LICHTENBURG SOLAR PARK

Visual Impact Assessment Report

April 2022

VISUAL IMPACT ASSESSMENT REPORT

LICHTENBURG SOLAR PARK

LICHTENBURG, NORTH WEST PROVINCE

Submitted to:

AGES LIMPOPO (PTY) LTD
120 Marshall Street
Polokwane, 0699

Prepared by:

GRAHAM A YOUNG **LANDSCAPE ARCHITECT**

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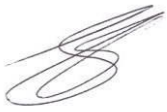
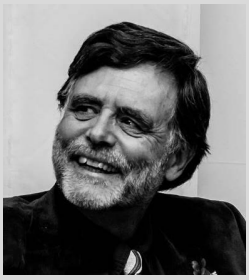
Signed:	
Reference:	086_2022: Lichtenburg Solar Park

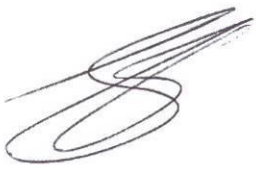
EXPERTISE OF SPECIALIST

Name:	**GRAHAM A YOUNG** 
Qualification:	BL (Toronto) ML (Pretoria)
Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Reg. No. 87001 Fellow Institute of Landscape Architects of South Africa (FILASA)
Experience in Years:	40 years
Experience	Graham Young is a registered landscape architect with an interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the Universities of Toronto (BL) and Pretoria (ML). He has conducted visual impact assessments in Canada and Africa, where he has spent most of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and vice president of the Board of Control for Landscape Architects. He is a Fellow of the ILASA and a professionally registered landscape architect in South Africa (SACLAP). He is Secretary-General for the International Federation of Landscape Architects, Africa Region (IFLA Africa). He runs his practice, Graham A Young Landscape Architect (GYLA). A speciality is Visual Impact Assessments, for which he has been cited with an Institute of Landscape Architects of South Africa (ILASA) Merit Award (1999). This work also includes landscape characterisation studies, end-use studies for quarries, and computer modelling and visualisation. He has completed over three hundred specialist reports for projects and conducted VIA reviews. He has served as a specialist witness in legal cases involving visual impact issues. Mr Young helped develop the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (Oberholzer 2005) and produced a research document for Eskom, *The Visual Impacts of Power Lines* (2009). In 2011 he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee, which manages a World Heritage Site in Mauritius, along with the *Visual Impact Assessment Training Module Guideline Document* for the same client.

DECLARATION OF INDEPENDENCE

I, Graham Young, declare that –

- I am contracted as the Visual Impact Assessment Specialist for the LICHTENBURG Solar PV Plant, Lichtenburg, North West Province, South Africa
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct; and



Graham A. Young FILASA PrLArch SACLAP Reg. No. 87001

27 April 2022

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ACRONYMS, ABBREVIATIONS & GLOSSARY

Acronyms & Abbreviations	
BAR	Basic Assessment Report
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GYLA	Graham Young Landscape Architect
MW	Megawatt
PV	Photovoltaic
SACLAP	South African Council for the Landscape Architectural Profession
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

Glossary	
Aesthetic Value	Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value encompasses more than the seen view, visual quality, or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993).
Aesthetically significant place	A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (After New York, Department of Environment 2000).
Aesthetic impact	Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a

	valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).
Cumulative Effects	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility. *See* Glint. (USDI 2013:314)
Glint	A momentary flash of light resulting from a spatially localised reflection of sunlight. *See* Glare. (USDI 2013:314)
Landscape Character	The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings, and roads. They are generally quantifiable and can be easily described.
Landscape Impact	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).
Study area	For the purposes of this report this Project the study area refers to the proposed project footprint / project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the Project beyond which the visual impact of the most visible features will be insignificant) which is a 5,0km radius surrounding the proposed project footprint / site.
Project Footprint / Site	For the purposes of this report the Project *site* / *footprint* refers to the actual layout of the Project as described.
Sense of Place (genius loci)	Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *A genius locus literally means* 'spirit of the place'.
Sensitive Receptors	Sensitivity of visual receptors (viewers) to a proposed development.
Viewshed analysis	The two-dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.
Visibility	The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance.
Visual Exposure	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather

	and light conditions.
Visual Impact	Visual effects relate to the changes that arise in the composition of available views because of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.
Visual Intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Visual absorption capacity	Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low-capacity areas, in which the location of an activity is likely to cause visual change in the character of the area, to high-capacity areas, in which the visual impact of development will be minimal (Amir & Gidalizon 1990).
Worst-case Scenario	Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.
Zone of Potential Visual Influence	By determining the zone of potential visual influence, it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

EXECUTIVE SUMMARY

INTRODUCTION

AGES Limpopo (PTY) commissioned Graham Young Landscape Architect LTD (AGES) to conduct a Visual Impact Assessment of the proposed Lichtenburg PV Solar Power project ("the Project"). The Project is part of the Renewable Energy IPP (Independent Power Producers) Procurement Programme, and the purpose of the proposed Lichtenburg Solar PV Power project is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the REIPP Procurement Programme and to the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP).

PROJECT, PROJECT SITE AND STUDY AREA

The proposed Project site is within the municipality owned Lichtenburg Vakansie Oord and Game Reserve, situated approximately 10km north of Lichtenburg town. The solar park site along with associated infrastructure and structures, and power line are on Portion 25 of the Farm Houthaalboomen 31 IP and Portion 10 of the Farm Lichtenburg Town and Townlands 27 IP, Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North West province. The plant is proposed to generate a maximum of up to 120 MW and its development footprint is approximately 240ha. The study area comprises a visual envelope of 5,0km around the site, as indicated in Figure 1.

AIM OF THE SPECIALIST STUDY

The study's main aim is to document the baseline and ensure that the visual/aesthetic consequences of the proposed Project are understood.

TERMS AND REFERENCE

A specialist study is required to establish the visual baseline and to identify and assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Data collected during the site visit (conducted on 19 April 2022) and from Google Earth will allow for a description and characterisation of the receiving environment.
- Describe the landscape character and quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for glint and glare.
- Rate the significance of the impact of the Project.
- Rate the potential cumulative effect of the Project.

ASSUMPTIONS AND LIMITATIONS

The following assumptions limitations have been made in the study:

- The description of project components and approved solar PV power projects is limited to what has been supplied to the author prior to the date of completion of this report.
- The accuracy of the viewshed analysis depends on the quality of the input digital surface model (DSM). Readily available digital contours for the area are limited to 20m contours. We have

interpolated these down to 1m intervals to get better accuracy. However, these types of viewshed investigations (using readily available GIS software and terrain contours only) are limited in their accuracy due to their inability to incorporate vegetation information. To be more accurate at predicting absolute visibility, the analysis would require "a 3D model of a tree/plant and a layer indicating the spatial distribution and density of vegetation on the landscape" (Llobera 2007:799) and buffering all existing buildings, structures and infrastructure. The possibility of indicating both the spatial and density distribution of tree/plants, and the three-dimensional model representing vegetation and all structures, is currently not available to the author. Therefore, on-site observations are critical.

- Site photos taken in the autumn do not necessarily reflect the complete landscape character of the area as experienced through all seasons. The weather was partly cloudy, with moderate haze conditions.

FINDINGS

The Visual Impact of the Project

The significance of impact, without mitigation and based on the worst-case scenario, for the various sensitive receptor areas during the construction and operational phases is *low,* i.e. Unlikely that the Project will have a real influence on the decision, and limited mitigation is required.

The impact on the visual environment during the construction phase is assessed to have a low intensity and would occur over the short term (less than five years). The unmitigated impact would be localised but extend beyond the site boundary (at least to 3,0km) and is predicted to be LOW. Mitigation if feasible but will not lower the assessed impact rating.

The impact during the operational phase is assessed to have a low intensity and would occur over the long term (less than five years). The unmitigated impact would be localised but extend beyond the site boundary (at least to 3,0km) and is predicted to be LOW. Mitigation if feasible but will not lower the assessed impact rating.

The degree of Confidence of the significance assessment is moderate as the results of the I&AP process were not known at the time of drafting the report. It is assumed that sensitivity to the Project is low.

Impact of Glint and Glare

The South African Civil Aviation Authority (SACAA) obstacle notice 3/2020[1] Additional Requirements for Solar Project Applications states that a Glint and Glare Assessment would not be required if the solar PV facility is not within a 3km radius of the aerodrome (Part 139.01.30 (3). Therefore a full Glint and Glare Assessment is not required.

The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare could occur with certain climatic and orientation conditions, for limited periods of the day in the early morning or late

[1] Obstacle Notice 3/2020 (Replacement for 17/11/2017): Additional Requirements for Solar Project Applications:
Kindly note that with immediate effect, 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).

afternoon for areas west and east of the Project site. The nature of the visibility of the project and the limited number of people that could be affected, suggests that glint and glare is not a significant issue associated with the Project.

CUMULATIVE EFFECT

The cumulative impact of the Project is potentially high as at least five other solar PV projects are proposed within the Project's study area. The intervisibility and the Project along with the other solar PV projects, would over time, result in the nature and character of the study being impacted in a manner far beyond the anticipated moderate negative impact of the proposed Project alone. The combined effect of approved, pending and proposed solar power developments would dominate the study area and irrevocably change the nature, sense of study and character of the landscape's baseline.

The significance of the cumulative impact of solar PV power projects on the visual environment during their operational phase is assessed to be of a high intensity over the long-term. The unmitigated impact would be sub-regional extending beyond the site (to at least 3,0km) and is assessed as HIGH. I.e. it should influence the decision to not proceed with all the projects or require significant modification(s) of the various projects' design/locations (where relevant). Perhaps a strategic assessment of proposed, pending and authorised solar PV projects within a 5,0km radius of the project should be commissioned.

AUTHOR'S OPINION

The author's opinion is that all aspects of the Project should be approved from a potential visual impact perspective if mitigation/management measures are effectively implemented and managed in the long term.

*** GYLA ***

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Project Overview and Background

AGES Limpopo (PTY) commissioned Graham Young Landscape Architect LTD (AGES) to conduct a Visual Impact Assessment of the proposed Lichtenburg PV Solar Power project ("the Project"). The VIA focuses on the potential impact of the physical aspects of the Project (i.e. form, scale, and bulk), and its potential impact within the local landscape and receptor context and is part of the Environmental Impact Assessment (EIA) process. The development of clean, green, and renewable energy has been qualified as a priority by the Government of South Africa as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol. To achieve this goal, the DoE announced a Renewable Energy IPP (Independent Power Producers) Procurement Programme. The Project is part of the programme, and the purpose of the proposed Lichtenburg Solar PV Power project is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the REIPP Procurement Programme and to the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP). The plant is proposed to generate a maximum of up to 120 MW.

1.2 Project site and Project

The proposed Project site is within the municipality owned Lichtenburg Vakansie Oord and Game Park (Game Breeding Centre), situated approximately 10km north of Lichtenburg town. The solar park site along with associated infrastructure and structures, and power line are on Portion 25 of the Farm Houthaalboomen 31 IP and Portion 10 of the Farm Lichtenburg Town and Townlands 27 IP, Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North West province.

The estimated development footprint is 240ha. The study area comprises a visual envelope of 5,0km around the site, as indicated in Figure 1.

1.3 Aim of the Specialist Study

The study's main aim is to document the baseline and ensure that the visual/aesthetic consequences of the proposed Project are understood.

1.4 Terms and Reference

A specialist study is required to establish the visual baseline and to identify and assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Data collected during the site visit (conducted on 19 April 2022) and from Google Earth will allow for a description and characterisation of the receiving environment.
- Describe the landscape character and quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for glint and glare.
- Rate the significance of the impact of the Project.
- Rate the potential cumulative effect of the Project.
- Propose mitigation measures to reduce the potential impact of the Project.

1.5 Assumption, Uncertainties and Limitations

The following assumptions limitations have been made in the study:

- The description of project components and approved solar PV power projects is limited to what has been supplied to the author prior to the date of completion of this report.
- The accuracy of the viewshed analysis depends on the quality of the input digital surface model (DSM). Readily available digital contours for the area are limited to 20m contours. We have interpolated these down to 1m intervals to get better accuracy. However, these types of viewshed investigations (using readily available GIS software and terrain contours only) are limited in their accuracy due to their inability to incorporate vegetation information. To be more accurate at predicting absolute visibility, the analysis would require “a 3D model of a tree/plant and a layer indicating the spatial distribution and density of vegetation on the landscape” (Llobera 2007:799) and buffering all existing buildings, structures and infrastructure. The possibility of indicating both the spatial and density distribution of tree/plants, and the three-dimensional model representing vegetation and all structures, is currently not available to the author. Therefore, on-site observations are critical.
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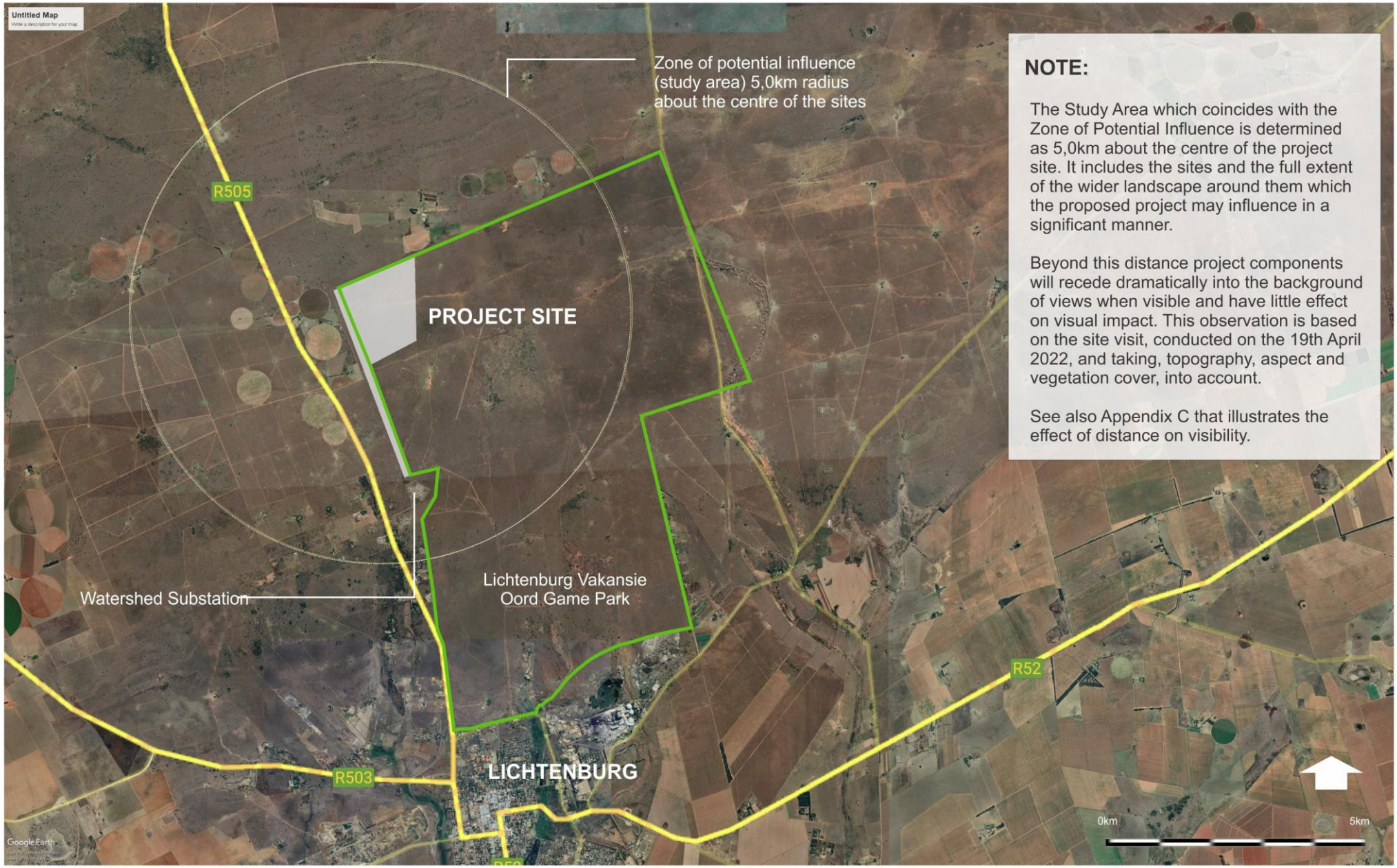

Figure 01: LOCALITY - Lichtenburg Solar Park

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2. NATIONAL ENVIROMENTAL GUIDELINES

National Environmental Management Act (Act 107 of 1998), EIA Regulations

The specialist report is in accordance with the specification on conducting specialist studies as per Government Gazette (GN) R 982 (as amended) of the National Environmental Management Act (NEMA) Act 107 of 1998. The mitigation measures as stipulated in the specialist report can be used as part of the Environmental Management Programme Report (EMPR) and will be in support of the Environmental Impact Assessment (EIA) and Appendix 6 of the EIA Regulations 2014 (as amended).

Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)

Although the guidelines were specifically compiled for the Province of the Western Cape, they provide guidance that is appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.[2]

[2] The Western Cape Guidelines are the only official guidelines for visual impact assessment reports in South Africa and can be regarded as best practice throughout the country.

3. APPROACH AND METHODOLOGY

3.1 Approach

The assessment of likely effects on a landscape resource and visual amenity is complex since it is determined through quantitative and qualitative evaluations. When assessing visual impact, the worst-case scenario is considered. Landscape and visual assessments are separate, although linked, procedures. The landscape, its analysis, and the assessment of impacts on the landscape all contribute to the visual impact assessment studies baseline. The potential impact on the landscape is assessed as an impact on an environmental resource, i.e. the physical landscape. On the other hand, visual impacts are assessed as one of the interrelated effects on people (i.e. the viewers and the result of an introduced object into a view or scene).

For a detailed description of the methodology to determine the value of a visual resource, refer to Appendix A. Appendices B and C list the criteria for determining the intensity and significance of visual impact. Image 1 below graphically illustrates the visual impact process used in this Project.

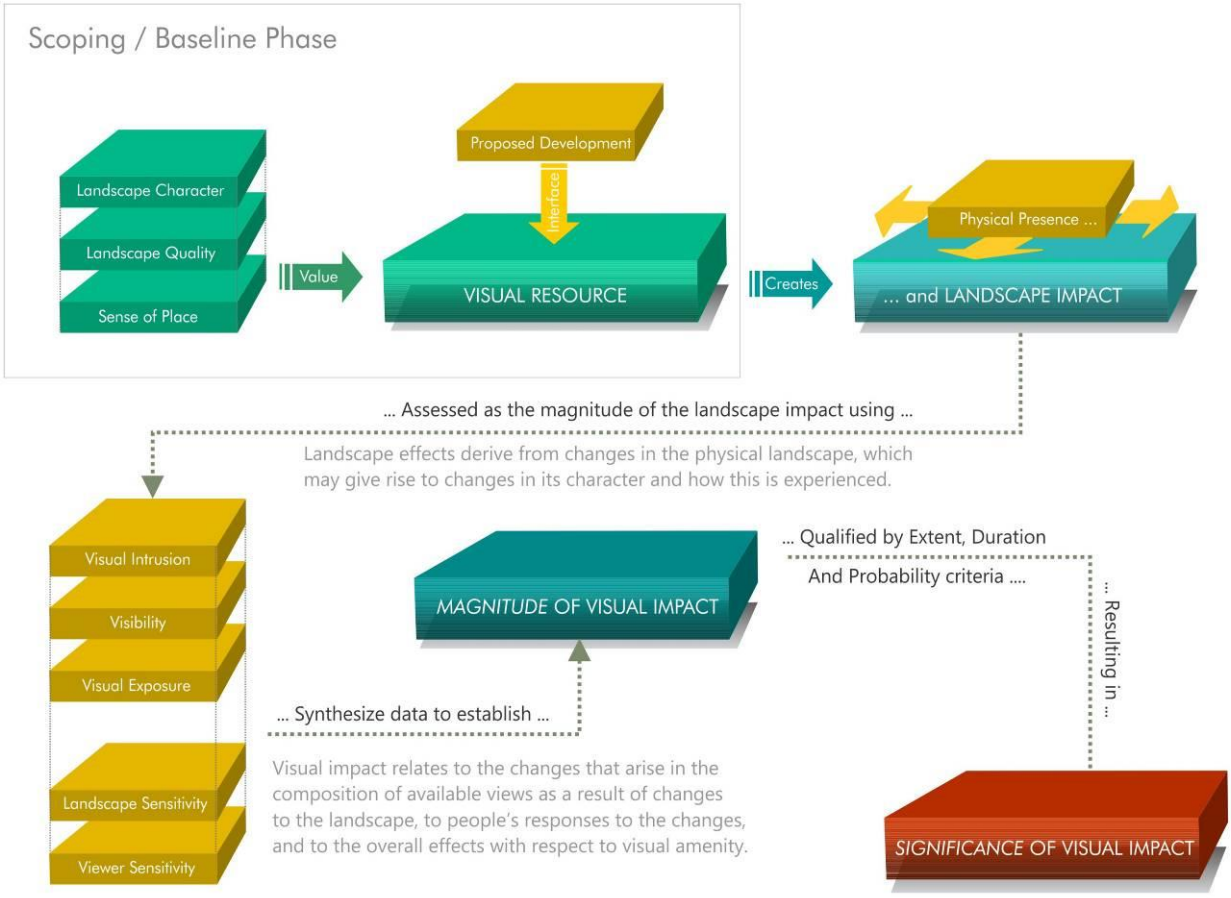


Image 1: Visual Impact Process

3.2 Methodology

The following method was used:

- Site visit: A field survey was undertaken on 19 April 2022.
- Project components: The physical characteristics of the project components were described and illustrated based on information supplied by AGES Limpopo.
- The landscape's character was described and rated in terms of its aesthetic appeal using recognised contemporary research in perceptual psychology as the basis, and its sensitivity as a landscape receptor.
- The sense of place of the study area was described as to its uniqueness and distinctiveness. The primary informant of these qualities was the spatial form and character of the natural landscape together with the cultural transformations associated with the historical/current use of the land.
- The visibility of the proposed Project was determined using on-site observations and a basic viewshed assessment.
- Illustrations, in basic simulations, of the proposed PV Solar Power Plant were overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points, to give the reviewer an idea of the scale and location of the proposed Project within their landscape context.
- Visual intrusion (contrast) of the proposed Project was determined by simulating its physical appearance from these sensitive viewing areas.
- The intensity and significance of the visual impact of the proposed Project were rated based on a professional opinion and the method described above; and
- Measures to mitigate the negative impacts of the proposed Project were recommended.

4. DESCRIPTION OF THE PROJECT

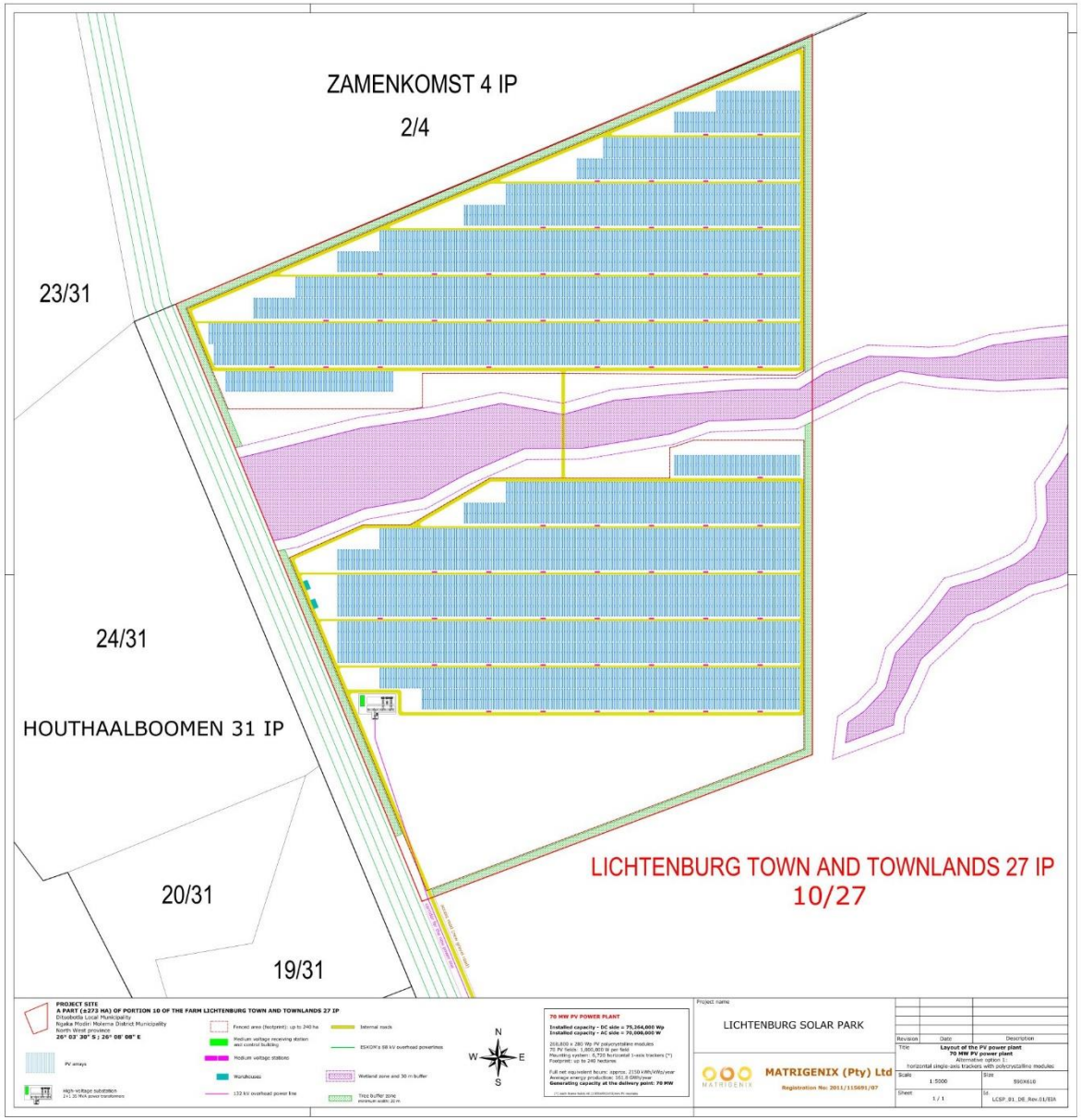
Solar energy facilities such as those using PV technology use the energy from the sun to generate electricity through a process known as Photovoltaic Effect, which consists in the generation of electrons by photons of sunlight to create electrical energy. The PV plant will mainly consist of the following components (AGES 2022:11-12).

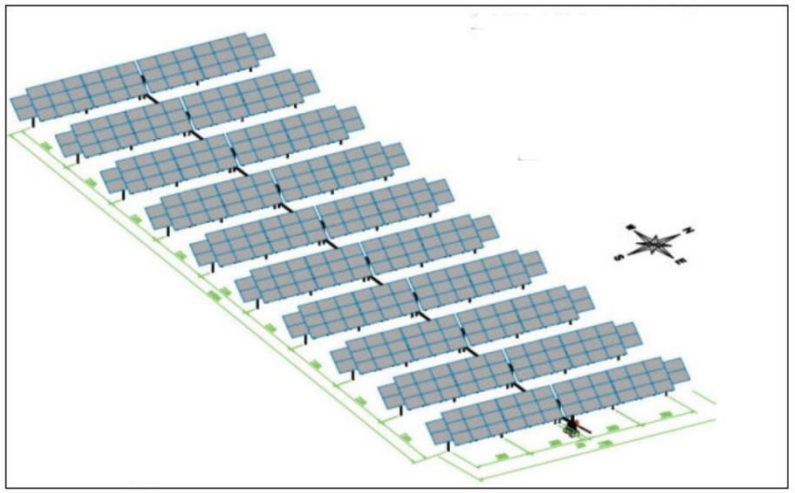
- **Photovoltaic cells and photovoltaic modules**: PV cells are made in silicone and function as a semiconductor used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic module. The facility will use mono/polycrystalline photovoltaic (PV) modules or bi-facial modules with high efficiency.
- **Support structures:** PV modules will be assembled on steel or aluminium frames. The preferred technical solutions for the proposed solar parks entail PV modules mounted on **single-axis horizontal trackers** (alternative option 1) or on **fixed mounting systems** (alternative option 2), or a combination of both. As depicted in Figures 1 and 2, each tracker is composed by several PV arrays North-South oriented and linked by a horizontal axis, driven by a motor. The horizontal axis allows the rotation of the PV arrays toward the West and East direction, to follow the daily sun path. In the case of fixed mounting systems, as depicted in Figures 3 and 4: each mounting frame hosts PV modules along parallel rows of PV modules placed side by side, with the position of the panels northwards and an optimized tilt angle (between 20° and 30°). The rows of PV modules are mounted horizontally one on top of the other, with an overall mounting structure height up to 4.5 meters above ground level.
- **Strings and string boxes:** the PV modules are connected in series to form PV strings, so that the string voltage fits into the voltage range of the DC/AC inverters. PV strings are devised to be connected to DC-connection boxes (string boxes) with a parallel connection solution (PV sub-field). String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a general circuit breaker to disconnect the photovoltaic sub-fields from the DC/AC inverters.
- **Medium-voltage stations:** each medium-voltage station is designed to host one or more DC/AC inverters, and one or more medium-voltage power transformers. The DC/AC inverters are deemed to convert the direct current (DC) to alternating current (AC) at low voltage; subsequently the AC will pass through a medium-voltage power transformer to step-up the voltage up to 22 kV or 34 kV.
- **Medium voltage receiving station:** the energy from the medium voltage stations will be collected into one medium voltage receiving stations, linking in parallel all the PV fields of the PV generator.
- **On-site high-voltage substation and switching station:** from the medium-voltage receiving station, the electrical energy will be delivered to one small on-site high-voltage substation with two or more high-voltage power transformers (one as spare), stepping up the voltage to the voltage of the Eskom grid (400 kV or 132 kV). Furthermore, the on-site high-voltage substation will be equipped with a control building and one busbar with metering and protection devices (also called “switching station”).

- One (1) 132 kV power line, for the connection of the on-site substation to the Eskom Watershed Substation located on the Remainder Portion of the farm Lichtenburg Town and Townlands 27 IP.
- Battery Energy Storage Systems (BESS) with a footprint up to 10 ha, next to the on-site high-voltage substation, within the PV plant footprint / fenced areas.
- Interventions on the Eskom Watershed Substation.

Other key features of the project are to ensure an elevated level of reliability, operational and maintenance safety, low water consumption. The expected operational life of a plant is deemed to be approximately 30 years. The construction and the commissioning of a PV plant are expected to last approximately **18 months**.

Refer to Figure 2 for the layout and typical examples of PV arrays on single axis horizontal trackers.





Single Axis Horizontal Trackers - alignment of arrays

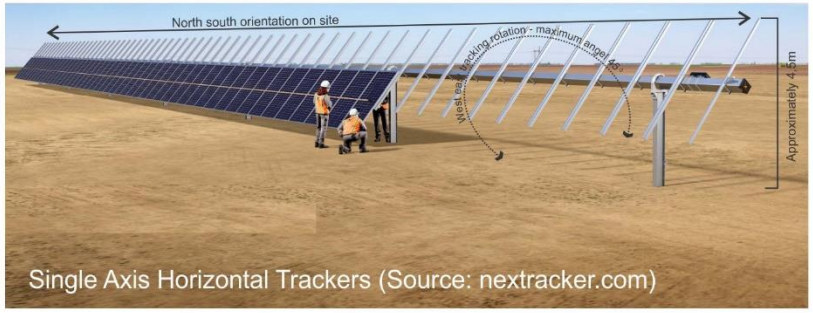


Figure 2: LAYOUT - LICHTENBURG SOLAR PV POWER PLANT

Refer to Figure for the location of the view points

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5. POTENTIAL VISUAL ISSUES

PV solar projects typically include medium to large-scale infrastructure that can cause change to the fabric and character of an area and possible visual intrusion in sensitive landscapes due to their physical presence.

Typical issues associated with solar PV projects are:

- Who will be able to see the new development?
- What will it look like, and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area, and if so, how?
- What will be the impact of the development during the day and at night?
- What will the cumulative impact be, if any?

These potential impacts will be considered and rated in the assessment section of the report. At the time of writing, the public participation process had not been completed. Therefore, it is unknown if the public would raise visual issues and potentially indicate a sensitivity to visual and aesthetic concerns. However, the Project is in the game reserve section of the Lichtenburg Vakansie Oord and could increase its sensitivity.

5.1 Glint and Glare

In addition to these common visual and aesthetic issues, the potential of glint and glare can be of concern. PV panel surfaces are designed to absorb the sunlight, therefore substantially reducing the potential for glint and glare. The glass layer covering the PV modules is made of high transmission tempered glass with an anti-reflective (AR) coating. Consequently, the percentage of the reflected light from PV modules can vary from 2% to 30% depending on the angle of incidence (PagerPower 2020:24). However, published guidance shows that the intensity of solar reflections from solar panels are equal to or less than those from water. It also shows that reflections from solar panels are significantly less intense than other reflective surfaces, which are common in an outdoor environment (PagerPower 2020:24). This amount is low: by comparison, a mirror can reflect a percentage of the incident light above 98% (Tata 2015:3).

However, the panels and other components reflect light that may result in glinting (but only at minimal angles), and glare depending on panel orientation, sun angle, viewing angle, viewer distance, and other visibility factors (USDI 2013:77). The images in Figure 2-1 illustrate this effect, where the arrays can vary in colour from black, to blue, to a bright silvery sheen. The result can also be distributed across a single project site when differing sky conditions exist, as is illustrated in the images of a solar park near Touws Rivier. The southern section of the solar park is in the sun, causing a silver sheen, while the park's northern area, which is in cloud shade, appears dull grey. The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare can occur with certain climatic and orientation conditions, as has been illustrated (USDI 2013:77).

The South African Civil Aviation Authority (SACAA) obstacle notice 3/2020[3] Additional Requirements for Solar Project Applications states that a **Glint and Glare Assessment would not** be required if the solar PV facility

[3] Obstacle Notice 3/2020 (Replacement for 17/11/2017): Additional Requirements for Solar Project Applications
Kindly note that with immediate effect, 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).

is not within a 3km radius of the aerodrome (Part 139.01.30 (3). Therefore a full Glint and Glare Assessment is not required.

The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare could occur with certain climatic and orientation conditions, for limited periods of the day in the early morning or late afternoon for areas west and east of the Project site. The nature of the visibility of the project and the limited number of people that could be affected, suggests that glint and glare is not a significant issue associated with the Project.

Apparent colour changes with differing sun angles and viewing geometry at a PV facility. (USDI 2013:78)
Credit: Robert Sullivan, Agganne National Laboratory.

PV panel surfaces are not designed to reflect light and therefore have reduced potential for glint and glare; however, the panels and other components do reflect light that may result in glinting, glare and other visual effects that would vary depending on panel orientation, sun angle, viewing angle, viewer distance, and other visibility factors (USDI 2013:77)

Figure 2-1: POTENTIAL FOR GLINT AND GLARE

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6. THE ENVIRONMENTAL SETTING

6.1 Landscape Character and Nature of the Study Area

Within a 5,0km radius of the Project site, the study area comprises primarily slightly undulating plains that gently slope to the north and to the south across the study area from a low west to east ridge line near the southern boundary of the site. The ridge line represents the highest elevation in the general area at 1515m AMSL. The development footprint follows this slope to the north with no PV arrays proposed south of it. Refer to Figures 2 and 3, which also gives the location of the panoramic views in Figures 4-1 to 4-4.

The original landscape, Carletonville Dolomite Grassland, was a “species-rich grasslands forming a complex mosaic pattern dominated by many species” (Mucina and Rutherford 2006: 388). The original vegetative layer is dominated by graminoids and herbs with few tall shrubs/low trees. The study area’s landscape has, however, been severely transformed by cultivation (Views 4 -6 Figure 4-2), urban sprawl, mining activity as well as grazing (Views 8 and 9 Figure 4-3) in areas. The most intact areas are in the northern section of the Lichtenburg Vakansie Oord Game Reserve east of the Project site and north of the project site where natural areas have been conserved on the adjacent farms. The site occurs in this landscape type (refer to the panoramas in Figure 4-4). Searsia species, low shrubs and Olea europaea subsp. Africana are dotted about the open rolling natural grasslands evident in Views 1, 2 and 3 (Figure 1) and views 8 – 12 (Figures 4-3 and 4-4).

The study area can be roughly divided into the following landscape types:

- Natural grasslands north and east of the Project site associated with the northern sections of the Lydenburg Vakansie Oord Game Reserve (the southern portions of the reserve are showing signs of deterioration).
- Cultivated/grazing lands west and immediately north of the site
- Rural agricultural plots west of the R505 and south of the site and immediately south of the Watershed substation
- Urban, power infrastructure and industry in the far south of the study area.

6.2 Sense of Place

According to Lynch (1992), a sense of place is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, unique, or at least particular, character of its own. The sense of place for the study area derives from the local landscape described above and their impact on the senses.

The landscape character types in the study area are common within the sub-region and have been impacted by agricultural, industry and quarry activities (specifically the southern part of the study area immediately north of Lichtenburg town). However, for much of the northern and eastern sections of study area the overwhelming sense of place of the is characterised by the open grazing lands and cultivation (mostly central pivot systems), resulting in a pastoral sense of place. The southern section is of mixed character and does not exert a strong sense of place, due to the variety of land uses with no unity.

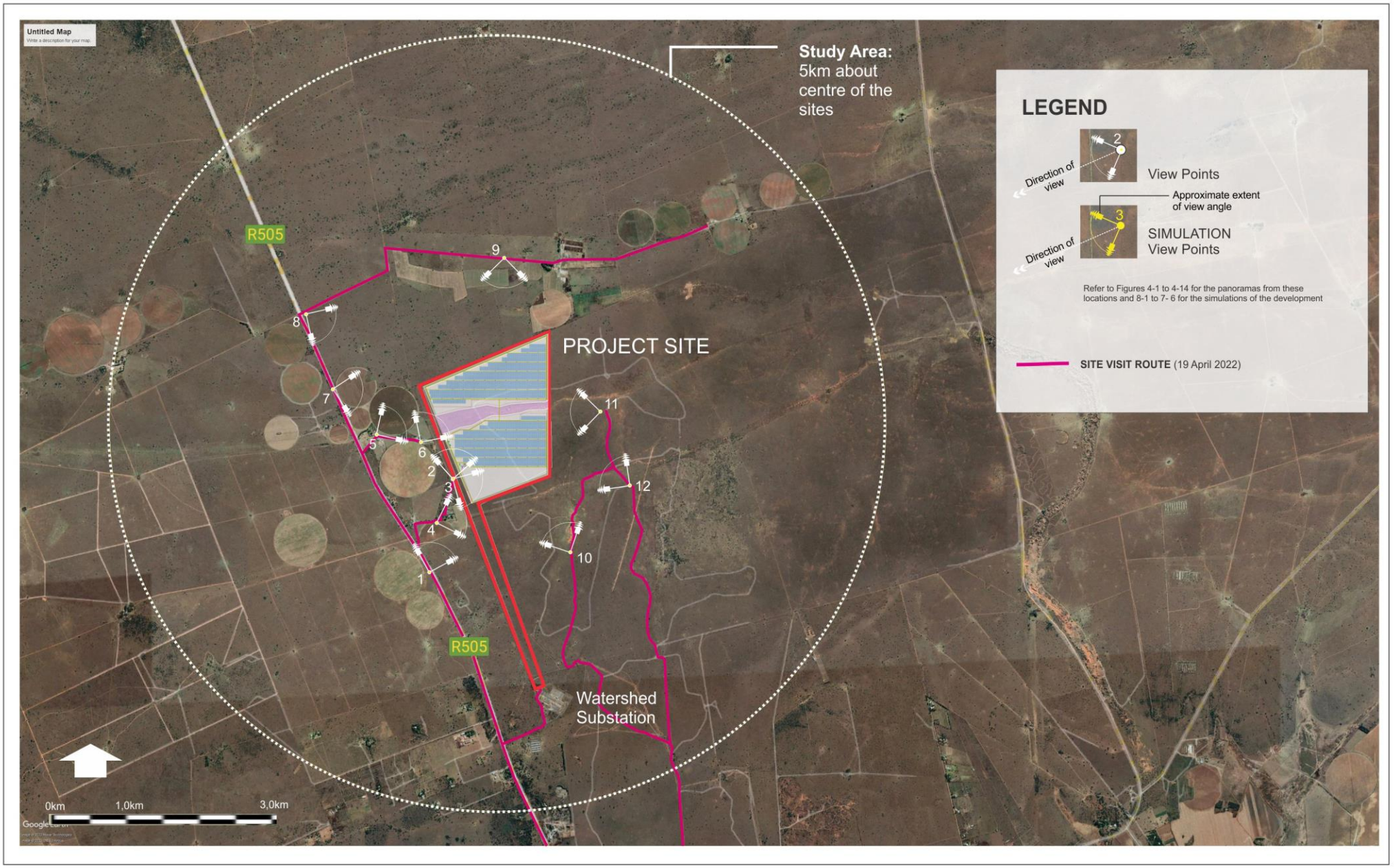

Figure 03: VIEW SITES - Lichtenburg Solar PV Park

Refer to Figures 4-1 to 4-4 for the panoramas

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Figure 04-1: LANDSCAPE CHARACTER - Views 1, 2 and 3

Refer to Figure 3 for location of viewing points

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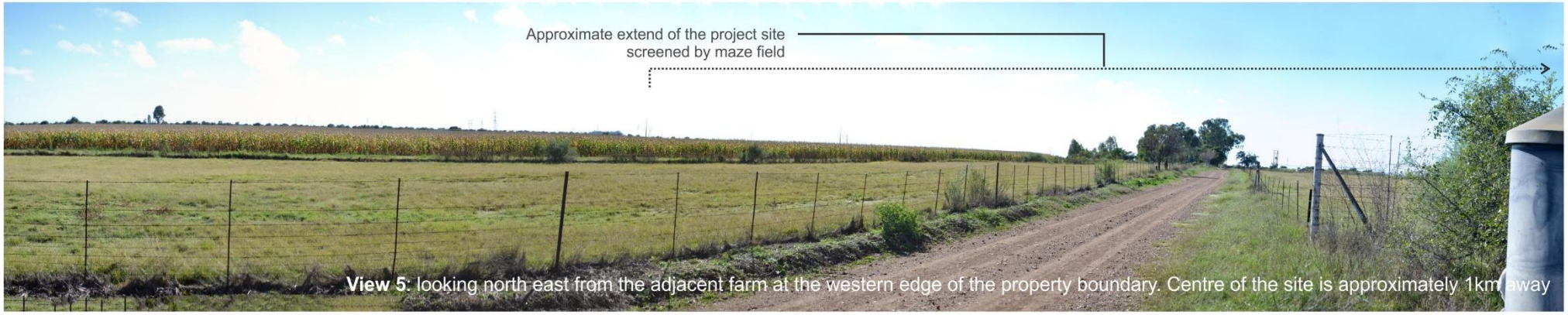

Figure 04-2: LANDSCAPE CHARACTER - Views 4, 5 and 6

Refer to Figure 3 for location of viewing points

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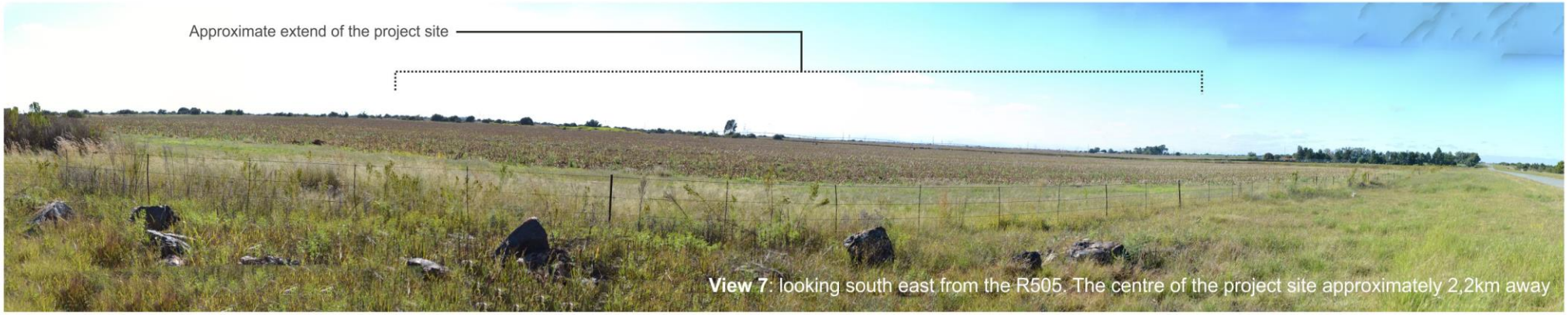

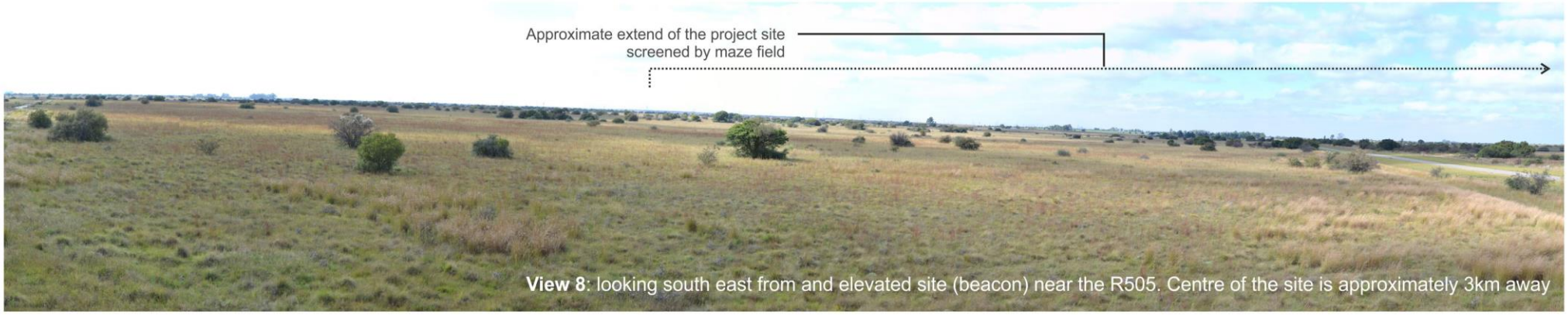

Figure 04-3: LANDSCAPE CHARACTER - Views 7, 8 and 9

Refer to Figure 3 for location of viewing points

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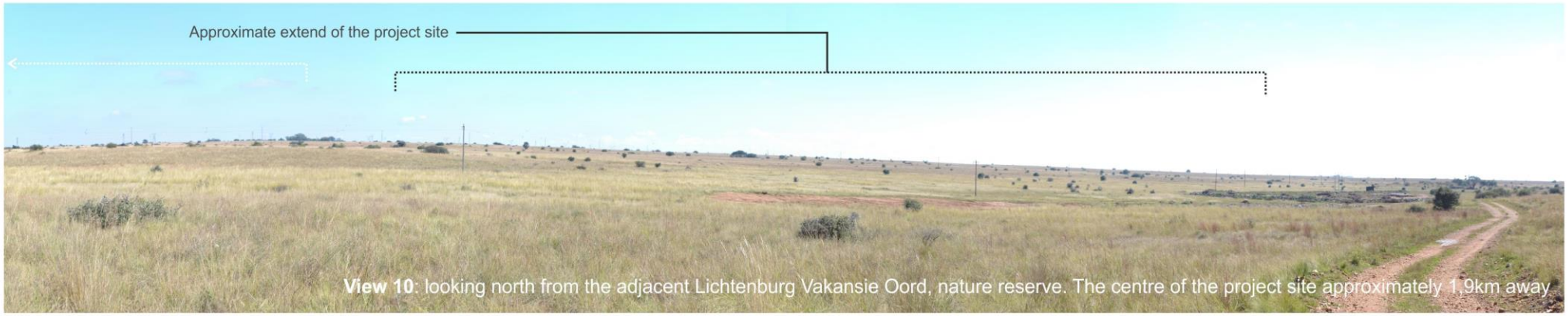

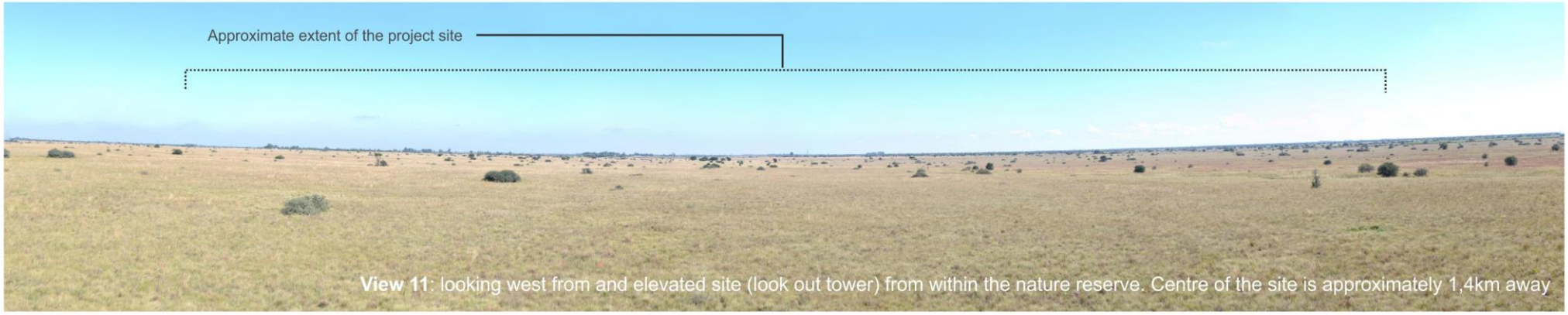

Figure 04-4: LANDSCAPE CHARACTER - Views 10, 11 and 12

Refer to Figure 3 for location of viewing points

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7. VISUAL RESOURCE

7.1 Visual Resource Value, Scenic Quality and Landscape Sensitivity

The value of the visual resource and its associated scenic quality (using the scenic quality rating criteria described in Appendix A) are derived from the landscape characteristics described above. The sensitivity of the study area's landscape as a scenic resource can be defined as *moderate* to *low* (as indicated in Table 1 below), within the context of the sub-region. These ratings are dependent on the landscape's character: does it contribute to the area's sense of place and distinctiveness? quality? – in what condition is the existing landscape? Value – is the landscape valued by people, local community, visitors, and is the landscape recognised, locally, regionally or nationally? and Capacity – what scope is there for positive change in the existing landscape character?

When the criteria listed in Appendix A are considered and understood within the context of the sub-region, a visual resource value of *low* (degraded open land, mining areas and power infrastructure) and *moderate* for the northern and eastern regions of the study area is assigned to these landscape types.

The study area exhibits a mixed character, which is expected within the sub-region. It has some positive characteristics, but there is evidence of alteration and degradation of these features, resulting in negative areas. A summary of these values is provided in Table 1 below, which categorises the various local landscape character types and sensitivities, within the context of the sub-region.

Table 1: Value of the Visual Resource
(After: LiEMA 2013)

High	**Moderate**	**Low**
None	- Natural grasslands north and east of the Project site - Cultivated /grazing lands west and immediately north of the site - Agricultural plots south of the site	Mining and power infrastructural areas and degraded open land mostly in the southern regions of the study area
This landscape type is considered to have a *high* value because it is a: Distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be of particular importance to conserve, and which has an intense sense of place.	This landscape type is considered to have a *moderate* value because it is a: Common landscape that exhibits some positive character, but which has evidence of alteration / degradation/ erosion of features resulting in areas of more mixed character.	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features.

Sensitivity: It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with.	Sensitivity: It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with. **The Project site is located within this landscape type**	Sensitivity: It is not sensitive to change in general and change. **.**

8. VISUAL IMPACT

8.1 Visual Receptors

Visual receptors include people living in, visiting, or travelling through the study area on the R505 and other local public roads. At the time of writing, the results of the public participation process where not known and therefore these assumptions of based on generic research into receptor sensitivities (see also Appendix B).

8.2 Sensitive Viewers

The project site is on a portion of the Lichtenburg Vakansie Oord – Game Park and is adjacent to several farm properties. The receptors and viewing areas identified in Table 2 below and illustrated in Figure 5 are potentially sensitive to the proposed development.

Table 2: Sensitivity of Visual Receptors

High	Moderate	Low
Receptors of farmsteads and residential units across the study area and guests of the Lichtenburg Game Park.	Locals travelling along the R505 and local gravel roads	People working or travelling to work in the study area (RUL Mine and related service industries)
-Visitors of tourist attractions and travelling along local routes, whose intention or interest may be focused on the landscape. -Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. -Occupiers of residential properties with views affected by the development.	-People travelling through or past the affected landscape in cars or other transport routes.	Visitors and people working within the study area and travelling along local roads whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

8.3 Visibility

Visual impacts will be caused by activities and infrastructure in both Project phases, i.e. construction and operational. Activities associated with the Project will be visible to varying degrees from varying distances around the project site, as indicated in Figure 6. During the construction phase, the Project's visibility will be influenced due to the preparatory activities, primarily earthworks and building works. During the operational phase, the visibility of the Project will be caused by the established solar PV arrays, associated infrastructure and the proposed new 132 kV powerline.

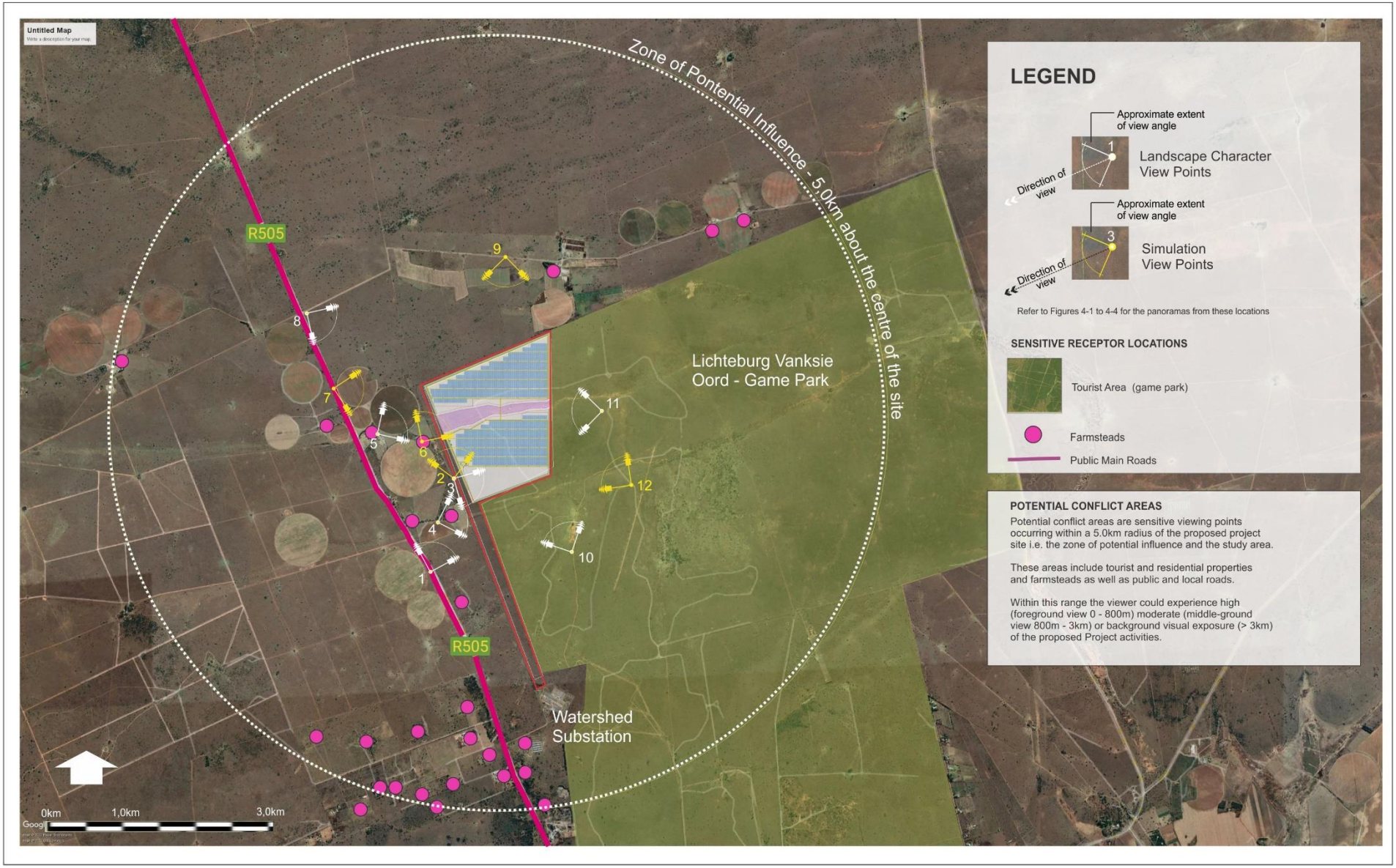

Figure 05: RECEPTOR SENSITIVITIES- Lichtenburg Solar PV Park

Refer to Figures 4-1 to 4-4 for the panoramas

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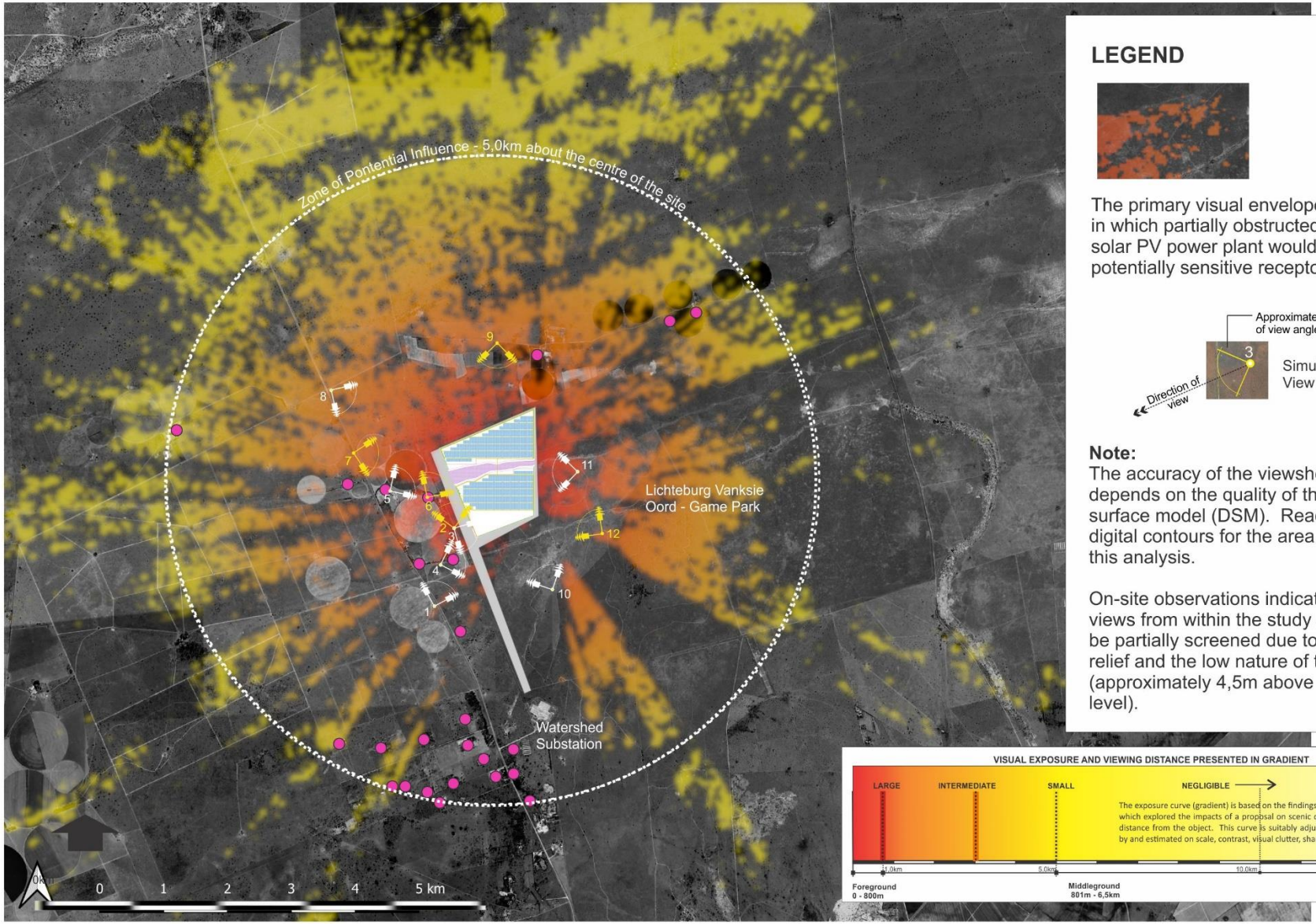

LEGEND

The primary visual envelope (coloured areas) in which partially obstructed views to the solar PV power plant would be available to potentially sensitive receptors.

Note:
The accuracy of the viewshed analysis depends on the quality of the input digital surface model (DSM). Readily available digital contours for the area were used for this analysis.

On-site observations indicated that most views from within the study area would be partially screened due to topographic relief and the low nature of the installation (approximately 4,5m above natural ground level).

Figure 6: VIEWSHED ANALYSIS - Lichtenburg Solar PV Power Plant

Refer to Figure 3 for the location of the view points

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The primary visual envelope, where open, partially obstructed views of the development would occur, is contained to the immediate north, west, east of the site and sections of the R505 as illustrated in Figure 6. However, due to the flat nature of the landscape and the prevalence of medium to tall trees west and north of the site, most of these views would be completely blocked or partially screened by vegetation, buildings and other structures. The Project's solar arrays would be most visible from east of the site in the game reserve where the landscape is open and there are fewer trees. Due to the low ridgeline along the southern boundary of the Project site and the prevalence of medium to tall vegetation southwest of the site, views from the south and southwest are mostly blocked. The sensitive viewing areas in the far southwest of the study area, would therefore not be affected.

8.4 Visual Intrusion and Exposure

Visual intrusion deals with contextualism, i.e. how well does a project component fit with or disrupt/enhance the ecological and cultural aesthetic of the landscape as a whole? And ties in with the concept of visual absorption capacity (VAC)[§] which for the Project site is *moderate* due to the nature of the landscape described above.

The simulations in Figures 7-1 to 7-5 illustrate the worst-case effect (with no mitigation and before the proposed tree buffer has grown in) that the PV arrays would have on views experienced from surrounding areas within 1,5km of the site. Project components will appear in sensitive foreground views (up to 800m from the nearest PV arrays) immediately west and east of the site, with the potential for high visual intrusion and exposure. Refer to simulations in Figures 7-1 and 7-2 from adjacent farm properties. The PV arrays would also appear in the middle-ground of views north, west and east of the site, as indicated in Figures 7-3 to 7-5 at 800m to 3,0km (moderate visual intrusion and exposure). For the remainder of the study area, visual intrusion is considered low to negligible, i.e. has a minimal to insignificant effect on the visual quality and sense of place of the landscape and contrasts minimally with the patterns or cultural elements that define the structure of the landscape.

8.4.1 Glint and Glare

Due to the low angle of the viewer relative to the Project PV arrays, a thin line of the PV arrays would be visible in any given view, i.e. the full extent of the solar park would never be visible as illustrated in the simulations. Also, the time that the PV arrays would glare is limited to times of the day when the sun is low in the sky (either early morning or late afternoon) and on those days when the climatic conditions are aligned to produce glare. However, research in published guidance studies shows that the intensity of solar reflections from solar panels is equal to or less than that of water. It also indicates that reflections from solar panels are significantly less intense than a variety of other reflective surfaces, which are common in an outdoor environment (Appendix A: Pager Power 2020:40).

Given that only a small portion of the PV arrays would be visible (mostly showing a dark blue or blackish colour as indicated in Figure 2-1) and that glare would occur infrequently, the effect of glare sensitive receptors and locations is considered low and would not contribute significantly to the visual impact of the Project.

[§] Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low-capacity areas, in which the location of an activity is likely to cause visual change in the character of the area, to high-capacity areas, in which the visual impact of development will be minimal (Amir & Gidalizon 1990).

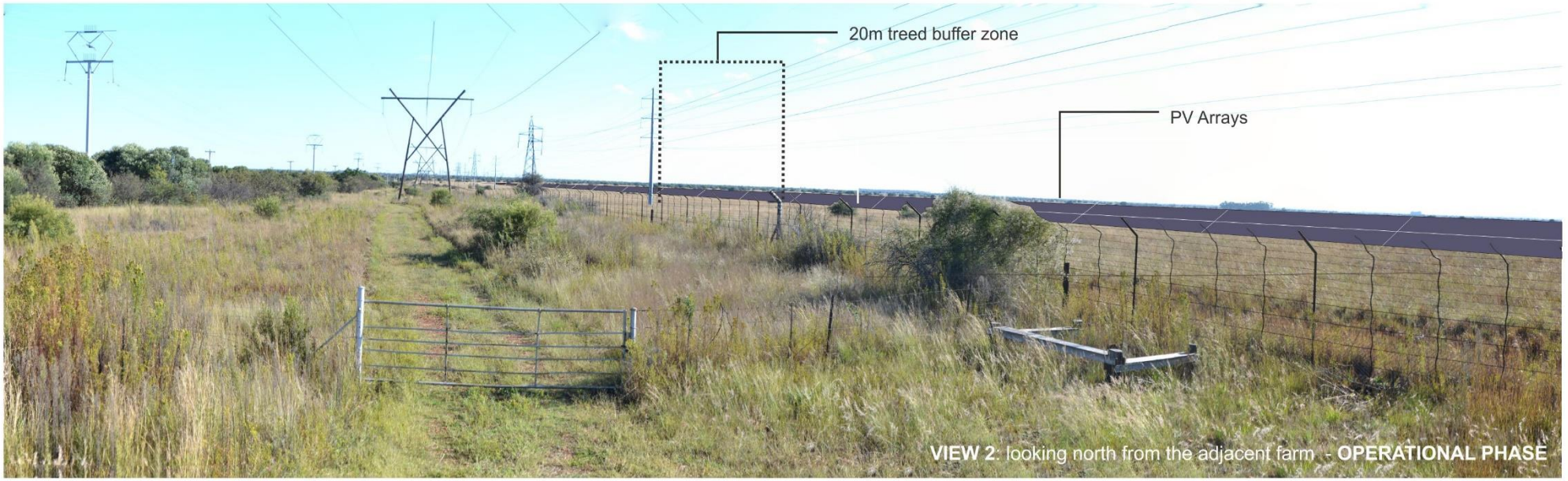

Figure 7-1: SIMULATION VIEW 2 - Lichtenburg Solar PV Power Plant

Refer to Figure for the location of the view points

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Figure 7-2: SIMULATION VIEW 6 - Lichtenburg Solar PV Power Plant

Refer to Figure for the location of the view points

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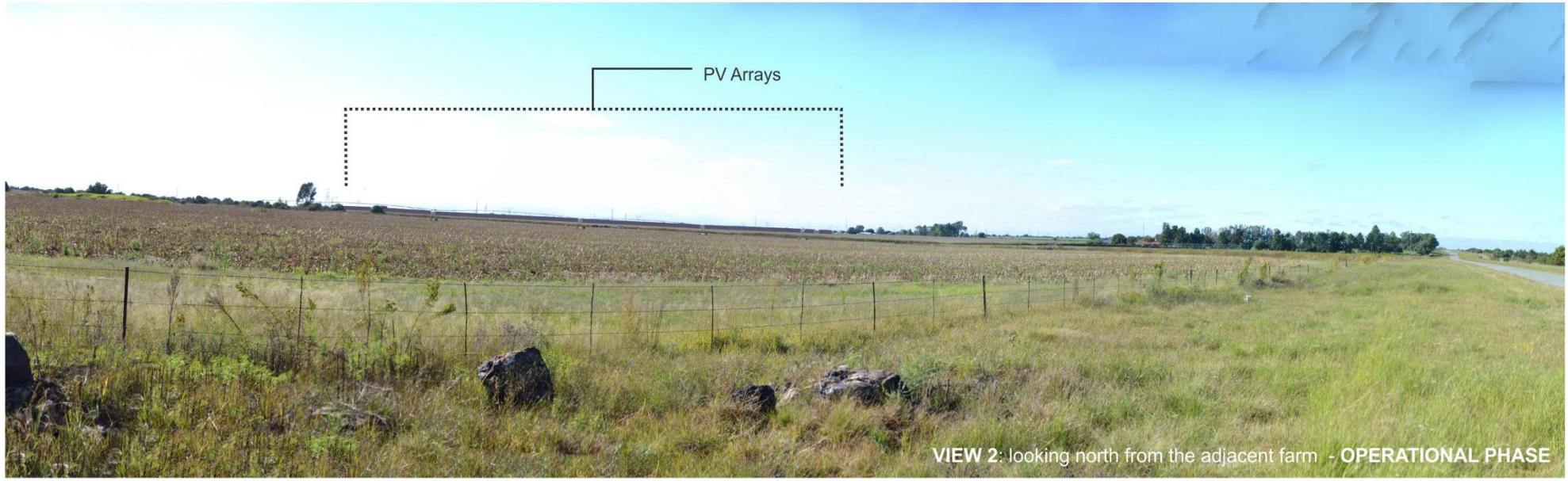

Figure 7-3: SIMULATION VIEW 7 - Lichtenburg Solar PV Power Plant

Refer to Figure for the location of the view points

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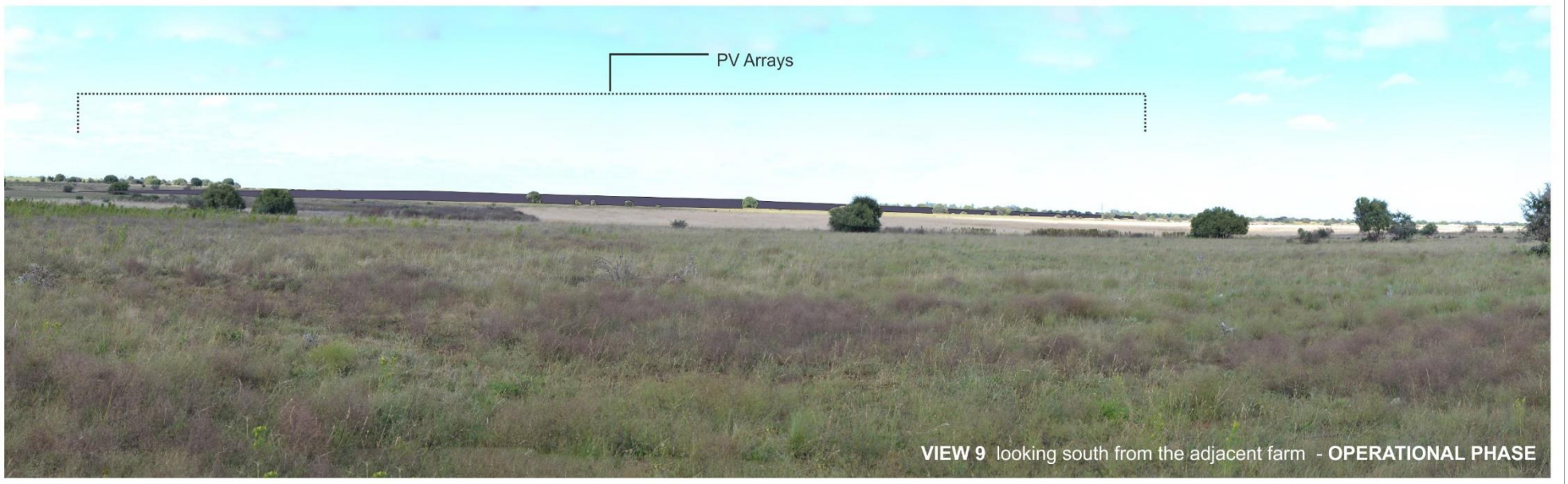

Figure 7-4: SIMULATION VIEW 9 - Lichtenburg Solar PV Power Plant

Refer to Figure for the location of the view points

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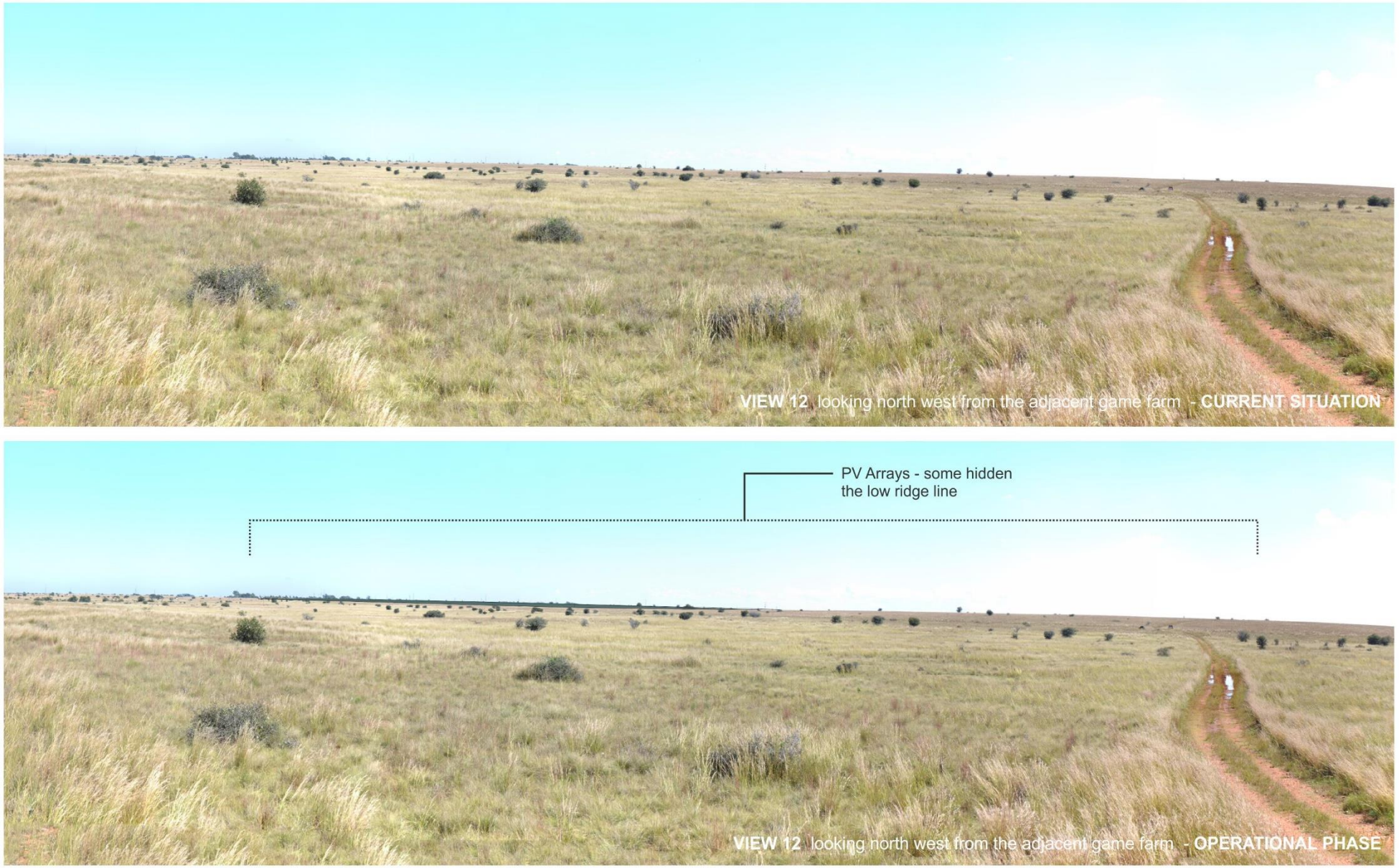

Figure 7-5: SIMULATION VIEW 12 - Lichtenburg Solar PV Power Plant

Refer to Figure for the location of the view points

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8.5 Night Lighting

I&APs consistently raises the impact of night lighting, specifically when they can be seen from tourist or residential sites and when the effect would continue for the Project's life. The negative effect of night lighting caused by the Project would be seen against the lights and glow of Lichtenburg when viewed from the north and a mostly dark rural sky when viewed from the south. Night lights would, therefore, not be particularly detrimental to people using the R505 road or living south and southwest of the site as it has been determined that topographic relief, vegetation and structures would block views to the Project site. However, lights could add to the adverse cumulative effects of the night-time glow of Lichtenburg on the northern sections of the study area. The management measures, as proposed in Section 9, should be implemented to limit the spillage of light beyond the Project's site boundaries.

8.6 The *intensity* of Visual Impact

Referring to the discussions in the previous sections and using the criteria listed in Appendix B, the *intensity* of the worst-case scenario visual impact of the Project is rated in Table 3 below for both phases of the Project. To assess the intensity of visual impact four main factors are considered.

- *Visual Intrusion:* The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use within the context of the landscape's VAC.
- *Visibility:* The area/points from which project components will be visible.
- *Visual exposure:* Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
- *Sensitivity:* Sensitivity of visual receptors to the proposed development

In synthesising the criteria, a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful and should not be used as a substitute for reasoned professional judgement (LI-IEMA 2013).

According to the results tabulated below in Table 3, the *intensity* of visual impact will be *high* (during the construction and operational phases without mitigation), for foreground views originating in the Lichtenburg Game Reserve east of the site, moderate for farmsteads west and north of the stie and low for users of the R505 and farmsteads at the north-western and north-eastern extremities of the study area. And *negligible to none* for the remainder of the study area.

Table 3: *Intensity* of visual impact without mitigation

High	**Moderate**	**Low**	**Negligible to None**
- Users of the Lichtenburg Game Reserve and farmsteads west of the property within 800m of the property boundaries	- Users of the Lichtenburg Game Reserve and farmsteads north and north-west of the Project site at > 800m from the property boundaries	-Users of the R505 provincial road - Farmsteads northwest and northeast of the site at > 3km from it	- Homesteads southwest of the site - The remainder of the study area
Major loss of or alteration to key elements / features / characteristics of the	Partial loss of or alteration to key elements / features /	Minor loss of or alteration to key elements / features	Very minor loss or alteration to key

baseline in the immediate vicinity of the site. i.e. Pre-development landscape or view and / or introduction of elements considered to be uncharacteristic when set within the attributes of the receiving landscape. **Result:** **A *high* scenic quality impacts would result.**	characteristics of the baseline. i.e. Pre-development landscape or view and / or introduction of elements that may be prominent but may not necessarily be substantially problematic when set within the attributes of the receiving landscape. **Result:** **A *moderate* scenic quality impacts would result**	/ characteristics of the baseline. i.e. Pre-development landscape or view and / or introduction of elements that may not be problematic when set within the attributes of the receiving landscape. **Result:** **A *low* scenic quality impacts would result.**	elements/features/characteristics of the baseline. i.e. Pre-development landscape or view and / or introduction of elements that is not problematic with the surrounding landscape – approximating the 'no change' situation. **Result:** **A *negligible* scenic quality impacts would result.**

9. MANAGEMENT MEASURES

In considering mitigating measures, three rules are considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area).

The following generic mitigation measures are suggested for the Project and should be included in the Environmental Management Plan Report (EMPr). The following general actions are recommended:

9.1 Planning and site development

- With the preparation of the land within the full extent of the Project site onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed.
- Specifications with regards to the placement of construction camps (if required), as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities, should be included in the EMPr. These areas should either be screened or positioned in areas where they would be less visible from nearby farmsteads and the R505 main road.
- Construction activities should be limited to between 08:00 and 17:00 or in conjunction with the ECO.
- Adopt responsible construction practices that strictly contain the construction/establishment activities to demarcated areas.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.

9.2 Earthworks and vegetation

- Earthworks should be executed so that only the footprint and a small 'construction buffer zone' around the proposed activities (internal roads, foundations for the array structures, high-voltage substation, and the medium voltage substations) are exposed. In all other areas, the naturally occurring vegetation should be retained, especially along the periphery of the sites and the wetland zone and 30mm buffer.
- All cut and fill slopes (if any) and areas affected by construction work should be progressively top soiled and re-vegetated as soon as possible.
- Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.
- Plant clumps of indigenous evergreen trees (*Searsia sp.* and *olea europaea subsp. africana*) in the proposed tree buffer zone, which is to be a minimum of 20m wide. The tree screen will only become effective after 5 – 10 years of growth, when the impact of the PV arrays can be reduced over time.

9.3 Structures and associated infrastructure

- Paint all structures (structural support for the arrays) with colours that reflect and compliment the colours of the surrounding landscape.

9.4 Good housekeeping

- "Housekeeping" procedures should be developed for the Project to ensure that the project site and lands adjacent to it are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated on-site; procedures should extend to control of "track out" of dirt on vehicles leaving the active construction site and controlling sediment in stormwater runoff.
- During construction, temporary fences surrounding the material storage yards and laydown areas should be covered with 'shack' cloth (khaki coloured) or shade cloth.
- Operating facilities should be actively maintained during operation.

9.5 Lighting

Light pollution is largely the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it is not wanted, instead of focusing the light downward, where it is needed. Ill designed lighting washes out the darkness of the night sky and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted.

Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilled into the atmosphere. The following are measures that must be considered in the lighting design of the Project, particularly at the management and service platforms:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site i.e. lights are to be aimed away from adjacent farmsteads areas, specifically west and north of the Project site.
- Minimize the number of light fixtures to the bare minimum, including security lighting.
- Avoid high pole top security lighting along the periphery of the site and use only lights activated on illegal entry to the site.

9.6 Glint and Glare

To experience glint and glare, an observer must have a visual line of sight to the solar panels. Therefore, provision of screening (as proposed in 9.2 above) between potentially affected receptors and the reflecting panels can mitigate the effects.

The only effective way of reducing/eliminating glare, in this instance, is to change the angle that the panels are facing. As mentioned in section 8.4.2, the potential for glare is in the summer months, either the early morning or late afternoon.

As a glint and glare analysis is not required for the Project, it is proposed that neighbours monitor and record incidents when glint and glare affected them. The date and time of day should be recorded. Should glare prove to become an issue, this information would be communicated to the owner/operator of the Project. On the days and times (if any) when issues were experienced, the angle that the panels face should be redirected to eliminate glare, for the duration of the period that issues were being experienced.

10. SIGNIFICANCE OF IMPACT

The significance ratings are based on the worst-case scenario and when the impacts of all aspects of the Project are taken together using the impact criteria in Appendix C. The sensitive receptor areas of concern are:

- Users of the Lichtenburg Game Reserve and farmsteads and residential units north and west of the site within 800m of the property boundaries
- Users of the Lichtenburg Game Reserve and farmsteads north-west of the stie at > 800m and < 3,0km of the property boundaries
- Users of the R505 provincial road.

The *intensity* of impact is further qualified with *duration*, *extent,* and *probability* criteria to determine the *significance. Significance* of impact is a function of Consequence x probability. The worst-case scenario is assessed below, i.e. the impact on users of the Lichtenburg Game Reserve and farmsteads and residential units north and west of the site within foreground views (i.e. eight hundred from the Project site's boundaries). Visual impact on all other areas within the study area would be less that the assessed worst-case scenario.

10.1 Construction and Operational Phases

The cause of visual impact during the construction phase are the activities associated with the erection of the PV structures and associated infrastructure. The estimated timeframe for this phase is eighteen months. The physical presence of the PV arrays would be the cause of visual impact during the operational phase. The operational phase is approximately thirty years.

Table 4: Determining the CONSEQUENCE of Visual Impact

Project Phase	***Unmitigated* summary of the rated visual impact per phase of the Project**				***Mitigated* summary of the rated visual impact per phase of the Project**			
	Intensity	**Spatial Scale**	**Duration**	**Consequence**	**Intensity**	**Spatial Scale**	**Duration**	**Consequence**
Construction	High (H)	Local (L)	Short Term (L)	**L**	High (H)	Local (L)	Short Term (L)	**L**
Operational	High (H)	Local (L)	Long Term (H)	**M**	High (H)	Local (L)	Mod Term (M)	**L**

Table 5: SIGNIFICANCE of Visual Impact and CONFIDENCE RATINGS

Potential Visual Impact i.e. change to the landscape characteristics and key views caused by the physical presence of Project activities	ENVIRONMENTAL SIGNIFICANCE							
	Unmitigated				Mitigated			
	Con	x	Prob	SIG	Con	x	Prob	SIG
Construction	Low (L)		Most likely (H)	**M**	Low (L)		Most likely (H)	**M**
Operational[5]	Moderate (M)		Most likely (H)	**M**	Low (L)		Possibly (M)	**L**
CONFIDENCE RATINGS								
Degree of Confidence of the significance assessment[6]	At the time of drafting the report, the outcome of the I&AP process was not known. If sensitives of the local community are high, the impact rating may be modified slightly to a high impact.							**M**
Degree to which the impact can be mitigated	Mitigation is feasible and the impact can be reversed over time 5 – 10 years and would lower impact from moderate to low							**M**
Loss of resources								**M**
Reversibility	After decommissioning the site will be rehabilitated back to its original topography and vegetative cover							**Fully rev.**

10.2 Significance of Visual Impact – Construction Phase

Construction activities include the removal of vegetation, earthworks required to create building terraces for substation and preparation of the internal roads as well as excavations for the array structures foundations, and the erection of the PV arrays and associated infrastructure. Construction activities would negatively affect the landscape's visual quality and sense of place relative to its baseline. They would contrast with the patterns that define the structure of the landscape and cause an intense change over a localized area, resulting in a moderate change to key views.

The impact on the visual environment during the construction phase is assessed to have a high intensity over a localized area and would occur over the short-term (less than five years). The significance of the unmitigated impact would be localized but extend beyond the site boundary (to at least 3,0km) and is predicted to be MODERATE. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MODERATE.

10.3 Significance of Visual Impact – Operational Phase

Operational activities include the physical presence of the PV arrays and the ongoing maintenance of the solar power plant including security and other lighting associated with the functioning of the plant.

[6] Once the significance of the impact has been determined, the degree of confidence in the assessment will be qualified. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. If sensitives of the local community are extremely high, the impact rating may be modified, particularly the rating with mitigation.

The impact on the visual environment during the operational phase is assessed to have a moderate intensity and would occur over the long-term (anticipated to be thirty years). The unmitigated impact would be localized but extend beyond the site boundary (to at least 3,0km) and is assessed to be MODERATE. The significance of a moderate impact is that it should have an influence on the decision and the impact will not be avoided unless it is mitigated.

Mitigation measures can reduce the visual impact of the Project to LOW, but they would take 5 – 10 to become effective as the tree screen grows to maturity.

11. CUMULATIVE EFFECT

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect how the landscape is experienced, and cumulative effects may be positive or negative. Where they comprise a range of benefits, they may form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility of a range of developments and the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual developments may not be significant, but they may adversely impact visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, vegetative cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions (LI-IEMA (2013)).

11.1 The cumulative effect of the Project

The cumulative impact of the Project is potentially high as at least five other solar PV projects are proposed within the Project's study area. Figure 8 indicates the location of these projects, which surround the site. Should all projects[7] should go ahead over two thirds of the entire study area (a 5,0km radius about the centre of the Project site) would contain solar PV projects. The intervisibility and the Project along with the other solar PV projects, would over time, result in the nature and character of the study being impacted in a manner far beyond the anticipated moderate negative impact of the proposed Project alone. The combined effect of approved, pending and proposed solar power developments would dominate the study area and irrevocably change the nature, sense of study and character of the landscape's baseline.

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a high intensity and over the long-term with an unmitigated sub-regional impact extending beyond the site (to at least 3,0km beyond the site boundaries) and is assessed to be HIGH. I.e. it should influence the decision to not proceed with the projects or require significant modification(s) of the various projects' design/locations (where relevant).

[7] Information provided by Ages Limpopo Environmental Consultants.

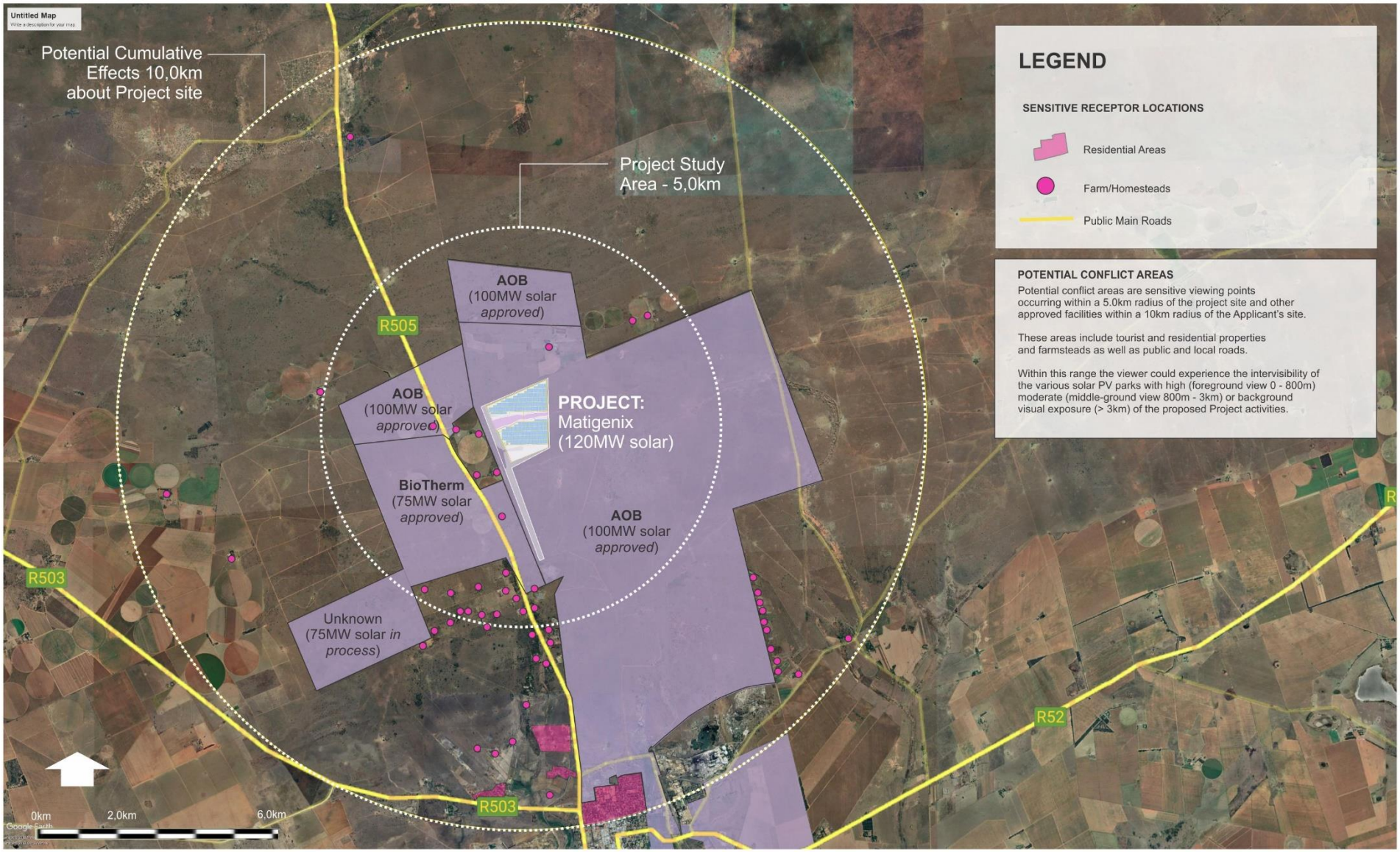

Figure 08: CUMULATIVE EFFECT- Lichtenburg Solar PV Park

Refer to Figures 4-1 to 4-4 for the panoramas

GYLA
Graham A Young
Landscape Architect
082 462 1491

12. CONCLUSION

The existing visual condition of the landscape that may be affected by the proposed Lichtenburg PV Solar Power Project has been described. The study area's scenic quality has been rated *low* to *moderate* within the context of the sub-region, and the project site is in a moderate rated landscape type. Sensitive viewing areas and landscape types have been identified and mapped, indicating potential sensitivity to the Project, mainly for residences of farmsteads to the immediate west and north of the site and visitors of the Lichtenburg Vakansie Oord Game Park east of the Project site.

Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The Project's visual impact will cause changes in the landscape that are noticeable to people viewing the landscape from the R505 provincial road and adjacent farmsteads. People living in the residential areas in the far south of the study area will not be affected by the Project.

12.1 The visual impact of the Project

The significance of impact, without mitigation and based on the worst-case scenario.

Construction activities include the removal of vegetation, earthworks required to create building terraces for substation and preparation of the internal roads as well as excavations for the array structures foundations, and the erection of the PV arrays and associated infrastructure. Construction activities would negatively affect the landscape's visual quality and sense of place relative to its baseline. They would contrast with the patterns that define the structure of the landscape and cause an intense change over a localized area, resulting in a moderate change to key views.

The impact on the visual environment during the construction phase is assessed to have a high intensity over a localized area and would occur over the short-term (less than five years). The significance of the unmitigated impact would be localized but extend beyond the site boundary (to at least 3,0km in some areas) and is predicted to be MODERATE. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MODERATE.

Operational activities include the physical presence of the PV arrays and the ongoing maintenance of the solar power plant including security and other lighting associated with the functioning of the plant.

The impact on the visual environment during the operational phase is assessed to have a moderate intensity and would occur over the long-term (anticipated to be thirty years). The unmitigated impact would be localized but extend beyond the site boundary (to at least 3,0km) and is assessed to be MODERATE. The significance of a moderate impact is that it should have an influence on the decision and the impact will not be avoided unless it is mitigated.

Mitigation measures can reduce the visual impact of the Project to LOW, but they would take 5 – 10 to become effective as the tree screen grows to maturity.

The degree of Confidence of the significance assessment is moderate as the results of the I&AP process were not known at the time of drafting the report. It is assumed that sensitivity to the Project is moderate.

After decommissioning, the site will be rehabilitated back to its original topography and vegetative cover.

12.2 Cumulative Effects

The intervisibility and the Project along with the other solar PV projects, would over time, result in the nature and character of the study being impacted in a manner far beyond the anticipated moderate negative impact of the proposed Project alone.

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a high intensity and over the long-term with an unmitigated sub-regional impact extending beyond the site (to at least 3,0km beyond the site boundaries) and is assessed to be HIGH. I.e. it should influence the decision to not proceed with the projects or require significant modification(s) of the various projects' design/locations (where relevant).

12.3 Author's Opinion

The author's opinion is that all aspects of the Project should be approved from a potential visual impact perspective, if mitigation/management measures are effectively implemented, managed, and monitored in the long term.

****GYLA****

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To reach an understanding of the effect of development on a landscape resource, it is necessary to consider the distinct aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of pattern, resulting from combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape reflects the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus, aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes.
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors.
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general.
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases, these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognised and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, "beauty is in the eye of the beholder," is often quoted to emphasise the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual

complexity particularly in scenes with water, over homogeneous areas. Based on contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase.
- Where water forms are present.
- Where diverse patterns of grasslands and trees occur.
- Where natural landscape increases and man-made landscape decreases.
- And where land use compatibility increases and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate extremely low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is several not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognise this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform / water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	Rating Criteria and Score

Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major Badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. **5**	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Flowing, or still, but not dominant in the landscape. **3**	Absent, or present, but not noticeable. **0**
Colour	Rich colour combinations, variety, or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colours and contrast of the soil, rock, and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
Scarcity	One of a kind; or unusually memorable, or exceedingly rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas *** 5+**	Distinctive, though somewhat like others within the region. **3**	Interesting within its setting, but common within the region. **1**
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

2	**0**	**4**

Scenic Quality (i.e. value of the visual resource)

In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource – expressed as Scenic Quality
(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	Moderate	Low
Areas that exhibit an incredibly positive character with valued features that combine to give the experience of unity, richness, and harmony. These are landscapes that may be of particular importance to conserve, and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character, but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again, change may be detrimental if inappropriately dealt with, but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the Project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual Impact

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the magnitude of visual impact four main factors are considered.

Visual Intrusion:	The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.
Visibility:	The area/points from which project components will be visible.
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
Sensitivity:	Sensitivity of visual receptors to the proposed development

Visual Intrusion / contrast

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Or conversely what is its contrast with the receiving environment. Combining landform / vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform / vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive, or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the Project enhance and promote cultural continuity, or does it disrupt it?

The consequence of the intrusion / contrast can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion

High	Moderate	Low	Positive
If the Project: - Has a substantial negative effect on the visual quality of the landscape. - Contrasts dramatically with the patterns or elements that define the structure of the landscape. - Contrasts dramatically with land use, settlement, or enclosure patterns. - Is unable to be 'absorbed' into the landscape.	If the Project: - Has a moderate negative effect on the visual quality of the landscape. - Contrasts moderately with the patterns or elements that define the structure of the landscape. - Is partially compatible with land use, settlement, or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the Project: - Has a minimal effect on the visual quality of the landscape. - Contrasts minimally with the patterns or elements that define the structure of the landscape. - Is mostly compatible with land use, settlement, or enclosure patterns. - Is 'absorbed' into the landscape.	If the Project: - Has a beneficial effect on the visual quality of the landscape. - Enhances the patterns or elements that define the structure of the landscape. - Is compatible with land use, settlement, or enclosure patterns.

Result Notable change in landscape characteristics over an extensive area and/or intensive change over a localised area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localised area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer's attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or most viewers are affected.	*Visual Receptors* If the development is visible from less than half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or

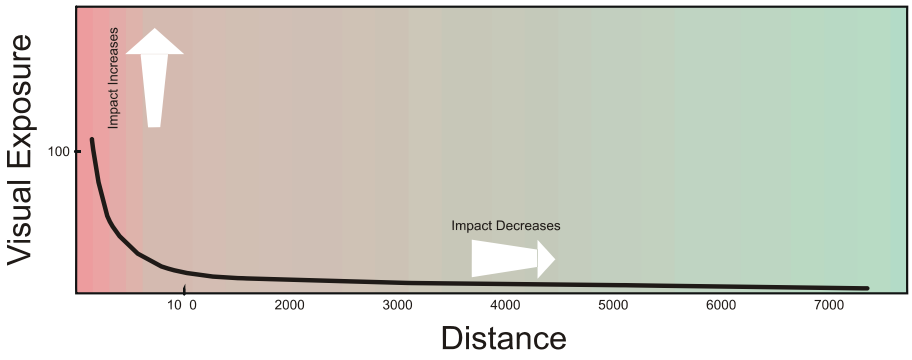
patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the Figures below.

Effect of Distance on Visual Exposure




View from 10 000 metres


View from 5 000 metres


View from 3 000 metres


View from 1 000 metres

Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the magnitude of the impact of the development can be determined.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint.
- The expectations and occupation or activity of the receptor.
- The importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.
- Occupiers of residential properties with views affected by the development.
- These would all be high

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).
- People travelling through or past the affected landscape in cars, on trains or other transport routes.
- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High	Moderate	Low
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas).
Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.	People travelling through or past the affected landscape in cars, on trains or other transport routes.	Roads going through urban and industrial areas

Occupiers of residential properties with views affected by the development.	

Magnitude of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. 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, especially in foreground views.

The magnitude of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the magnitude of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

Intensity (Magnitude) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline.	Partial loss of or alteration to key elements/features/characteristics of the baseline.	Minor loss of or alteration to key elements/features/characteristics of the baseline.	Very minor loss or alteration to key elements/features/characteristics of the baseline.
I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view an/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.

High scenic quality impacts would result.	Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

APPENDIX C: CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT (NAMISUN)

Table 1: IMPACT ASSESSMENT CRITERIA

SIGNIFICANCE determination	Significance = consequence x probability	
CONSEQUENCE	**Consequence is a function of:** • **Nature and Intensity of the potential impact** • **Geographical extent should the impact occur** • **Duration of the impact**	
Ranking the NATURE and INTENSITY of the potential impact		
Negative impacts		
Low (L)	The impact has no / minor effect/deterioration on natural, cultural and social functions and processes. No measurable change. Recommended standard / level will not be violated. (Limited nuisance related complaints).	
Moderate (M)	Natural, cultural and social functions and processes can continue, but in a modified way. Moderate discomfort that can be measured. Recommended standard / level will occasionally be violated. Various third-party complaints expected.	
High (H)	Natural, cultural or social functions and processes are altered in such a way that they temporarily or permanently cease. Substantial deterioration of the impacted environment. Widespread third-party complaints expected.	
Very high (VH)	Substantial deterioration (death, illness or injury). Recommended standard / level will often be violated. Vigorous action expected by third parties.	
Positive impacts		
Low (L) +	Slight positive effect on natural, cultural and social functions and processes Minor improvement. No measurable change.	
Moderate (M) +	Natural, cultural and social functions and processes continue but in a noticeably enhanced way. Moderate improvement. Little positive reaction from third parties.	
High (H) +	Natural, cultural or social functions and processes are altered in such a way that the impacted environment is considerably enhanced /improved. Widespread, noticeable positive reaction from third parties.	
Very high (VH) +	Substantial improvement. Will be within or better than the recommended level. Favourable publicity from third parties.	
Ranking the EXTENT		
Low (L)	Local (confined to within the project concession area and its nearby surroundings).	
Moderate (M)	Regional (confined to the region, e.g. coast, basin, catchment, municipal region, district, etc.).	
High (H)	National (extends beyond district or regional boundaries with national implications).	
Very high (VH)	International (Impact extends beyond the national scale or may be transboundary).	
Ranking the DURATION		
Low (L)	Temporary/short term. Quickly reversible. (Less than the life of the Project).	
Moderate (M)	Medium Term. Impact can be reversed over time. (Life of the Project).	
High (H)	Long Term. Impact will only cease after the life of the Project.	
Very high (VH)	Permanent	
Ranking the PROBABILITY		
Low (L)	Unlikely	
Moderate (M)	Possibly	
High (H)	Most likely	
Very high (VH)	Definitely	
SIGNIFICANCE Description		
	Positive	**Negative**
Low (L)	Supports the implementation of the Project	No influence on the decision.
Moderate (M)	Supports the implementation of the Project	It should have an influence on the decision and the impact will not be avoided unless it is mitigated.
High (H)	Supports the implementation of the Project	It should influence the decision to not proceed with the Project or require significant modification(s) of the project design/location, etc. (where relevant).
Very high (VH)	Supports the implementation of the Project	It would influence the decision to not proceed with the Project.

Table 2: DETERMINING THE CONSEQUENCE

DETERMINING THE CONSEQUENCE					
INTENSITY OF IMPACT = LOW					
DURATION	VH	Moderate	Moderate	High	High
	H	Moderate	Moderate	Moderate	Moderate
	M	Low	Low	Low	Moderate
	L	Low	Low	Low	Moderate
INTENSITY OF IMPACT = MODERATE					
DURATION	VH	Moderate	High	High	High
	H	Moderate	Moderate	High	High
	M	Moderate	Moderate	Moderate	Moderate
	L	Low	Moderate	Moderate	Moderate
INTENSITY OF IMPACT = HIGH					
DURATION	VH	High	High	Very High	Very high
	H	High	High	High	Very High
	M	Moderate	Moderate	High	High
	L	Moderate	Moderate	High	High
INTENSITY OF IMPACT = VERY HIGH					
DURATION	VH	Very high	Very High	Very High	Very high
	H	High	High	Very High	Very high
	M	High	High	High	Very High
	L	Moderate	High	High	Very High
		L	M	H	VH
		EXTENT			

Table 3: DETERMINING THE SIGNIFICANCE

DETERMINING THE SIGNIFICANCE					
PROBABILITY	VH	Moderate	High	High	Very high
	H	Moderate	Moderate	High	Very high
	M	Low	Moderate	High	High
	L	Low	Low	Moderate	High
		L	M	H	VH
		CONSEQUENCE			

APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterise the nature and magnitude of visual intrusion of the proposed Project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness:	A simulation should represent important and typical views of a project.
Accuracy:	The similarity between a simulation and the reality after the Project has been realised.
Visual clarity:	Detail, parts and overall contents have to be clearly recognisable.
Interest:	A simulation should hold the attention of the viewer.
Legitimacy:	A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

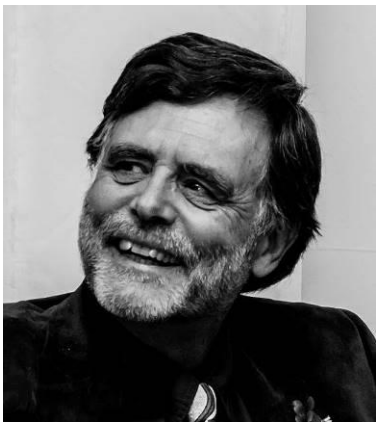
To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange, 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect / designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

APPENDIX E: CURRICULUM VITAE



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Graham is a registered landscape architect with interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the University of Toronto and has practiced in Canada and Africa, where he has spent the greater part of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and as Vice President of the Board of Control for Landscape Architects.

During his 30 years plus career he has received ILASA and other industry awards. He has published widely on landscape architectural issues and has had projects published both locally and internationally in, scientific and design journals and books. He was a being a founding member of Newtown Landscape Architects and is also a senior lecturer, teaching landscape architecture and urban design at post and undergraduate levels, at the University of Pretoria. He has been a visiting studio critic at the University of Witwatersrand and University of Cape Town and in 2011 was invited to the University of Rhode Island, USA as their Distinguished International Scholar for that year. Recently, Graham resigned from NLA and now practices as a Sole Proprietor.

A niche specialty of his is Visual Impact Assessment for which he was cited with an ILASA Merit Award in 1999. He has completed over 250 specialist reports for projects in South Africa, Canada and other African countries. He was on the panel that developed the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (2005) and produced a research document for Eskom, *The Visual Impacts of Power Lines* (2009). In 2011, he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee (they manage a World Heritage Site) along with the *Visual Impact Assessment Training Module Guideline Document.*

*** GYLA ***