March 2023

DONAWAY
ENVIRONMENTAL

Visual Impact Assessment

The development of the proposed Notsi PV 5 near Dealesville, Free State Province

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PROJECT DETAILS

Project title: **Visual Impact Assessment –** The development of the proposed Notsi PV 5 near Dealesville, Free State Province

Prepared by:

Johan Botha
Donaway Environmental
30 Fouché Street
Steynsrus
9515
Tel: +27 82 316 7749
Email: johan@donaway.co.za

Prepared for:

Notsi PV (Pty) Ltd
2nd Floor, Fernwood House, The Oval
1 Oakdale Road
Newlands
Cape Town
7700
Tel: +27 21 001 3758
Email: Simamkele.Ntsengwane@aced.co.za

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PROJECT BACKGROUND

Notsi PV (Pty) Ltd is proposing the development of Notsi PV 5, a commercial Photovoltaic (PV) energy facility and associated infrastructure, located on Farm Ebenhaezer 1623 and Farm Welgeluk 1622, Tokologo Local Municipality, Free State Province. Notsi PV 5 will form part of the Notsi PV Cluster, which include five PV facilities in close proximity to each other. The proposed project is intended to form part of the Department of Mineral Resources and Energy (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, but the option also exists for other tenders, wheeling or to supply privately, without a generation license from NERSA. The REIPPP Programme aims to secure 14 725 Megawatts (MW) of new generation capacity from renewable energy sources, while simultaneously diversifying South Africa's electricity mix. According to the 2021 State of the Nation Address, Government will soon be initiating the procurement of an additional 11 800 MW of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019 and fulfilling their commitments under the United Nations Framework Convention on Climate Change and its Paris Agreement which include the reduction of greenhouse gas emissions. Eskom, our largest greenhouse gas emitter, has committed in principle to net zero emission by 2050 and to increase its renewable capacity.

The proposed development of Notsi PV 5 requires Environmental Authorisation (EA) from the National Department of Forestry, Fisheries and the Environment (DFFE) in accordance with the National Environmental Management Act (No. 107 of 1998) (NEMA), and the 2019 Environmental Impact Assessment (EIA) Regulations (GNR 325 and 327).

The Visual Impact Assessment (VIA) Report has been prepared by Donaway Environmental on behalf of Environamics and is intended to provide input into the Basic Assessment Report (BAR) to be submitted to DFFE.

APPROACH TO THE STUDY

The Impact Assessment considered the nature, scale and duration of impacts on the visual receptors whether such impacts are positive or negative. Each impact was assessed according to the visual receptors, which were determined by using the ZTV, and the following project phases:

- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact were detailed. A brief discussion of the impact and the rationale behind the assessment was included. The rating system is applied to the potential impacts on the receiving visual receptors and includes an objective evaluation of the mitigation of the impact.

The ZTV reflects the visibility rating in term of proximity of viewers to the solar PV projects. The distances were calculated using satellite imagery, but the impact magnitude was determined by using previous experiences, assumptions and opinions, it is therefore theoretical. The ZTV maps will give a clearer understanding of areas susceptible to line of sight which means, an imaginary line from the eye to a perceived object, in this case the PV facility. The ZTV assessment **did not consider existing screening such as buildings and vegetation cover but rather the terrain's above mean sea level**

(AMSL) which indicates line of sight. The receptors which were identified were subject to an impact assessment.

SUMMARY OF KEY FINDINGS

Referring to the assessment score of this VIA report review, the significance of the visual impact will be a "Negative Low Impact" for both project sites. The only receptors likely to be impacted by the proposed development are the nearby property owners and nearby roads. However, a large part of the visual landscape is still reflecting a farming landscape with a better visual appearance. A summary of the potential impacts identified for the detailed design and construction, and operation phase are presented in **Table A** and **Table B**. A summary of the potential cumulative visual impacts identified for the project is provided in Table **C**.

Table A: Summary of potential visual impacts identified for the design and construction phase

Impact	Significance Without Mitigation	Significance With Mitigation
Construction impacts.	(28) Negative Low	(24) Negative Low

Table B: Summary of potential visual impacts identified for the operational phase

Impact	Significance Without Mitigation	Significance With Mitigation
Potential visual impacts on sensitive visual receptors located within a 1km radius.	(57) Negative High	(34) Negative Medium
Potential visual impacts on sensitive visual receptors between a 1km and 3km radius.	(36) Negative Medium	(32) Negative Medium
Potential visual impacts on sensitive visual receptors located between a 3km and 5km radius.	(30) Negative Medium	(14) Negative Low
Potential visual impacts on sensitive visual receptors located between a 5km and 10km radius.	(14) Negative Low	(10) Negative Low
Lighting Impacts.	(48) Negative Medium	(20) Negative Low
Solar glint and glare impacts.	(18) Negative Low	(18) Negative Low
Visual impacts on sense of place.	(30) Negative Medium	(13) Negative Low

Table C: Summary of potential cumulative visual impacts identified for the project

Impact	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Cumulative visual impact	(26) Negative Low	(80) Negative Very High

Key Findings

PV Facility

The construction and operational phase of the proposed PV facility and associated infrastructure will have a visual impact on the study area, especially within (but not restricted to) a 1km radius of the proposed project. The visual impact will differ amongst places, depending on the distance to the project. Receptors that might be the most sensitive to the proposed development are residents living and working on nearby farms and people travelling on the S322 secondary road. Referring to **Table 8.1** to **Table 8.3** and the ZTV assessment, the PV facility will have a negative low visual impact on the surrounding environment after mitigation, within a 10km radius. Referring to the ZTV assessments, the PV facility has a line-of-sight low average visual coverage percentage within the 10km radius of 34.51%. Sensitive visual receptors are sparsely scattered throughout the region and tourism developments are low.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection and is characterised by agricultural developments with a better visual quality. No buffer areas or areas to be avoided are applicable for this development.

Cumulative Impact

The proposed development is located in a close proximity to intensive existing power infrastructure and might have a cumulative impact on viewers. 28 other solar facilities are also proposed in the area and the potential for cumulative impacts to occur as a result of the projects is therefore highly likely. Permanent residents of the area might be desensitised over time with the construction of more solar facilities but will stay subjective for each viewer. Although the cumulative impact might be very high if all proposed projects be constructed, the location of the solar facilities within the study area (also a REDZ) will contribute to the consolidation of solar PV structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region. As mentioned in **8.1.1** sensitive visual receptors are sparsely scattered throughout the region.

Mitigation

Due to the extent of the project, no viable mitigation measures can be implemented to eliminate the visual impact of the PV facility entirely, but the possible visual impacts can be reduced. Several mitigation measures have however been proposed regardless of whether mitigation measures will reduce the significance of the of the anticipated impacts, they are considered good practice and should be implemented and maintained throughout the construction, operational and decommissioning phases of the project, if possible.

Conclusion

It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Aesthetic characteristics are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; It is mostly perceived as symbols of energy independence, and local prosperity. The visual impact is also dependant on the land use of an area and the sensitivity thereof in terms of visual impact, such as protected areas, parks and other tourism related activities.

Considering all positive factors of such a development including economic factors, social factors and sustainability factors, especially in a semi-arid country, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view. **PLEASE NOTE** that the details of the PV facility should be submitted to the South African Civil Aviation Authority (SACAA).

It is therefore Donaway Environmental's recommendation that the project be approved.

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LIST OF ACRONYMS

AMSL	Above Mean Sea Level
AC	Alternating Current
AGL	Above Ground Level
BAR	Basic Assessment Report
B-BBEE	Broad-Based Black Economic Empowerment
BEE	Black Economic Empowerment
BESS	Battery Energy Storage System
CLO	Community Liaison Officer
CSP	Concentrated Solar Power
DC	Direct Current
DEA	Department of Environmental Affairs (National)
DEAT	Department of Environmental Affairs and Tourism
DFFE	Department Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
DM	District Municipality
EA	Environmental Authorisation
ECA	Environment Conservation Act (No. 73 of 1989)
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPC	Engineering, Procurement and Construction
FMP	Fire Management Plan
HA	Hectares
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEP	Integrated Energy Plan

IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
GIS	Geographic Information System
KM	Kilometre
kV	Kilovolt
LED	Local Economic Development
LM	Local Municipality
MW	Megawatt
NDP	National Development Plan
NEPCO	National Electrical Power Company
NEMA	National Environmental Management Act (No. 107 of 1998)
O&M	Operations and Maintenance
OHS	Occupational Health and Safety
PSDF	Provincial Spatial Development Framework
PV	Photovoltaic
RE	Renewable Energy
REDZ	Renewable Energy Development Zone
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
SDF	Spatial Development Framework
SEF	Solar Energy Facility
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VIA	Visual Impact Assessment
ZTV	Zone of Theoretical Visibility

1. INTRODUCTION

1.1. Project Background

Notsi PV (Pty) Ltd is proposing the development of Notsi PV 5, a commercial Photovoltaic (PV) energy facility and associated infrastructure, located on Farm Ebenhaezer 1623 and Farm Welgeluk 1622, Tokologo Local Municipality, Free State Province. Notsi PV 5 will form part of the Notsi PV Cluster, which include five PV facilities in close proximity to each other. The proposed project is intended to form part of the Department of Mineral Resources and Energy (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, but the option also exists for other tenders, wheeling or to supply privately, without a generation license from NERSA. The REIPPP Programme aims to secure 14 725 Megawatts (MW) of new generation capacity from renewable energy sources, while simultaneously diversifying South Africa's electricity mix. According to the 2021 State of the Nation Address, Government will soon be initiating the procurement of an additional 11 800 MW of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019 and fulfilling their commitments under the United Nations Framework Convention on Climate Change and its Paris Agreement which include the reduction of greenhouse gas emissions. Eskom, our largest greenhouse gas emitter, has committed in principle to net zero emission by 2050 and to increase its renewable capacity.

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The Visual Impact Assessment (VIA) Report has been prepared by Donaway Environmental on behalf of Environamics and is intended to provide input into the Basic Assessment Report (BAR) to be submitted to DFFE.

1.2. Project Location

The proposed development of Notsi PV 5 will be located on Farm Ebenhaezer 1623 and Farm Welgeluk 1622, Tokologo Local Municipality, Free State Province. The site is located approximately 13km south west from the town centre of Dealesville and 1.2km from the S322 gravel (secondary) road, which will be used as access. The project site has been identified within the affected property and is under assessment for the proposed project:

Please refer to **Figure 1.1** below, Locality Map.

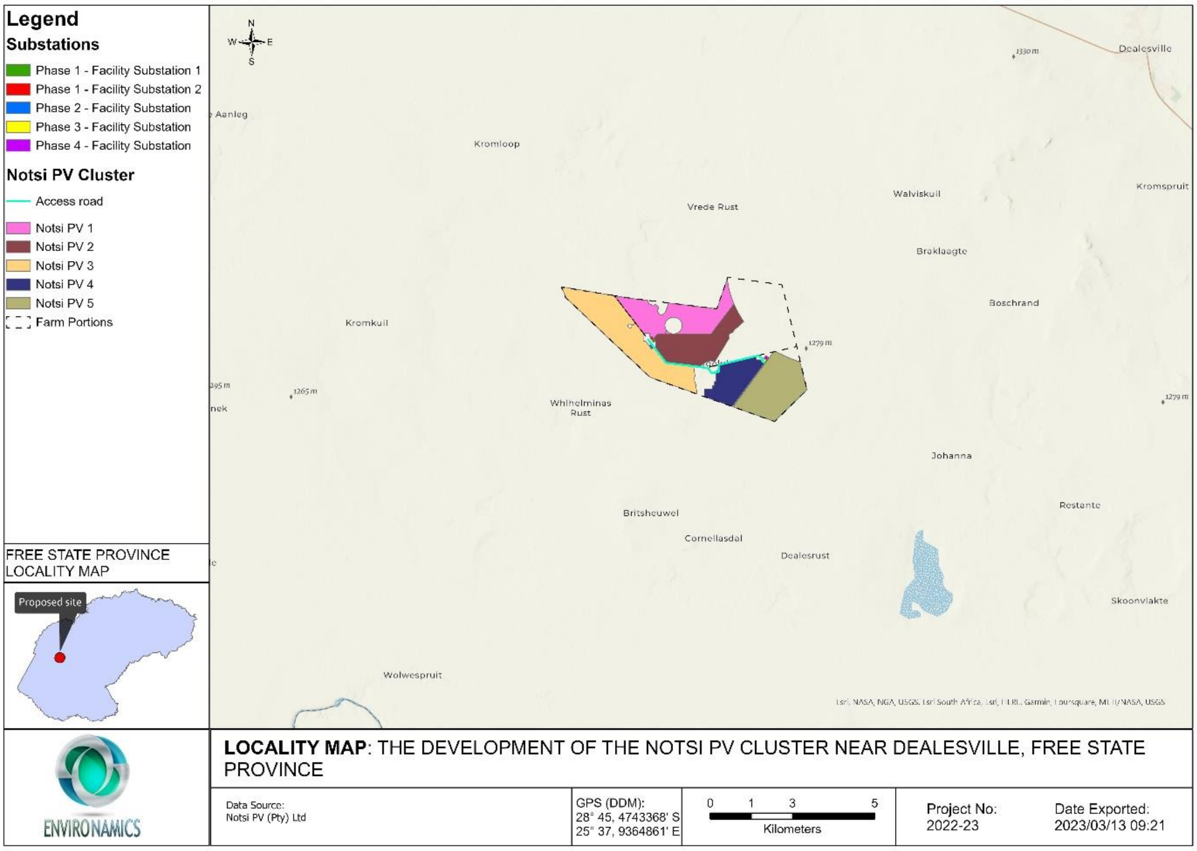


Figure 1.1: Locality map for the proposed Notsi PV Cluster, near Dealesville, Free State Province

1.3. Project Description

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e., semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below and general site information in **Table 1.1**:

Table 1.1: General site information

Description of affected farm portions (information to be used for the respective project as relevant)	Farm Welgeluk 1622 Farm Ebenhaezer 1623
Province	Free State Province
District Municipality	Lejweleputswa District Municipality
Local Municipality	Tokologo Local Municipality

Ward numbers	3
Closest towns	Approximately 13 km southwest of the centre of Dealesville in the Free State Province
21 Digit Surveyor General codes	Farm Welgeluk 1622 - F00400000000162200000 Farm Ebenhaezer 1623 - F00400000000162300000
Type of technology	Photovoltaic
Structure Height	PV Panels: up to 4.5m Battery Energy Storage System (BESS): ≤ 8m Buildings: up to 4m On-site Facility Substation: < 30m
EIA footprint (area assessed for the placement of the development footprint)	195ha
Structure orientation	Tracking PV with mono- or bi-facial panels. Bi-facial panels with single axis tracking is preferred over fixed-axis or double axis tracking systems and mono-facial panels due to the potential to achieve higher annual energy yields whilst minimising the balance of system (BOS) costs and maximizing the efficiency of land use, resulting in the lowest levelized cost of energy (LCOE). The preference for single axis tracking is also based on the economic viability, water requirements, land requirements, efficiency and potential environmental impacts of the proposed solar panel mounting types. The development of the PV facility will take into consideration during the final design phase the use of either mono-facial or bi-facial PV panels as well as tracker vs fixed-tilt mounting structures. Both options are considered feasible for the site.
Generation capacity	Up to 100MW

Based on a review of previous similar projects and the basic project information received for the purpose of this VIA, the scope of work and basic infrastructure that are inclusive of any ancillary activities and that can be associated with the proposed development of Notsi PV 5 would include:

- <u>PV Panel Array</u>

The proposed facility will require numerous linked rows of PV (single axis) modules placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility with associated support infrastructure (concrete footings, below ground electrical cables) to produce up to 100MW electricity.

- Battery Energy Storage System (BESS)

The battery energy storage system will make use of solid state or flow battery technology and will have a capacity of up to 400MWh. Both lithium-ion and Redox-flow technology are being considered for the project, depending on which is most feasible at the time of implementation. The extent of the system will be 2ha. The containers may be single stacked only to reduce the footprint. The containers will include cells, battery charge controllers, inverters, transformers, HVAC, fire, safety and control systems.

- Wiring to Inverters

Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Supporting infrastructure:

The following auxiliary buildings with basic services including water and electricity will be required:

- Temporary Laydown Areas; (~ 20000 m2) and construction site camp/site office;
- Site Administration Office (~500m²);
- Switch gear and relay room (~400m²);
- Staff lockers and changing room (~200m²);
- Security control (~60m²);
- Operations & Maintenance (O&M) building (~ 500 m2); and
- Warehouse.

- Roads

Access will be obtained via the S322 secondary (gravel) road and various gravel farm roads within the area and affected property. An internal site road network will also be required to provide access to the solar field and associated infrastructure. Access roads will be up to 8m wide (6m wide road surface, with 1m drainage either side).

- Fencing

For health, safety and security reasons, the facilities will require perimeter fencing and internal security fencing. The fencing will be up to 2m in height.

Table 1.2: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	Up to 4.5 meters
Area of PV Array	TBC - detail will only be available once the layouts for the respective facilities have been designed following consideration of the environmental sensitivities of the sites as part of the final facility layout design.
Number of inverters required	To be determined as part of the final facility layout design.
Area occupied by inverter / transformer stations / substations	On-site Facility Substation: Up to 4ha Eskom Portion of the Substation: up to 5ha BESS: 3 ha
Capacity of the on-site substation	33kV / 132kV
Area occupied by both permanent and construction laydown areas	Up to 4 hectares
Area occupied by buildings	Up to 3ha: • Administration Office (~500m²); • Switch gear and relay room (~400m²); • Staff lockers and changing room (~200m²); • Security control (~60m²);
Width of internal roads	Between 6 and 8 meters
Height of fencing	Approximately 2.4 meters

1.4. Consideration of Alternatives

The Department of Environmental Affairs and Tourism (DEAT) 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer and the farm portions were found favorable due to its proximity to grid connections, solar radiation, site access and relative flat terrain. These factors were then taken into consideration and avoided as far as possible, where required.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

- No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for these purposes. The potential opportunity costs in terms of adding solar energy generation to the current land use, would be lost if the status quo persist, and therefore all positive socio-economic opportunities and associated growth will also be lost.

- Location alternatives

The location identified for the development is based on various aspects considered by the Applicant from a technical, economic, and environmental perspective. This includes the solar radiation values of the area, proximity to the national grid, available grid connection capacity in the national grid, readily available access to the development, landowner support, terrain characteristics and the absence of potentially sensitive environmental features and areas. The properties proposed are considered suitable for the development by the Applicant and therefore the area has been demarcated and indicated as being preferred. No other properties have been identified for the development in the Dealesville area.

- Technical alternatives: BESS

Three types of battery technologies are being considered for the proposed project: Lithium-ion (Lithium-Phosphate), Sodium-sulphur or Vanadium Redox flow battery. While there are various battery storage technologies available, Li-ion batteries have emerged as the leading technology in utility-scale energy storage applications because it offers the best mix of performance specifications, such as high charge and discharge efficiency, low self-discharge, high energy density, and long cycle life (Divya KC et al., 2009). Both lithium-ion and Redox-flow technology are being considered for the project, depending on which is most feasible at the time of implementation.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the baseload and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

- Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

- Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. Due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

1.5. EIA Regulations

The National Environmental Management Act identifies listed activities (in terms of Section 24) which are likely to have an impact on the environment. These activities cannot commence without obtaining an EA from the relevant competent authority. Sufficient information is required by the competent authority to make an informed decision and the project is therefore subject to an environmental assessment process which can be either a Basic Assessment Process or a full Scoping and

Environmental Impact Assessment process. The EIA Regulations No. 324, 325, and 327 outline the activities that may be triggered and therefore require EA.

The activities triggered under Listing Notice 1 & 2 (Regulation 327 & 325) for the projects implies that the developments are considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation measures. The project is located in the Kimberley Solar Renewable Energy Development Zone (REDZ5). Therefore, the project is subject to a Basic Assessment process, as well as the 57-day timeframe for the processing of the Application for Environmental Authorisation by the Department of Forestry, Fisheries and the Environment (DFFE).

It must be noted that activities listed under Listing Notice 3 may be applicable to the development, however this will only be determined during the BA process and applied for accordingly.

1.6. Terms of Reference

The Terms of Reference (ToR) as provided and agreed upon with Environamics include the following:

Specialists in their field of expertise will consider baseline data and identify and assess impacts according to predefined rating scales. Specialists will also suggest optional or essential ways in which to mitigate negative impacts and enhance positive impacts. Further, specialists will, where possible, take into consideration the cumulative effects associated with this and other projects, which are either developed or in the process of being developed in the local area. The results of these specialist studies will be integrated into the BAR for comments and final submissions to all Interested and Affected Parties (I&APs) and DFFE. The Terms of Reference (ToR) or general requirements proposed for the inputs are listed below:

General Requirements:

Specialists' reports must comply with Appendix 6 of GNR326 published under sections 24(5), and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and whereby the following are to be included:

- The details of the specialist who prepared the report and the expertise of that specialist to compile a specialist report including a curriculum vitae.
- A declaration that the specialist is independent in a form as may be specified by the competent authority.
- An indication of the scope of, and the purpose for which, the report was prepared.
- The date and season of the site investigation and the relevance of the season to the outcome of the assessment.
- A description of the methodology adopted in preparing the report or carrying out the specialised process; the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.
- An identification of any areas to be avoided, including buffers.
- A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.

- A description of any assumptions made and any uncertainties or gaps in knowledge.
- A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment.
- Any mitigation measures for inclusion in the EMPr;
- Any conditions for inclusion in the environmental authorisation.
- Any monitoring requirements for inclusion in the EMPr or environmental authorisation.
- A reasoned opinion as to whether the proposed activity or portions thereof should be authorised, and if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan.
- A description of any consultation process that was undertaken during preparing the specialist report.
- A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
- Any other information requested by the competent authority.

In development of the above, specialists are expected to:

- Review the BAR, with specific reference to the Comments and Response Report to familiarize with all relevant issues or concerns relevant to their field of expertise.
- In development of the impacts listed in the BAR, identify any issue or aspect that needs to be assessed and provide expert opinion on any issue in their field of expertise that they deem necessary in order to avoid potential detrimental impacts.
- Assess the degree and extent of all identified impacts (including cumulative impacts) that the preferred project activity and its proposed alternatives, including that of the no-go alternative, may have.
- Identify and list all legislation and permit requirements that are relevant to the development proposal in context of the study.
- Reference all sources of information and literature consulted; and
- Include an executive summary to the report.

The terms of reference for this Visual Impact Assessment (VIA) requires providing the following:

- Conduct a desktop review of available information that can support and inform the specialist study;
- Describe the receiving environment and the visual absorption for the proposed project;
- Conduct a field survey to determine the actual or practical extent of potential visibility of the proposed development;

- Conduct a photographic survey of the landscape surrounding the development;
- Identify issues and potential visual impacts for the proposed project, to be considered in combination with any additional relevant issues that may be raised through the public consultation process;
- Identify possible cumulative impacts related to the visual aspects for the proposed project;
- Assess the potential impacts, both positive and negative, associated with the proposed project for the construction, operation and decommissioning phases;
- Identify management actions to avoid or reduce negative visual impacts; and to enhance positive benefits of the project; and
- Use mapping and photo-montage techniques as appropriate.

1.7. Project Team and Experience

The project team will consist of Johan Botha and Michael Cloete.

Johan Botha graduated with an Honours degree in 2011 from the North West University in the field of Environmental Sciences specialising in Geography and Environmental Management and has since been involved in the environmental management of substations, powerlines and solar PV plants together with over 50 Visual Impact Assessments (VIA) and 20 Social Impact Assessments (SIA), mostly in the field of Renewable Energy. All the above-mentioned experience accumulated the necessary skills to conduct visual and social impact assessments.

Michael Cloete graduated with a Masters degree in 2020 from the North West University in Geography and Environmental Management with a focus on Geographic Information Systems (GIS) and Visual Impact Assessments (VIA). Accumulating two years of environmental specialist knowledge and reporting in the Hydrogeology field. The accumulated experience provides the necessary skills to conduct visual and social impact assessment.

2. METHODOLOGY

A site inspection was conducted on 14 September 2022. Most of the visual receptors were determined by using ZTV and geographical imagery within a 10km radius before the site inspection.

2.1. Purpose of the Study

To determine the purpose of the study, one would first have to understand what a visual impact is: Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks and conservation areas, highways and travel routes, and important cultural features and historic sites.

Visual impacts therefore relate to the changes that arise in the composition of views as a result of:

- Changes to the landscape;
- People's response to those changes; and
- the overall negative effect with respect to the scenic beauty of that landscape, which can be subjective.

Visual impact is therefore measured as the change or contrast to the existing visual environment and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the landscape.

Visual impacts can be seen as an issue because it reduces the public's enjoyment and appreciation of the landscape and impair the character or quality of such a place as well as the aesthetic quality of the landscape if it is considered to be a national resource.

VIAs addresses the importance of the inherent aesthetics of the landscape, the public value of viewing that landscape, and the contrast or change in the landscape derived from the physical presence of a proposed project. For instance, Sensitive Geographical Areas can be classified as sensitive properties that are evaluated for the potential for adverse visual impacts, based on the current land use or enjoyment of the view. The sensitivity of a certain geographical area is the degree to which a particular area can accommodate change. An example of a sensitive geographical area would be when scenic quality was influential in its being. In other words, a geographical area is not sensitive to visual impact if visual aspects of its feeling and setting are not part of what makes it eligible.

A project therefore has a significant visual impact in a certain geographical area when the proximity of the proposed project impairs aesthetic features or attributes of that area in a substantially visual way such that features, or attributes are considered important contributing elements to the value of the resource.

The purpose and objectives of this VIA report is to:

- give the reader an overview of the aesthetics of the landscape.
- determine the visual receptors present within the study area.
- determine the receptors likely to be sensitive to the proposed development.
- determine the extent and significance of the visual impact.

The scope of the assessment includes the proposed development area and its associated structures and infrastructure.

2.2. Approach to the Study

The approach to the study followed various guidelines for visual impact assessments that are available. This assessment will be undertaken in accordance with:

- South African Provincial Government (Western Cape Province) – Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (2005);
- United States of America, Texas Department of Transportation - Standard Operating Procedure for Visual Impact Assessments (2012);
- The Landscape Institute with the Institute of Environmental Management and Assessment – Guidelines for Landscape and Visual Impact Assessments, Second Edition (2002); and
- World Bank Group - Environmental, Health, and Safety Guidelines for Wind Energy (2015).

Together these documents provide a comprehensive basis and data base for the level of approach of a visual impact assessment.

2.3. Baseline Assessment – Significance Rating

Impact assessment must take account of the nature, scale and duration of impacts on the visual receptors whether such impacts are positive or negative. Each impact is also assessed according to the visual receptors, which were determined by using the ZTV, Google Earth (for visual receptors and development types) and the following project phases:

- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving visual receptors and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, **Table 2.1** below, will be utilised as the baseline impact assessment for visual receptors and phases of the project.

Table 2.1: Impact Significance Rating

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.

2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.

2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

2.4. Visibility rating in terms of proximity by using the Zone of Theoretical Visibility (ZTV) model

The ZTV reflects the visibility rating in term of proximity of viewers to the proposed development within a 10km radius. The distances were calculated using satellite imagery, but the impact magnitude was determined by using previous experiences, assumptions and opinions, it is therefore theoretical. The ZTV maps will give a clearer understanding of areas susceptible to line of sight within a 10km radius which means, an imaginary line from the eye to a perceived object. The ZTV assessment **did not consider existing screening such as buildings and vegetation cover but rather the terrain's above mean sea level (AMSL) which indicates line of sight**. The receptors which were identified were subject to an impact assessment. The following table was utilised to determine the ZTV Visibility Rating in terms of proximity:

Table 2.2: ZTV Visibility Rating in terms of proximity

Radius	Visibility rating in terms of proximity
0-1km	Very High
1-3km	High
3-5km	Medium
5-10km	Low

2.5. Assumptions and Limitations

2.5.1. Spatial Data Accuracy

Spatial data used for visibility analysis originate from various sources and scales. Inaccuracy and errors are therefore inevitable. Where relevant, these are highlighted in the report. Every effort was made to minimize their effect.

2.5.2. View Shed Analysis

A view shed is the geographical area that is visible from a location. It includes all surrounding points that are in line-of-sight of that location and excludes points that are beyond the horizon or obstructed by terrain and other features. The initial determination of the view sheds on maps does not consider the potential screening effect of vegetation and buildings.

2.5.3. Viewer Subjectivity

It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Aesthetic issues are subjective, and some people find wind & solar farms, power line infrastructure and masts pleasant and optimistic while others may find it visually invasive; it is mostly perceived as symbols of energy independence; and local prosperity. Some tourism officials predict that solar farms will enhance tourism, while some solar farms have themselves become tourist attractions, with several around the world having visitor. Other tourists might find the Solar PV projects intrusive and spoil their views of the natural environment.

2.5.4. Site Access and UAV Photos

Access to certain areas of the proposed project can sometimes be difficult due to terrain limitations or access denied by landowners. Thus, site photos are taken at the best possible location.

Photos taken by the Unmanned Arial Vehicle (UAV) are conducted at a certain Above Ground Level (AGL) shown on the UAV's controller. The AGL on the UAV's controller might slightly differ from the real world AGL.

3. EXISTING LANDSCAPE

It is possible that landscape change due to the proposed development could impact the character of an important landscape area.

Importance can be derived from specific features that can relate to urban or rural settings. They might include key natural, historic or culturally significant elements. Importance might also relate to landscapes that are uncommon or under threat from development.

Generally, the most significant natural areas are afforded a degree of legal protection such as National Parks and Reserves; however, they might also have local significance and not be protected.

This section describes the types of landscape that may be impacted, indicating the likely degree of sensitivity and describes how the landscape areas are likely to be impacted.

3.1. Landscape Character

Landscape character is a composite of several influencing factors including:

- Landform and drainage.
- Vegetation patterns.
- Nature and density of development.

3.1.1. Landform and Drainage

The project site is located in an area with relatively low significance in elevation, meaning that the site is not located on a mountain, at the foot of a mountain or in an area with a significant difference in elevation. The site is located at an above mean sea level (amsl) of approximately 1262m at the highest elevation and at an amsl of 1244m at the lowest elevation. The site drains towards the west.

The landform and drainage described above is unlikely to limit visibility except to the north-east and north at a distance of approximately 7km and 10km respectively, where small isolated ridges and plateaus are present. The highest amsl point in a 10km radius around the proposed sites is 1320m, approximately 10km towards the north on top of the isolated plateau ridge. This is a difference of approximately 58m in an extreme case from the site. The rest of the area is rather level with much lower difference in amsl. Areas within 5km from the proposed development might have a clear view without taking existing screening into account.

Please refer to the Hillshade map and photos below for a better understanding of the visual landscape surrounding the proposed development.

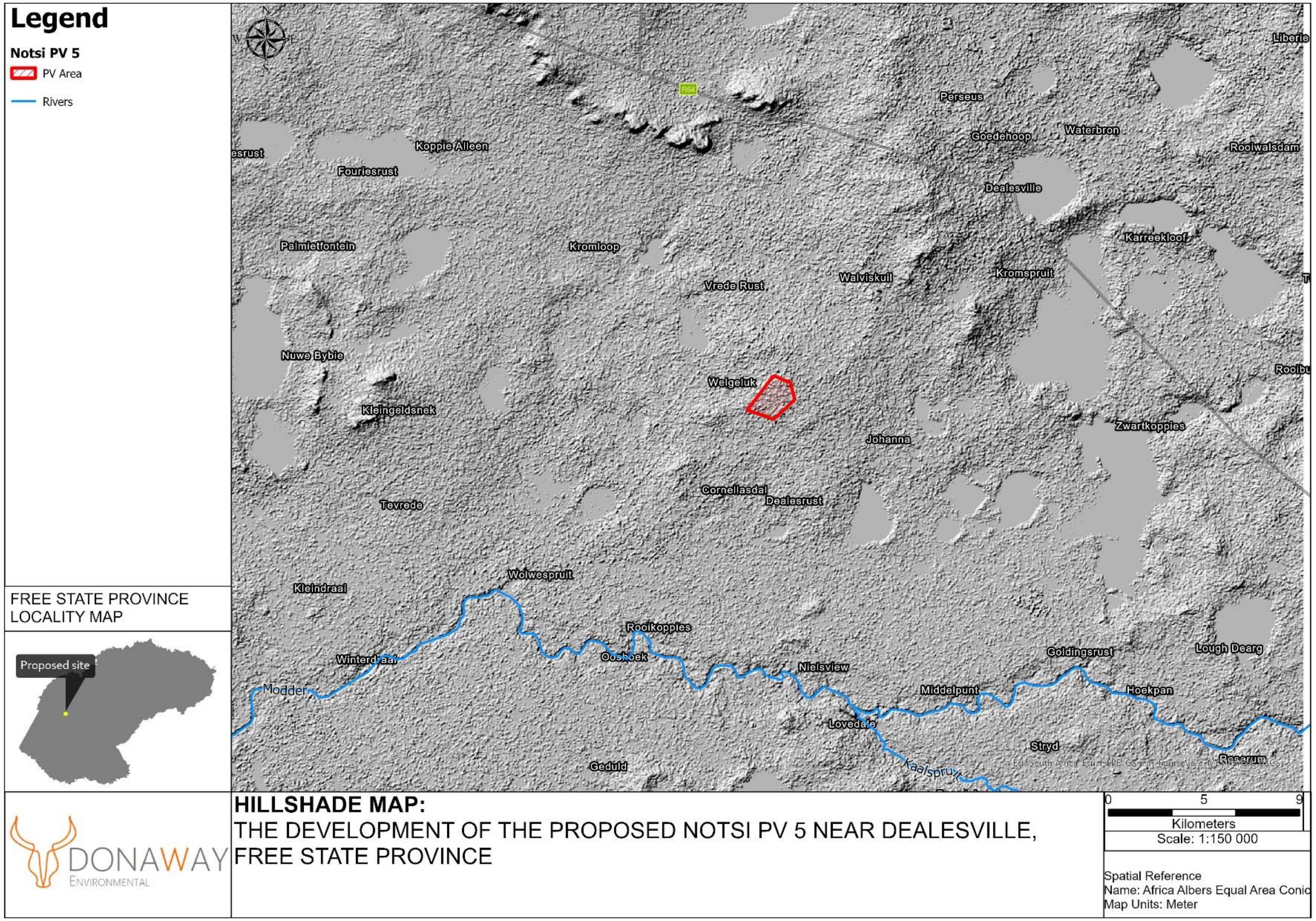


Figure 3.1: Hillshade Map

Figure 3.2: Centre of the site taken towards the north: AGL 6m

Figure 3.3: Centre of site taken towards the north-east: AGL 6m

Figure 3.4: Centre of site taken towards the east: AGL 6m

Figure 3.5: Centre of site taken towards the south-east: AGL 6m

Figure 3.6: Centre of site taken towards the south: AGL 6m

Figure 3.7: Centre of site taken towards the south-west: AGL 6m

Figure 3.8: Centre of site taken towards the west: AGL 6m

Figure 3.9: Centre of site taken towards the north-west: AGL 6m

Figure 3.10: Centre of the site taken towards the north: AGL 32m

Figure 3.11: Centre of site taken towards the north-east: AGL 32m

Figure 3.12: Centre of site taken towards the east: AGL 32m

Figure 3.13: Centre of site taken towards the south-east: AGL 32m

Figure 3.14: Centre of site taken towards the south: AGL 32m

Figure 3.15: Centre of site taken towards the south-west: AGL 32m

Figure 3.16: Centre of site taken towards the west: AGL 32m

Figure 3.17: Centre of site taken towards the north-west: AGL 32m

Figure 3.18: 100m AGL area: Taken towards the north

Figure 3.19: 100m AGL area: Taken towards the north-east

Figure 3.20: 100m AGL area: Taken towards the east

Figure 3.21: 100m AGL area: Taken towards the south-east

Figure 3.22: 100m AGL area: Taken towards the south

Figure 3.23: 100m AGL area: Taken towards the south-west

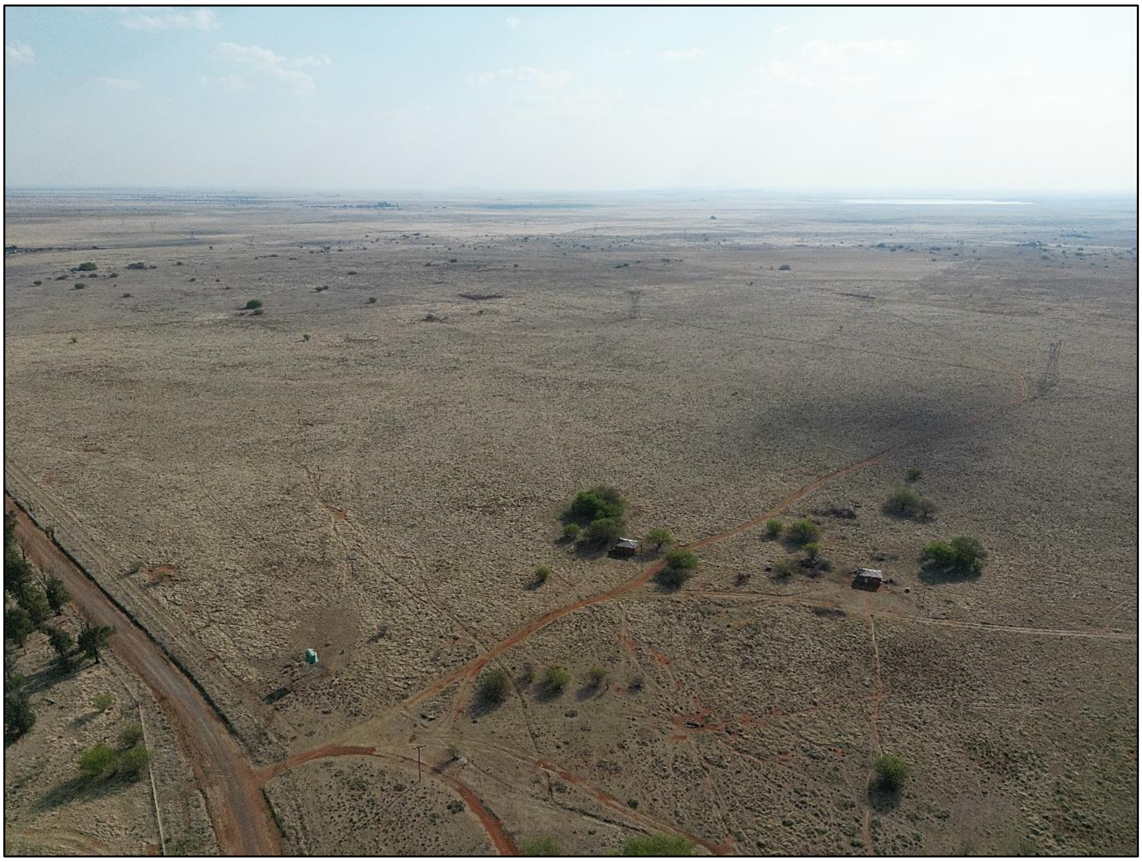


Figure 3.24: 100m AGL area: Taken towards the west

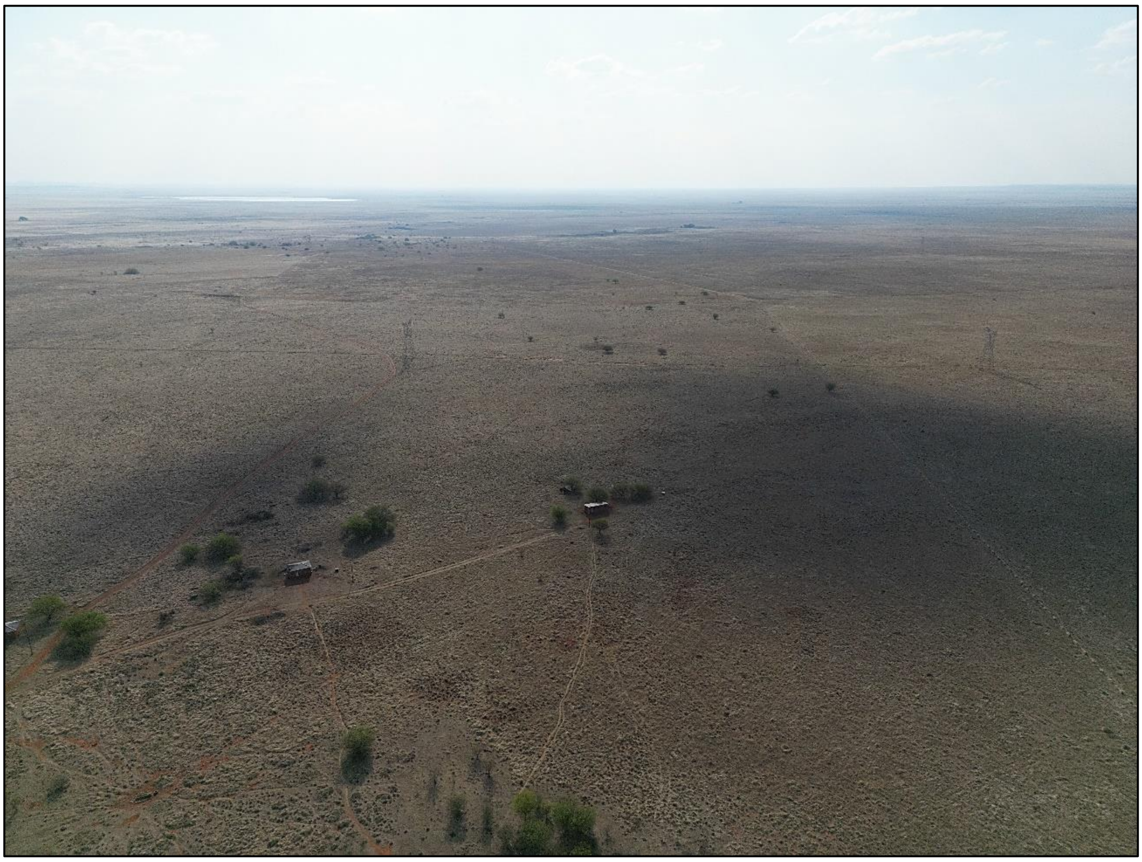


Figure 3.25: 100m AGL area: Taken towards the north-west

3.1.2. Vegetation Patterns

The most recent classification of the area by Mucina & Rutherford (2006) shows that the site falls within the classified *Western Free State Clay Grassland*. Distribution covers part of the western Bloemfontein District (south), Boshof (southwest), Hertzogville (west), Wesselsbron (north) and Brandfort (east) and consisting of three main areas, of which the southern and middle sections are separated by a slightly elevated area (dolerite hills) between Hertzogville, Boshof and Soutpan. The Vet River Valley separates the middle and northern sections, and all three sections are separated from one another by belts of Gh 10 Vaal-Vet Sandy Grassland. Altitude 1 200–1 420 m.

The vegetation and landscape features can be described as restricted to flat bottomlands which support dry, species-poor grassland with a high number of salt pans (playas) embedded. Dwarf karoo shrublands surround the playas in disturbed habitats.

The conservation status is classified as “Least Threatened”. None conserved in statutory conservation areas. Almost 20% already transformed for maize and wheat cultivation. A species of *Prosopis* appears as occasional invasive alien. Erosion is very low.

3.1.3. Nature and Density of Development

Development within the 10km radius study area (some beyond) can be divided into the following types:

- **Industrial Development;** No significant industrial development in the area except for, what looks like, an abandoned salt mine east of Dealesville, outside the study area.
- **Urban Development;** Small scale urban development, outside the study radius, only including the town of Dealesville and one associated suburb, called Tswaraganang.
- **Sports and Recreational Development;** It seems no real recreational development is present within the study area. Sports development is more associated with the three schools found in Dealesville.
- **Agricultural Development;** This is one of the main development types in the area consisting mostly out of cattle, sheep, dryland cultivation and irrigation farming. The latter being located approximately 13km south from the proposed development.
- **Service Development;** Facilities and infrastructure associated with development. This includes roads, power infrastructure, water infrastructure etc. Most services are linked to electricity distribution with a dense power line network and two major substations called Perseus and Beta.
- **Tourism Development;** Dealesville and surrounds are not known to be an attractive tourist destination. Tourism development, in this case more accommodation, is very limited with only a few lodging facilities located in the area.

4. VISUAL RECEPTORS

Visual Receptors can be defined as: "Individuals, groups or communities who are subject to the visual influence of a particular project".

4.1. Identified Sensitive Visual Receptors

This section is intended to highlight possible Receptors within the 10km radius which due to use could be sensitive to landscape change. They include:

- **Area Receptors** which include:
  - None.
- **Linear Receptors** which include:
  - S322 secondary road.
  - S401 secondary road.
  - One unnamed secondary road leading to Petrusburg. For the sake of this report, it will be referred to as the "Petrusburg secondary road".
- **Point Receptors** which include:
  - Homesteads on farms.
  - Lodging facilities.

Refer to **Figure 5.7 and 5.8: Zone of Theoretical Visibility (ZTV). These maps indicate all areas that are in direct line of site of the proposed development up to a distance of 10km.

4.2. Impacts on airports and aerodromes

4.2.1. Objects affecting airspace and applicable legislation

Any communications structure, building or other structure, whether temporary or permanent, which has the potential to endanger aviation in navigable airspace, or has the potential to interfere with the operation of navigation or surveillance systems or Instrument Landing Systems, including meteorological systems for aeronautical purposes, is considered an obstacle and shall be submitted to the Commissioner for Civil Aviation for evaluation (refer to SA-CAR Part 139.01.33).

As navigable airspace is any airspace where "heavier than air" craft can operate, it means that any obstacle, anywhere, needs to be evaluated.

The main reason is to control or prevent structures that could have a serious effect on aviation safety, especially in the vicinity of an aerodrome. It also follows that the knowledge of where obstacles are, will add to aviation safety.

<u>Power lines</u>

Power lines, overhead wires and cables are considered as obstacles and the detail shall be communicated to the Commissioner for Civil Aviation at an early planning stage.

The Commissioner shall require the route of the power line, the co-ordinates (latitude and longitude in degree, minute, seconds and tenth of seconds format) of turning points in the line, the maximum height of the structures above ground level and the name of the power line. The Commissioner shall evaluate the route and require those sections of the line (if any), which is considered a danger to aviation to be marked or rerouted.

Power lines shall be marked when crossing a river, valley or major highway with marker spheres of a diameter of not less than 60 cm. The spheres shall be of one colour and displayed alternately orange/red and white or a colour that is in sharp contrast to the background as seen from an airborne perspective. The spacing between the spheres and between the spheres and the supporting towers shall not exceed 30m. On lines with multiple cables, the spheres shall be fitted to the highest cable.

The marker spheres shall be visible from at least 1000m from an airborne perspective and 300m from the ground.

Where power lines cross a river or valley, the co-ordinates (latitude and longitude in degree, minute, seconds and tenth of seconds format) and the height of the line above the valley or river, shall be communicated to the Commissioner for publication in the appropriate media.

The Commissioner may require that supporting towers be marked and lighted.

Cranes

Where cranes are erected, prior permission shall be obtained from the Commissioner. The co-ordinates (latitude and longitude in degree, minute, seconds and tenth of seconds format), the ground elevation of the site above mean sea level, the height of the crane, the dimensions of the jib as well as the erecting date and duration of the project must be communicated to the Commissioner for evaluation and publication in the relevant media.

The Commissioner shall specify markings, if required.

When markings are required, the crane shall be painted in a conspicuous colour which in a sharp contrast to the background from an airborne perspective. Illumination shall clearly define the shape of the crane and the extremities of the structure shall be illuminated by medium intensity Type B flashing red light (20 – 60 flashes per minute), of 2000 candela (±25 %) intensity.

Variations on Markings

Written, motivated request for the variation of any of the requirements for the marking of structures may be addressed to the Commissioner.

Specifications on markings

Specification on the lighting and painting of structures can be found in International Civil Aviation Organization's Annex 14 chapter 6 and the specifics in Annex 14 APPENDIX 1. COLOURS FOR AERONAUTICAL GROUND LIGHTS, MARKINGS, SIGNS AND PANELS. (https://www.flashtechnology.com/wp-content/uploads/2017/09/ICAO-Annex-14-Chapter-6-2013.pdf).

4.2.2. Glare

Solar panels are designed to absorb light, and accordingly only reflect a small amount of the sunlight that falls on them compared to most other everyday objects (Refer to **Figure 4.1 to 4.4**). Most notably, solar panels reflect significantly less light than flat water.

In fact, glass, one of the uppermost and important components of a solar panel, reflects only a small portion of the light that falls on it–about 2-4%, depending on whether it has undergone an anti-reflective treatment. These days, to increase solar panel efficiency and power output, most panels are treated with anti-reflective coating.

The potential glint and glare effects for Bi-facial panels remains the same due to both faces consisting of a reflective surface, it is deemed very unlikely that significant glare effects from the underside are possible for static, single and dual axis trackers. This is because this face will almost always be facing away from the Sun. On static systems (north facing with a 20-degree elevation angle, for example), the underside of the panel will be angled downward towards the ground. Considering the path of the Sun throughout a typical day in South Africa, any reflections will only ever go towards the floor. The possibility of glare effects for the optimised face (the face orientated towards the Sun) remains the same.

Figure 4.1: Reflection Characteristics of normal glass (left) and PV glass (right)

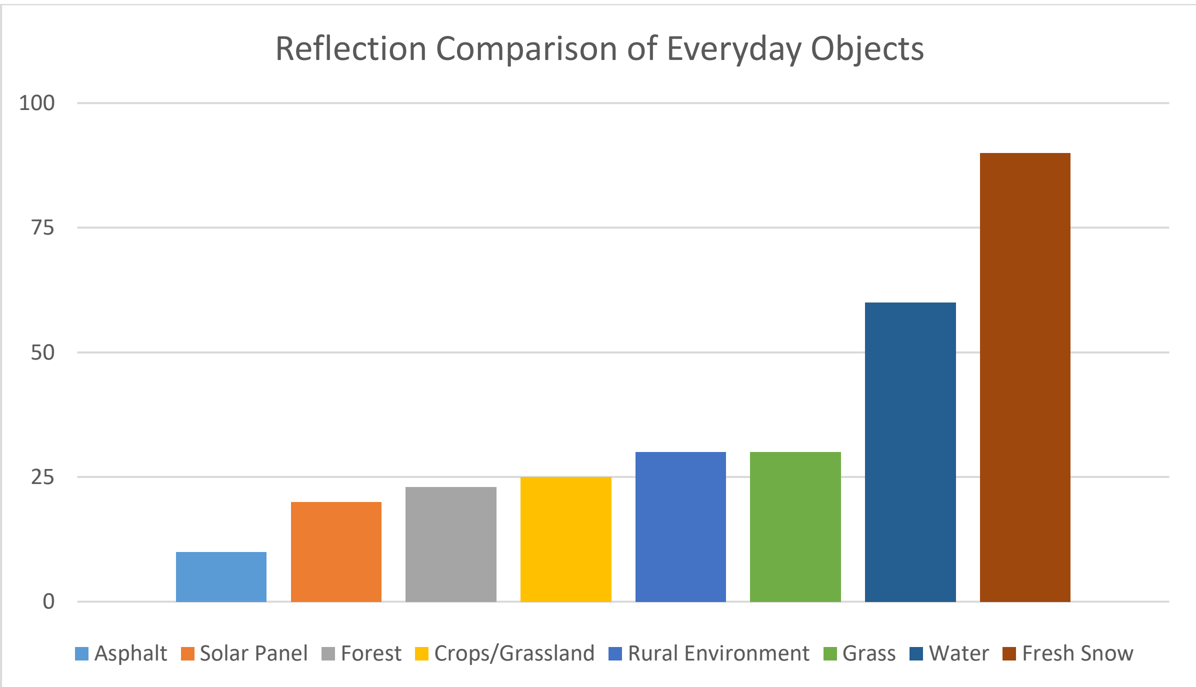


Figure 4.2: Reflection Comparison of everyday objects

Numerous airports around the world have solar installations located on their premises (Refer to Figure 4.3). Airports Company South Africa (ACSA) has commissioned three solar powered airports, George Airport in the Western Cape, followed by Kimberley Airport and Upington International Airport, both in the Northern Cape. Most examples in which solar panels have been installed at, on or near airports are testament to fact that they are not automatically a hazard to pilots.

Figure 4.3: Solar Installations at the George Airport in the Western Cape

Figure 4.4: View of the Bokamoso PV facility from an airplane at a height of 36000 feet amsl

Please Note: A Glint & Glare Assessment will be required as soon as the proposed site is located on the extended runway centreline within the ICAO Annex 14 Approach Surface, Take-Off Climb Surface & Departure Surface, and within 3km radius around an Aerodrome/helistop as pe Part 139.01.30 (3).

5. ZONE OF THEORETICAL VISIBILITY MODEL

Visual Receptors can be defined as: "Individuals, groups or communities who are subject to the visual influence of a particular project."

A Zone of Theoretical Visibility (ZTV) is a Geographic Information System (GIS)-generated tool to identify the likely (or theoretical) extent of visibility of a development. The tool used in this model does not take existing screening into account but only the above mean sea level of the landscape.

Table 5.1: ZTV Assumptions

Radius	Visibility rating in terms of proximity
0-1km	Very High
1-3km	High
3-5km	Medium
5-10km	Low

ZTV Rating

Table 5.2 below reflects the visibility rating in terms of proximity on sensitive receptors of each site. **Figures 5.7 and 5.8** reflects the theoretical visibility. The distances were calculated according to experience, assumptions and opinion. The ZTV maps will give a clearer understanding of areas susceptible to line of sight of the PV facility within a 10km radius.

Table 5.2: ZTV Visibility Rating in terms of Proximity to Notsi PV 5

Radius	Visual Receptors	Visibility rating in terms of proximity
0-1km	None **Visibility Coverage: 79.39%**	Very High
1-3km	- Three homesteads on farms - S322 secondary road **Visibility Coverage: 27,39%**	High
3-5km	- S322 secondary road **Visibility Coverage: 15.26%**	Medium
5-10km	- Eight homesteads on farms - One lodging facility - S322 secondary road	Low

	- Petrusburg secondary road **Visibility Coverage: 16%**	

Please Note: The ZTV assessment did not consider existing screening such as buildings and vegetation cover but rather the terrain's above mean sea level (AMSL) which indicates line of sight.

The photos below reflect a view towards the operational 200 hectares Matla A Bokone Solar Power Plant, previously known as Droogfontein 2, at a distance of approximately 1km and 2km respectively. Three photos were taken at different AGL of 6m, 30m and 50m. The photos reflect an almost negligible visibility of the solar power plants in their operational phase. Furthermore, as seen in the photos, almost no existing screening is present.

Figure 5.1: View towards the Droogfontein 2 SPP at 2km: 6m AGL

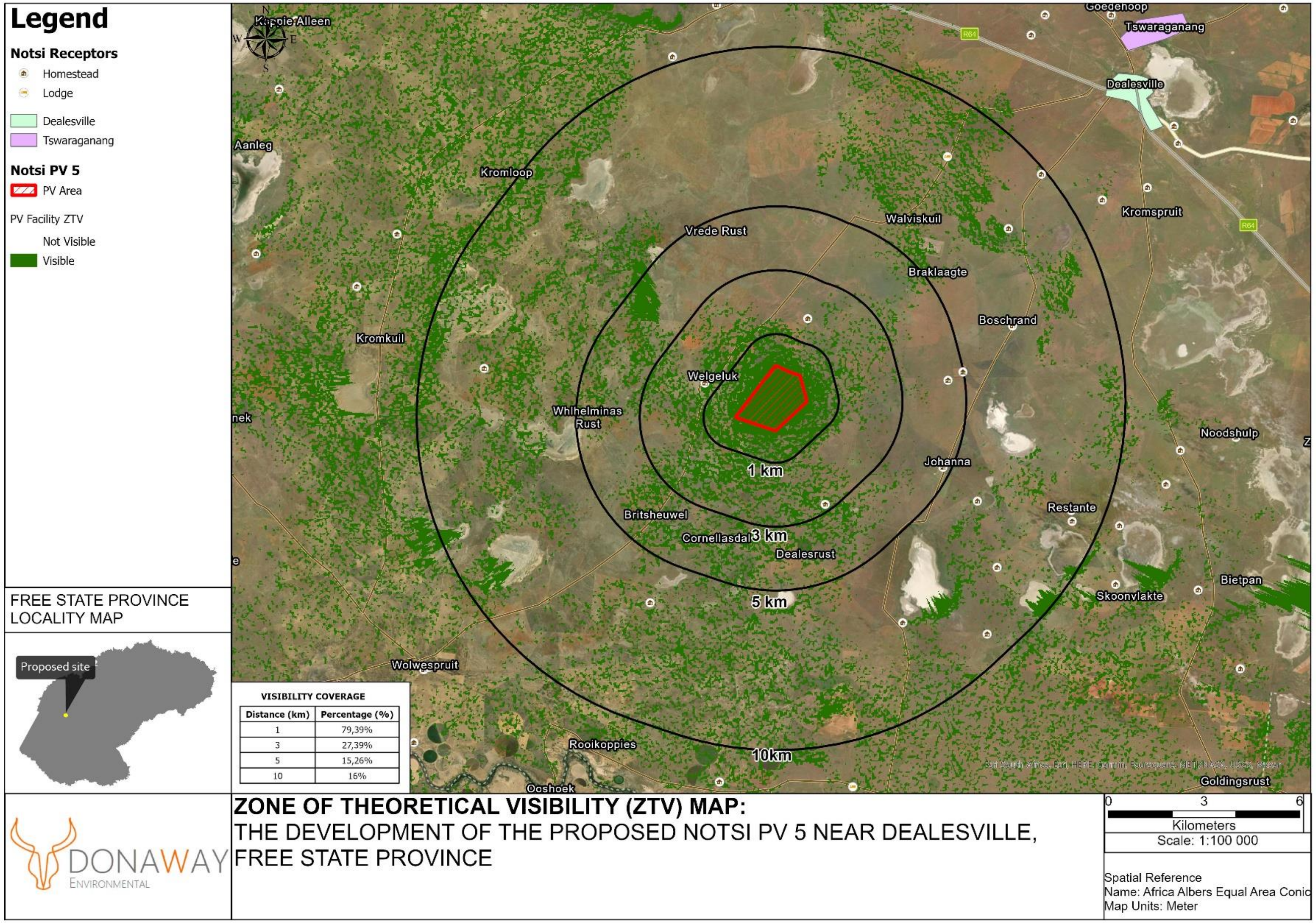
Figure 5.2: View towards the Droogfontein 2 SPP at 2km: 30m AGL

Figure 5.3: View towards the Droogfontein 2 SPP at 2km: 50m AGL

Figure 5.4: View towards the Droogfontein 2 SPP at 1km: 6m AGL

Figure 5.5: View towards the Droogfontein 2 SPP at 1km: 30m AGL

Figure 5.6: View towards the Droogfontein 2 SPP at 1km: 50m AGL



VISIBILITY COVERAGE

Distance (km)	Percentage (%)
1	79,39%
3	27,39%
5	15,26%
10	16%

Figure 5.7: Zone of Theoretical Visibility (ZTV), Satellite View

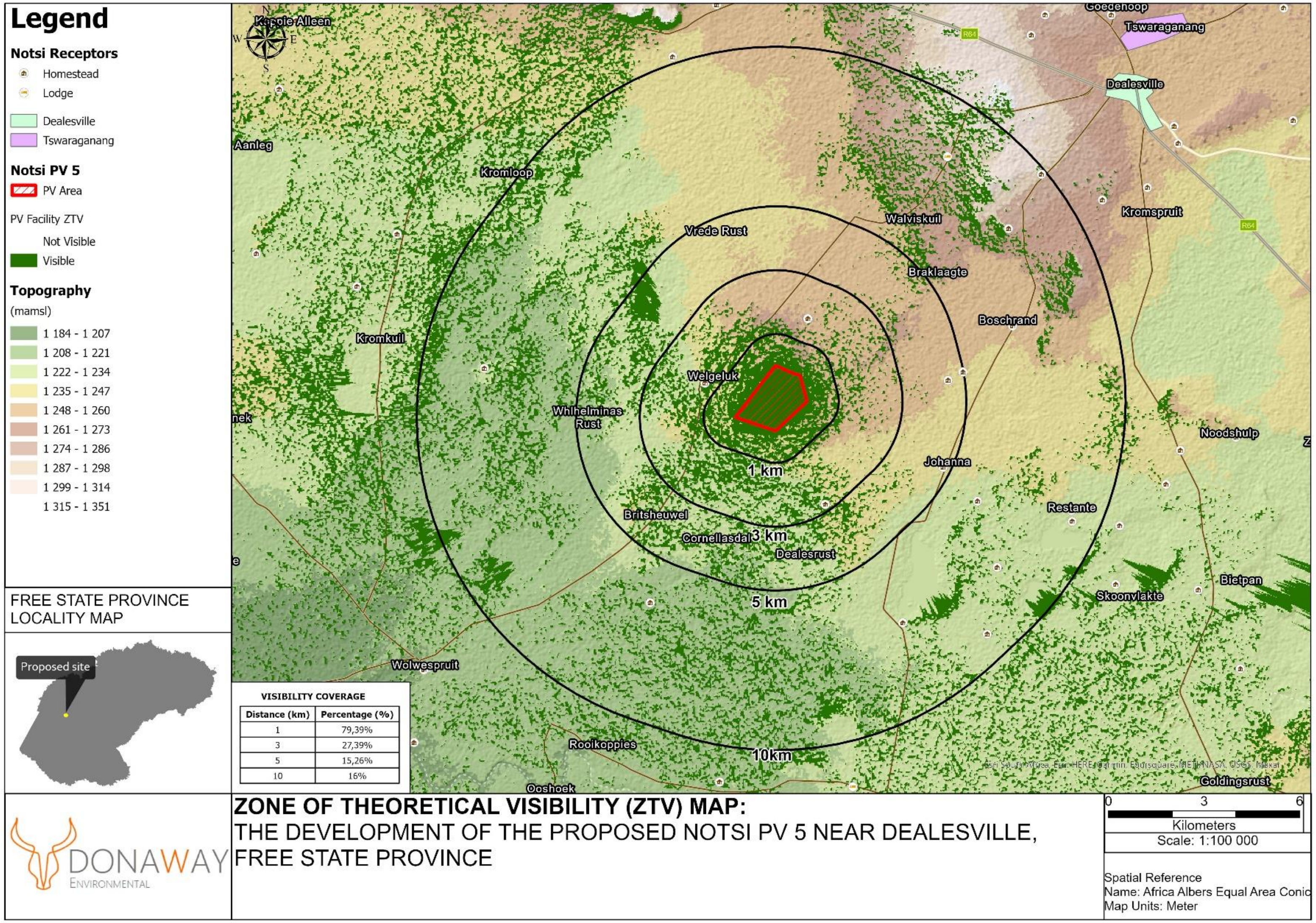


Figure 5.8: Zone of Theoretical Visibility (ZTV), Topography View

6. VISUAL IMPACT ASSESSMENT

This section provides a detailed description and assessment of the potential visual impacts that were identified during the Basic Assessment process for the detailed design and construction, operation, and decommissioning phases of the proposed Notsi PV 5.

6.1. Design and Construction Phase

The design and construction phase are expected to take approximately 18 to 24 months to complete. It is anticipated that the following activities would be included and would form part of the detailed design and construction phase:

- **Pre-planning:** Several post-authorisation factors are expected to influence the final design of the facility and could result in small-scale modifications of the positioning of the PV array and / or associated infrastructure. The construction process is dynamic and unforeseen changes to the project specifications may occur. The final facility design is required to be approved by DFFE prior to any construction activities commencing on-site. Should any substantive changes or deviations from the original scope or layout of the project reflected in the Basic Assessment process occur, DFFE would need to be notified thereof, and where applicable additional approval may need to be obtained.
- **Conduct surveys**: Prior to initiating construction, several surveys will be required. These include, but are not limited to, confirmation of the micro-siting footprint (i.e., confirming the precise location of the PV panels, substation, and the plant's associated infrastructure) and a geotechnical survey.
- **Procurement and employment**: At the peak of construction the project is likely to create up to 300 employment opportunities during the peak of construction. These employment opportunities will be temporary and will last for a period of approximately 18 to 24 months (i.e., the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of large numbers of unskilled and semi-skilled labour so there will be good opportunity to use local labour. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Most of the labour force is expected to be sourced from the surrounding cities. No labourers will be accommodated on-site during the construction period.
- **Establishment of an access road to the site:** Access to the facility will be obtained via the S322 secondary road. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor. The final layout will be determined following the identification of site related sensitivities.
- **Undertake site preparation:** Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and / or spread on site.
- **Transport of components and equipment to site:** The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment

required during the construction phase of the solar facility. Some of the components (i.e., substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTO) by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the site (e.g., excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.

- **Establishment of laydown areas on site:** Laydown and storage areas will be required for typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area will need to be established adjacent to the workshop area. The equipment construction camp serves to confine activities and storage of equipment to one designated area to limit potential impacts associated with this phase of development. The laydown area will be used for the assembly of the PV panels and the general placement / storage of construction equipment.
- **Erect PV arrays and construct substation and invertors:** The construction phase involves installation of the PV solar panels and structural and electrical infrastructure required for the operation of the facility. In addition, preparation of the soil and improvement of the access roads is likely to continue for most of the construction phase. For array installations, vertical support posts are driven into the ground. The posts will hold the support structures (tables) on which the PV modules would be mounted. Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared if necessary. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the solar facility’s onsite substation. The construction of the substation will require a survey of the site, site clearing and levelling and construction of access road(s) (where applicable), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas, and protection of erosion sensitive areas.
- **Establishment of ancillary infrastructure:** Ancillary infrastructure will include workshop, storage and laydown areas, gatehouse and security complex, as well as a temporary contractor’s equipment camp. The establishment of the ancillary infrastructure and support buildings will require the clearing of vegetation and levelling of the development site, and the excavation of foundations prior to construction. Laydown areas for building materials and equipment associated with these buildings will also be required.
- **Undertake site rehabilitation:** Once construction is completed and all construction equipment has been removed, the site will be rehabilitated where practical and reasonable. In addition, on full commissioning of the solar facility, any access points which are not required during operation must be closed and rehabilitated accordingly.

The majority of visual impacts associated with the projects are anticipated to occur during the operational phase of the development. Impacts during the construction phase of the Solar PV projects are typical of the type of visual impacts generally associated with construction activities. Impacts associated with the design and construction phase of a project are usually of a short duration and temporary in nature but could have long-term effects on the surrounding visual environment if not planned or managed appropriately. It is therefore necessary that the design phase be conducted in such a manner so as not to result in permanent impacts associated with the ill placement of project components or associated infrastructure.

Impacts during the construction phase of the project mainly relate to construction activities, dust generation and there may be a notable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

Table 6.1: Visual impact of construction activities on sensitive visual receptors

Nature of Impact	**Visual impact of construction activities on sensitive visual receptors.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Definite (4)	Short term (1)	Medium (2)	Completely Reversable (1)	Marginal loss of resources (2)	High (4)	(28) Negative Low
Post-Mitigation	Local (2)	Probable (3)	Short term (1)	Medium (2)	Completely Reversable (1)	Marginal loss of resources (2)	Medium (3)	(24) Negative Low
Can the impact be mitigated?	Yes, but only partially.							
Mitigation:	Planning - Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction - Ensure that vegetation is not unnecessarily removed during the construction phase. - Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible. - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. - Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site. - Reduce and control dust during construction by utilising dust suppression measures. - Limit construction activities to daylight hours, where possible, in order to reduce the impacts of construction lighting. - Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.							

No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The construction of the PV facility may increase the cumulative visual impact together with existing power infrastructure and should any of the other proposed PV facilities be constructed. Dust will be the main factor to consider.
Residual Impacts:	None, if rehabilitation is carried out as specified.

6.2. Operational Phase

The PV facility is anticipated to operate for a minimum of 20 years. The facility will operate continuously, 7 days a week, during daylight hours. While the solar facility will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Management (O&M) Plan include monitoring and reporting the performance of the solar facility, conducting preventative and corrective maintenance, receiving visitors, and maintaining security.

The potential positive and negative visual impacts which could arise as a result of the operation of the proposed project include the following:

6.2.1. Potential visual impacts on sensitive visual receptors located within a 1km radius.

Table 6.2: Visual impacts on sensitive visual receptors within a 1km radius

Nature of Impact	**Visual impact on sensitive visual receptors within a 1km radius.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Definite (4)	Long term (3)	High (3)	Irreversible (4)	Marginal loss of resources (2)	High (4)	(57) Negative High
Post-Mitigation	Local (2)	Definite (4)	Long term (3)	Medium (2)	Partly Reversable (2)	Marginal loss of resources (2)	High (4)	(34) Negative Medium

Can the impact be mitigated?	Yes, but only partially.
Mitigation:	Planning - Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. - Where insufficient natural vegetation exists next to the property, a 'screen' can be planted if the landowner requests additional mitigation. This can be done using endemic, fast growers that are water efficient. Operations - Maintain general appearance of the facility as a whole.
No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The project may increase the cumulative visual impact together with existing power infrastructure and should any of the other proposed PV facilities be constructed.
Residual Impacts:	The visual impact will be removed after decommissioning of the site, if the PV facility is not decommissioned after 20 years – the visual impact will remain.

6.2.2. Potential visual impacts on sensitive visual receptors located between a 1km and 3km radius.

Table 6.3: Visual impacts on sensitive visual receptors between a 1km and 3km radius

Nature of Impact	**Visual impact on sensitive visual receptors between a 1km and 3km radius.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Definite (4)	Long term (3)	Medium (2)	Barely Reversable (3)	Marginal loss of resources (2)	High (4)	(36) Negative Medium
Post-Mitigation	Local (2)	Probable (3)	Long term (3)	Medium (2)	Partly Reversable (2)	Marginal loss of resources (2)	High (4)	(32) Negative Medium

Can the impact be mitigated?	Yes, but only partially.
Mitigation:	Planning - Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. - Where insufficient natural vegetation exists next to the property, a 'screen' can be planted if the landowner requests additional mitigation. This can be done using endemic, fast growers that are water efficient. Operations - Maintain general appearance of the facility as a whole.
No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The project may increase the cumulative visual impact together with existing power infrastructure and should any of the other proposed PV facilities be constructed.
Residual Impacts:	The visual impact will be removed after decommissioning of the site, if the PV facility is not decommissioned after 20 years – the visual impact will remain.

6.2.3. Potential visual impacts on sensitive visual receptors located between a 3km and 5km radius.

Table 6.4: Visual impacts on sensitive visual receptors between a 3km and 5km radius

Nature of Impact	**Visual impact on sensitive visual receptors between a 3km and 5km radius.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Probable (3)	Long term (3)	Medium (2)	Partly Reversable (2)	Marginal loss of resources (2)	Medium (3)	(30) Negative Medium
Post-Mitigation	Local (2)	Possible (2)	Long term (3)	Low (1)	Partly Reversable (2)	Marginal loss of resources (2)	Medium (3)	(14) Negative Low
Can the impact be mitigated?	Yes							

Mitigation:	Planning - Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. - Where insufficient natural vegetation exists next to the property, a 'screen' can be planted if the landowner requests additional mitigation. This can be done using endemic, fast growers that are water efficient. Operations - Maintain general appearance of the facility as a whole.
No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The project may increase the cumulative visual impact together with existing electricity infrastructure and should any of the other proposed PV facilities be constructed.
Residual Impacts:	The visual impact will be removed after decommissioning of the site, if the PV facility is not decommissioned after 20 years – the visual impact will remain.

6.2.4. Potential visual impacts on sensitive visual receptors located between a 5km and 10km radius.

Table 6.5: Visual impacts on sensitive visual receptors between a 5km and 10km radius

Nature of Impact	**Visual impact on sensitive visual receptors between a 5km and 10km radius.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Possible (2)	Long term (3)	Low (1)	Partly Reversable (2)	Marginal loss of resources (2)	Medium (3)	(14) Negative Low
Post-Mitigation	Local (2)	Unlikely (1)	Long term (3)	Low (1)	Completely Reversable (1)	No loss of resources (1)	Low (2)	(10) Negative Low
Can the impact be mitigated?	Yes							
Mitigation:	Planning - Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.							

	- Where insufficient natural vegetation exists next to the property, a 'screen' can be planted if the landowner requests additional mitigation. This can be done using endemic, fast growers that are water efficient. Operations - Maintain general appearance of the facility as a whole.
No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The project may increase the cumulative visual impact together with existing electricity infrastructure and should any of the other proposed PV facilities be constructed.
Residual Impacts:	The visual impact will be removed after decommissioning of the site, if the PV facility is not decommissioned after 20 years – the visual impact will remain.

6.2.5. Lighting impacts.

These 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. It is possible that the PV facility may add sky glow to a rural landscape.

Table 6.6: Significance of visual impacts of lighting at night on sensitive visual receptors

Nature of Impact	**Visual impacts of lighting at night on sensitive visual receptors in close proximity.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Definite (4)	Long term (3)	High (3)	Completely Reversable (1)	Marginal loss of resources (2)	High (4)	(48) Negative Medium
Post-Mitigation	Local (2)	Unlikely (1)	Long term (3)	Medium (2)	Completely Reversable (1)	No loss of resources (1)	Low (2)	(20) Negative Low

Can the impact be mitigated?	Yes, but only partially.
Mitigation:	Planning & Operation As far as practically possible: - Shield the source of light by physical barriers (walls, vegetation etc.) - Limit mounting heights of lighting fixtures, or alternatively use footlights or bollard level lights. - Make use of minimum lumen or wattage in fixtures. - Make use of down-lighters, or shield fixtures. - Make use of low-pressure sodium lighting or other types of low impact lighting. - Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. - The use of night vision or thermal security cameras are very effective and can replace security lighting entirely.
No-Go Alternative:	The current status quo is maintained due to no impact.
Cumulative Impacts:	The project may increase the cumulative visual impact together with existing sky glow from the city of Bloemfontein and should any of the other proposed PV facilities be constructed.
Residual Impacts:	The visual impact will be removed after decommissioning of the site, if the PV facility is not decommissioned after 20 years – the visual impact will remain.

6.2.6. Solar glint and glare impacts.

Glint and glare occur when the sun reflects of surfaces with specular (mirror-like) properties. Examples of these include glass windows, waterbodies and potentially some solar energy generation technologies. Glint is generally of shorter duration and is described as "a momentary flash of bright light", whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relatively close proximity to the source (e.g., residents of neighbouring properties), or aviation safety risks for pilots.

Photovoltaic panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark materials and are covered by an anti-reflective coating. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels.

Table 6.7: Significance of visual impacts of solar glint and glare as a visual distraction and possible air travel hazard

Nature of Impact	Visual impacts of glint and glare as a visual distraction and possible air travel hazard.							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Unlikely (1)	Long term (3)	Medium (2)	Completely Reversable (1)	No loss of resources (1)	Low (1)	(18) Negative Low
Post-Mitigation	Local (2)	Unlikely (1)	Long term (3)	Medium (2)	Completely Reversable (1)	No loss of resources (1)	Low (1)	(18) Negative Low
Can the impact be mitigated?	N/A							
Mitigation:	No mitigation measures are required.							
No-Go Alternative:	The current status quo is maintained due to no impact.							
Cumulative Impacts:	N/A							
Residual Impacts:	N/A							

6.2.7. Visual and sense of place impacts.

An area's sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture, and heritage. An area's sense of place is however subjective and largely dependent on the demographics of the population residing within the area and their perceptions regarding trade-offs. For example, while some individuals may prefer not to see any form of infrastructure development, others may have an interest in large-scale infrastructure, or engineering projects, and the operation of such facilities, and consider the impact to be less significant. Such a scenario may especially be true given that the project comprises a Renewable Energy project and could therefore be seen as benefitting the local environment, when compared to non-renewable energy generation projects.

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 visual impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of the project. The area surrounding the project site is characterised by existing livestock, irrigation and dryland cultivation farming.

Table 6.8: Visual impacts on sense of place

Nature of Impact	**Visual impacts on sense of place associated with the operational phase.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Pre-Mitigation	Local (2)	Probable (3)	Long term (3)	Medium (2)	Reversable (2)	Significant loss of resources (3)	Low (2)	(30) Negative Medium
Post-Mitigation	Local (2)	Possible (2)	Long term (3)	Low (1)	Reversable (1)	Significant loss of resources (3)	Low (2)	(13) Negative Low
Can the impact be mitigated?	Yes							
Mitigation:	- It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Aesthetic issues are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; it is mostly perceived as symbols of energy independence; and local prosperity. - The subjectivity towards the project in its entirety can be influenced by implementing public awareness campaigns. Though not a requirement, it is recommended that the proponent investigate implementing a "Green Energy" awareness campaign, educating the local community and potentially tourists on the benefits of renewable energy, and/or hosting an 'open day' (subject to the land owner's consent) where the local community can have the opportunity to view the completed project which may enlist a sense of pride in the renewable energy project in their area. - Implement good housekeeping measures.							
No-Go Alternative:	The current status quo is maintained due to no impact.							

Cumulative Impacts:	Potential impact on the current sense of place in the area due to other solar power developments within the area.
Residual Impacts:	The visual impact of the project will remain if the facility is not decommissioned and dismantled after the end of its operational life.

6.3. Cumulative Impacts

The EIA Regulations (as amended in 2017) determine that cumulative impacts, "*in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*." Cumulative impacts can be incremental, interactive, sequential or synergistic. EIAs have traditionally failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements;
- Complexity - dependent on numerous fluctuating influencing factors which may be completely independent of the controllable actions of the proponent or communities; and
- Project level investigations are ill-equipped to deal with broader biophysical, social and economic considerations.

According to the DFFE's database 28 solar PV plant applications have been submitted to the Department within the geographic area of investigation (refer to **Table 6.9** and **Figure 6.1** for an overview of solar PV facilities within a 30km radius of the project site).

Table 6.9: A summary of related projects, that may have a cumulative impact, in a 30 km radius of the study area

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Visserpan PV 2	~5km	75MW	14/12/16/3/3/1/2154	Basic Assessment	Approved
Visserpan PV 3	~5km	75MW	14/12/16/3/3/1/2155	Basic Assessment	Approved
Visserpan PV 4	~5km	75MW	14/12/16/3/3/1/2156	Basic Assessment	Approved
Keren Klipbult Solar Plant	~7km	75MW	14/12/16/3/3/2/432	Scoping and EIA	Withdrawn/Lapsed
Eleven Kentanie PV Solar	<1km	75MW	14/12/16/3/3/2/717 14/12/16/3/3/2/718 14/12/16/3/3/2/719 14/12/16/3/3/2/720 14/12/16/3/3/2/721	Scoping and EIA	Approved (6 of these projects are preferred bidders in REIPPPP round 5 and will commence construction in early 2023 – currently in

			14/12/16/3/3/2/722 14/12/16/3/3/2/723 14/12/16/3/3/2/724 14/12/16/3/3/2/725 14/12/16/3/3/2/726 14/12/16/3/3/2/728		financial close phase)
Sebina Letsatsi Solar PV	~12km	75MW	14/12/16/3/3/2/755	Basic Assessment	Approved
Edison PV Solar	~15km	100MW	14/12/16/3/3/2/851	Scoping and EIA	Approved
Maxwell PV Solar	~17km	100MW	14/12/16/3/3/2/852	Scoping and EIA	Approved
Marconi PV Solar	~16km	100MW	14/12/16/3/3/2/853	Scoping and EIA	Approved
Watt PV Solar	~18km	100MW	14/12/16/3/3/2/854	Scoping and EIA	Approved
Farday PV Solar	~18km	100MW	14/12/16/3/3/2/855	Scoping and EIA	Approved
Springhaas Solar Facility 1	~ 8 km	250 MWac	14/12/16/3/3/1/2523	Basic Assessment	Approved
Springhaas Solar Facility 3	~ 8 km	150 MWac	14/12/16/3/3/1/2524	Basic Assessment	Approved
Springhaas Solar Facility 4	~ 8 km	150 MWac	14/12/16/3/3/1/2525	Basic Assessment	Approved
Springhaas Solar Facility 5	~ 8 km	150 MWac	14/12/16/3/3/1/2526	Basic Assessment	Approved
Springhaas Solar Facility 6	~ 8 km	250 MWac	14/12/16/3/3/1/2527	Basic Assessment	Approved
Springhaas Solar Facility 8	~ 8 km	150 MWac	14/12/16/3/3/1/2528	Basic Assessment	Approved
Springhaas Solar Facility 9	~ 8 km	150 MWac	14/12/16/3/3/1/2529	Basic Assessment	Approved

***It is unclear whether other projects not related to renewable energy will be constructed in this area. In general, development activity in the area is focused on agriculture. It is quite possible that more future solar farm development may take place within the general area.*

The potential for cumulative impacts to occur as a result of the projects are therefore highly likely. On the other hand, the location of the PV facility within the study area will contribute to the consolidation of PV structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region.

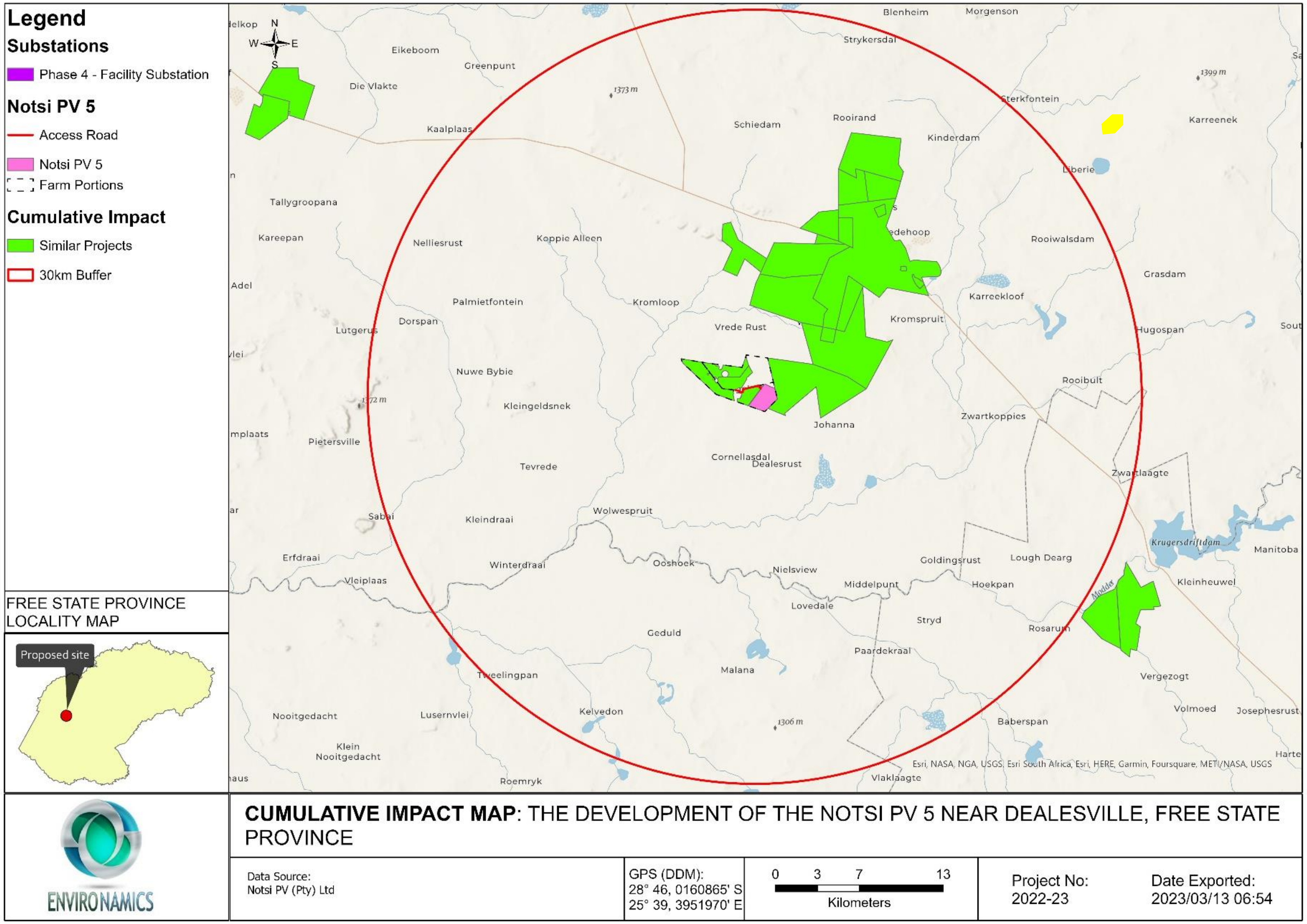


Figure 6.1: Cumulative map showing the location of other solar energy facilities within 30km of the project site

The anticipated cumulative visual impact for the proposed PV facility is expected to include the change in sense of place, as well as the precedent being set for Solar PV projects in the area where currently there is only a precedent for agricultural developments. The construction and operation of the PV facility in the area is likely to have a negative impact.

Table 6.10: Cumulative visual impacts

Nature of Impact	**Cumulative visual impacts.**							
	Geographical Extent	**Probability**	**Duration**	**Magnitude**	**Reversibility**	**Irreplaceable Loss of Resources**	**Cumulative Effect**	**SIGNIFICANCE**
Overall impact of the proposed project considered in isolation	Local (2)	Possible (2)	Long term (3)	Medium (2)	Partly Reversable (2)	Marginal loss of resources (2)	Low (2)	(26) Negative Low
Cumulative impact of the project and other projects in the area	Local (2)	Definite (4)	Long term (3)	Very High (4)	Irreversible (4)	Significant loss of resources (3)	High (4)	(80) Negative Very High
Can the impact be mitigated?	Mitigation will have a negligible influence if all projects in the area be constructed.							
Enhancement:	Planning - Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint / servitude.							
No-Go Alternative:	The current status quo is maintained due to no impact.							
Residual Impacts:	The visual impact of the project will remain if the facility is not decommissioned and dismantled after the end of its operational life.							

6.4. Decommissioning Phase

The decommissioning phase of the project will result in the same visual impacts experienced during the construction phase of the project. However, it is anticipated that the proposed PV facility will be refurbished and upgraded to prolong its life. No decommissioning of the facility is proposed.

6.5. Assessment of Alternatives

The property proposed for development is considered suitable for the development by the Applicant and therefore the area has been demarcated and indicated as being preferred. No other properties have been identified for the development in the Dealesville area.

6.6. Assessment of Impacts for the No-Go Alternative

The "no-go" alternative is the option of not constructing Notsi PV 5. The implementation of Notsi PV 5 is expected to result in several negative visual impacts, but if the project is not constructed the following positive impacts will be lost:

- Potential direct and indirect employment opportunities.
- Potential economic multiplier effect.
- Development of non-polluting, renewable energy infrastructure.

7. MITIGATION MEASURES

The primary visual impact, which is associated with the layout and appearance of the PV solar panels is not mitigatable to the point where the visual impact can be eliminated, but it can be reduced by implementing best practice measures. The functionality of the PV facility cannot be changed to reduce the possible visual impact, but the following measures can be put in place to reduce the possible visual impact:

- It is recommended that vegetation cover (i.e., either natural or cultivated) immediately adjacent to the development footprint, be maintained, during both the construction and operational phases of the Solar PV projects. This will minimise the visual impact through the presence of a buffer screen between the visual receptors and the PV facility.
- Existing roads should be utilised wherever possible. New roads should be planned to take 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 minimise the risk of erosion.
- In terms of onsite associated infrastructure and buildings, it is recommended that proper planning is implemented to minimise vegetation clearing. Consolidating infrastructure as much as possible and making use areas that already disturbed, where possible.
- Mitigation of lighting impacts include the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting fixtures for the proposed PV facility and associated infrastructure will go far in containing, rather than spreading the light. As far as practically possible, mitigation measures include:
    - Shielding the sources of light by physical barriers (walls, vegetation, or structures.)
    - Limiting mounting heights of lighting fixtures, or alternatively using footlights or bollard level lights.
    - Making use of minimum lumen or wattage lights.
    - Making use of downlighters, or shielded fixtures.
    - Making use of low-pressure sodium lighting or other types of low impact lighting.
    - Making use of motion detectors for security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
    - The use of night vision or thermal security cameras are very effective and can replace security lighting entirely.

The following mitigation and monitoring requirements are recommended to ensure the visual impact of the proposed development is limited:

7.1. Mitigation Measures during the Construction and Decommissioning Phases

- An Environmental Control Officer should be appointed during the construction and decommissioning phase to oversee environmental compliance.
- Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources.

- Plan the placement of lay-down areas and potential temporary construction camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Implement good housekeeping through the removal of rubble, litter and construction material, if it is not removed daily to a registered landfill site, then it should be stored appropriately until removal can take place.
- Dust suppression should be implemented during construction especially near roads where dust may cause reduced visibility. Due to a scarcity of water in most parts of South Africa, contractors could source alternative ways to implement dust suppression. One such way could be the use of fine gravel stone on roads with heavy traffic.
- Restrict construction activities to daylight hours in order to negate or reduce the visual impact associated with lighting.
- Rehabilitate all disturbed areas outside the construction footprint immediately after the completion of construction works.

7.2. Mitigation Measures during the Operational Phase

- Maintenance and good housekeeping of the PV facility.
- Roads must be maintained to eliminate erosion and suppress dust.
- Rehabilitated areas must be monitored for rehabilitation failure and remedial action must then be implemented as and when required.
- Where sensitive visual receptors are likely to be affected (e.g., residents of homesteads in close proximity to the PV facility), it is recommended that the developer enter into negotiations with property owners, if the owner insist, regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation or trees. Visual screening has been found to be most effective when placed at the receptor itself.
- Similar screening (e.g., vegetation barriers or vegetation berms) may be considered, but is not a requirement, along boundaries of the PV facility that is adjacent to busy roads, mitigating the potential visual impact on observers travelling along the road.

7.3. Monitoring Requirements

The following monitoring requirements are recommended to be included as conditions in the Environmental Authorisation to ensure the visual impact of the proposed development is limited:

- The ECO and ELO should monitor the amount of litter on site during construction on a daily basis to ensure litter prevention.
- The ECO and ELO should monitor housekeeping during construction to ensure neat and tidy laydown areas.
- The ECO and ELO should monitor the amount of dust seen on and surrounding the site during construction. Dust suppression should be implemented on a daily basis.
- The ECO and ELO should ensure and monitor all rehabilitation after construction for at least the first 6 months to ensure all vegetation is established in a proper and healthy way. This will also depend on the amount of rainfall and season after construction which might shorten the monitoring requirement.

- o Permanent workforce should monitor the health and progress of the added vegetation to ensure proper screening is maintained. This monitoring can be implemented for at least the first 3 years after construction **IF** drought tolerant vegetation is added, otherwise on a permanent basis.
- o Any other monitoring requirements set out by the EA, EMP and SACAA.

8. KEY FINDINGS AND CONCLUSION

Referring to the assessment score of this VIA report review, the significance of the visual impact will be a "Negative Low Impact" after mitigation. The only receptors likely to be impacted by the proposed development are the nearby property owners and nearby roads. However, a large part of the visual landscape is still reflecting a farming landscape with a better visual appearance. A summary of the potential impacts identified for the detailed design and construction, and operation phase are presented in **Table 8.1** and **Table 8.2**. A summary of the potential cumulative visual impacts identified for the project is provided in Table **8.3**.

Table 8.1: Summary of potential visual impacts identified for the design and construction phase

Impact	Significance Without Mitigation	Significance With Mitigation
Construction impacts.	(28) Negative Low	(24) Negative Low

Table 8.2: Summary of potential visual impacts identified for the operational phase

Impact	Significance Without Mitigation	Significance With Mitigation
Potential visual impacts on sensitive visual receptors located within a 1km radius.	(57) Negative High	(34) Negative Medium
Potential visual impacts on sensitive visual receptors between a 1km and 3km radius.	(36) Negative Medium	(32) Negative Medium
Potential visual impacts on sensitive visual receptors located between a 3km and 5km radius.	(30) Negative Medium	(14) Negative Low
Potential visual impacts on sensitive visual receptors located between a 5km and 10km radius.	(14) Negative Low	(10) Negative Low
Lighting Impacts.	(48) Negative Medium	(20) Negative Low
Solar glint and glare impacts.	(18) Negative Low	(18) Negative Low
Visual impacts on sense of place.	(30) Negative Medium	(13) Negative Low

Table 8.3: Summary of potential cumulative visual impacts identified for the project

Impact	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Cumulative visual impact	(26) Negative Low	(80) Negative Very High

8.1. Key Findings

8.1.1. PV Facility

The construction and operational phase of the proposed PV facility and associated infrastructure will have a visual impact on the study area, especially within (but not restricted to) a 1km radius of the proposed project. The visual impact will differ amongst places, depending on the distance to the project. Receptors that might be the most sensitive to the proposed development are residents living and working on nearby farms and people travelling on the S322 secondary road. Referring to **Table 8.1** to **Table 8.3** and the ZTV assessment, the PV facility will have a negative low visual impact on the surrounding environment after mitigation, within a 10km radius. Referring to the ZTV assessments, the PV facility has a line-of-sight low average visual coverage percentage within the 10km radius of 34.51%. Sensitive visual receptors are sparsely scattered throughout the region and tourism developments are low.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection and is characterised by agricultural developments with a better visual quality. No buffer areas or areas to be avoided are applicable for this development.

8.1.2. Cumulative Impact

The proposed development is located in a close proximity to intensive existing power infrastructure and might have a cumulative impact on viewers. 28 other solar facilities are also proposed in the area and the potential for cumulative impacts to occur as a result of the projects is therefore highly likely. Permanent residents of the area might be desensitised over time with the construction of more solar facilities, but will stay subjective for each viewer. Although the cumulative impact might be very high if all proposed projects be constructed, the location of the solar facilities within the study area (also a REDZ) will contribute to the consolidation of solar PV structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region. As mentioned in **8.1.1** sensitive visual receptors are sparsely scattered throughout the region.

8.1.3. Mitigation

Due to the extent of the project, no viable mitigation measures can be implemented to eliminate the visual impact of the PV facility entirely, but the possible visual impacts can be reduced. Several mitigation measures have however been proposed regardless of whether mitigation measures will reduce the significance of the of the anticipated impacts, they are considered good practice and should be implemented and maintained throughout the construction, operational and decommissioning phases of the project, if possible.

8.2. Conclusion

It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Aesthetic characteristics are subjective, and some people find solar farms and their associated infrastructure pleasant and optimistic while others may find it visually invasive; It is mostly perceived as symbols of energy independence, and local prosperity. The visual impact is also dependant on the land use of an area and the sensitivity thereof in terms of visual impact, such as protected areas, parks and other tourism related activities.

Considering all positive factors of such a development including economic factors, social factors and sustainability factors, especially in a semi-arid country, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view. **PLEASE NOTE** that the details of the PV facility should be submitted to the South African Civil Aviation Authority (SACAA).

It is therefore Donaway Environmental's recommendation that the project be approved.

9. REFERENCES

Department of Water Affairs and Forestry, South Africa. 2004. Upper Vaal Water Management Area: Internal Strategic Perspective. Prepared by PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3 on behalf of the Directorate: National Water Resource Planning. DWAF Report No P WMA 08/000/00/0304.

Department of Water Affairs and Forestry, South Africa. 2004 Middle Vaal Water Management Area: Internal Strategic Perspective. Prepared by PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3 on behalf of the Directorate: Water Resource Planning. DWAF Report No P WMA 09/000/00/0304)

Department of Water Affairs and Forestry, South Africa. 2004. Lower Vaal Water Management Area: Internal Strategic Perspective. Prepared by PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3 on behalf of the Directorate: National Water Resource Planning. DWAF Report No P WMA 10/000/00/0304).

Mucina and Rutherford. 2006. **The vegetation of South Africa, Lesotho and Swaziland.** Strelitzia 19, South African National Biodiversity Institute, Pretoria, South Africa (2006).

South African Civil Aviation Authority. 2016. Objects affecting air space. Available at: http://www.caa.co.za/Pages/Obstacles/Objects-affecting-airspace.aspx [accessed Jul 19, 2017].

The Landscape Institute. 2002. Guidelines for Landscape and Visual Impact Assessment 2nd ed., New York: Spon Press.

WESSA. 2012. Wind Energy: WESSA Position Statement. Available at: http://wessa.org.za/site17/wp-content/uploads/2017/01/Wind_Energy_Position_Statement_2013.pdf [accessed Jul 23, 2017].

World Bank Group. 2015. Environmental, Health, and Safety Guidelines for Wind Energy. Available at: http://www.ifc.org/wps/wcm/connect/2c410700497a7933b04cf1ef20a40540/FINAL_Aug+2015_Wind+Energy_EHS+Guideline.pdf?MOD=AJPERES. [accessed Jul 19, 2017].

Young, G, Maxibuko, B., and Muller, L. 2009. Visual Impacts of Power Lines in Eskom, Eskom Research and Innovation Department Technology, Strategy and Planning, Research Report, Report Number RES/RR/08/30193