (>15 yrs. = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)[6].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 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)

---

[5] 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).

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

6.7. 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 Project and ancillary infrastructure

During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the Development Footprint that may cause, at the very least, a visual nuisance to other road users in close proximity (< 1 km) to the construction activities.

Construction activities may potentially result in a **high** (significance rating = 80), temporary visual impact, that may be mitigated to **moderate** (significance rating = 48).

A mitigating factor within this scenario is the low occurrence of receptors within the receiving environment. Observers traveling along the R104 Old Rustenburg road and N4 Bakwena National highway will only be exposed to the visual intrusion for a short period of time. This reduces the probability of this impact occurring.

Similarly, all properties forming part of the Buffelspoort homestead have been acquired by the Applicant, resulting in no homesteads within close proximity being affected.

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 users of the secondary road 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)**	Moderate **(6)**
Probability	Definite **(5)**	Highly Probable **(4)**
Significance	High **(80)**	Moderate **(48)**
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 = 42) post mitigation on residents of homesteads and observers travelling along the R104 and N4. Additionally, observers traveling along the R104 and N4 will only be exposed to the visual intrusion for a short period of time. It should also be noted that the VAC of the area is moderate to high and will therefore have a screening/shielding effect. This reduces the probability of this impact occurring.

A mitigating factor is that all properties forming part of the Buffelspoort homestead have been acquired by the Applicant, resulting in no homesteads within close proximity being affected and have not been considered in the impact assessment table below.

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 homesteads and observers travelling along the R104 and N4 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)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(72)**	Moderate **(42)**
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/ hedges.

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 observers travelling along the R104 and residents at homesteads north south of the N4 including visitors to the AKTV resort within 1 – 3km radius of the PV facility structures. 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 observers travelling along the R104 and residents of homesteads 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?	No, 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. 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 Solar PV Energy facility may contribute to the effect of sky glow within the environment which is currently undeveloped.

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

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

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

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed 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 top of the sources of light by physical barriers (walls, vegetation, or the structure itself) to reduce/limit sky glow.
- Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
- Make use of minimum lumen or wattage in fixtures if possible.
- 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 if possible and practical. 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.

6.7.2.4. 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 occurs 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 relative close proximity to the source (e.g. users of the secondary road), 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 Buffelspoort PV 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.[7]

The N4 Bakwena National highway and the arterial R104 Old Rustenburg road are located within a 1km radius of the proposed Project. This approximate distance is recommended as a threshold within which the visual impact of glint and glare (if

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

there is visual line of sight from the road) may influence road users.[8] An existing large vegetated berm located outside of the road reserve and in the property boundary and moderate to high VAC of the Project Site to the south, will greatly reduce the likelihood of the facility being seen from the R104. Road users of the N4 could potentially be impacted upon by the proposed Project. The potential visual impact related to solar glint and glare as a road travel hazard is therefore expected to be of **moderate** significance pre mitigation and **low** post mitigation.

Table 6: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction to users of the N4 and R104

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	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(36)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	N.A.
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: ➢ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ➢ If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible. ➢ Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the Development Footprint.		
Residual impacts: N.A.		

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

There are a fair number of residences located within a 1km radius of the proposed Solar PV Energy facility. However the nature of the vegetation and moderate to high VAC should provide significant screening with respect to the visibility of the PV panels. 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 7: Impact table summarising the significance of the visual impact of solar glint and glare on static ground receptors.

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

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: <u>Planning & operation</u>: ➢ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ➢ 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.		

6.7.2.5. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes an overhead powerline, BESS, inverters, low voltage cabling between the PV arrays, internal access roads, workshop, office buildings, etc.

No dedicated viewshed analyses have been generated for the ancillary infrastructure. The anticipated visual impact resulting from this infrastructure is likely to be of **moderate** significance. It should be noted that visual receptors in built-up areas are less sensitive due to the presence of structures, infrastructure and general visual clutter.

Table 8: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation (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.
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.

6.7.2.6. Secondary impacts

The potential visual impact of the proposed PV facility on the sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), plays a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has been greatly transformed by mining activities, particularly to the north. 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 9: 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, where possible, both during construction and operation of the proposed Project. 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 Solar PV Energy facility and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

    - Shielding the top of the sources of light by physical barriers (walls, vegetation, or the structure itself) to limit sky glow;
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of minimum lumen or wattage in fixtures if possible;
    - 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 if practical and possible. 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.
    - 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 12 months following decommissioning, and remedial actions implemented as and when required i.e. reification of any erosion, brush packing etc.

- 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 Buffelspoort PV Solar Energy 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 moderate to low visual and scenic quality owing to the presence of industrial areas, particularly mines, as well, as informal settlements to the north. There are also existing high voltage powerlines within the study area.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the study are being largely transformed by mining. 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.

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.

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 VIA undertaken for the proposed Buffelspoort PV Solar facility and its associated infrastructure 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 15 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 residents 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 homesteads and observers travelling along the R104 and N4 within a 1 km radius.

- The operational PV facility could have a **moderate** visual impact on observers travelling along the R104 and residents at homesteads north south of the N4 including visitors to the AKTV resort within a 1 – 3km 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 **moderate** significance mitigated to **low** significance.

- There are a fair number of residences located within a 1km radius of the proposed PV facility. 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 both before and after 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 Buffelspoort Solar PV Energy 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 10: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Buffelspoort Solar PV energy facility.		
Project Component/s	The solar PV 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, where possible.	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 11: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Buffelspoort Solar PV energy 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 Project 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 12: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Buffelspoort Solar PV energy facility.		
Project Component/s	The solar PV 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**
If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site.	Project proponent / operator	Throughout the operation phase.
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 (by operator) for resolution of complaints on an ongoing basis (i.e. during all phases of the project).	

Table 13: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Buffelspoort Solar PV energy facility.		
Project Component/s	The solar PV 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 Development Footprint.	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 every 3 months for 12 months following decommissioning, and implement remedial action as and when required e.g. rectification of any erosion, brush pack areas etc.	Project proponent / operator	Post decommissioning.

Performance Indicator	Vegetation cover on and in the vicinity of the site is Project Site (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.

10. REFERENCES/DATA SOURCES

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

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

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

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

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

DFFE, 2021. *South African Protected Areas Database (SAPAD_OR_2021_Q1).*

DFFE, 2021. *South African Renewable Energy EIA Application Database (REEA_OR_2021_Q1).*

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

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

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

Forge Solar PV Planning and Glare Analysis, 2019. *Guidance and information on using Forge Solar analysis tools.*

JAXA, 2021. Earth Observation Research Centre. *ALOS Global Digital Surface Model (AW3D30).*

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

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

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

Pager Power Urban and Renewables, 2020. *Solar Photovoltaic and Building Development – Glint and Glare Guidance.*

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