VISUAL IMPACT ASSESSMENT

PROPOSED 75MW PHOTOVOLTAIC, RENEWABLE ENERGY SOLAR FACILITY ON THE REMAINDER OF THE FARM 271 - JS AND ASSOCIATED POWER LINES ON THE FARM KRUISRIVIER NO. 270

Prepared for:

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Menno Klapwijk has specialised for 30 years in environmental planning, construction rehabilitation and control, visual impact assessment, and landscape site design. Significant visual impact projects include: Moatize Power Plant (Mozambique), Transnet Multi-purpose Pipeline, Saldanha Steel, Mozal (Alusaf – Mozambique), Letsibogo Dam (Botswana), Blue Circle Cement Factory (East London), Phlogopite Factory (Phalaborwa), Iscor Heavy Minerals Smelter (Empangeni), many VIA's for Eskom transmission lines and substations, Mmamabula 400kV Transmission Line, Mine and Power Plant (Botswana), West Coast Combined Cycle Gas Turbine Power Plant (CCGT), De Hoop Dam and Pipeline (Sekhukuneland), Tugela Water Project (KwaZulu-Natal), Delportshoop Tower Mast (Delportshoop, Northern Cape), N3 Toll Road, Cedara (KwaZulu-Natal) to Heidelberg (Gauteng), Maputo Steel Project (Maputo, Mazambique), Ga-Pila Village (Potgietersrus, Limpopo Province) and Pom Pom Camp (Okavango, Botswana).

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DECLARATION OF INDEPENDENCE

I, Menno Klapwijk, as authorised representative of Bapela Cave Klapwijk, hereby confirm my independence as a specialist and declare that neither I nor Bapela Cave Klapwijk have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Bapela Cave Klapwijk appointed as Visual Impact Assessor in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Visual Impact Assessment for the Zeerust Solar Facility. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it – as is described in my attached report.

Signed…….. Date: 13 December 2013

TABLE OF CONTENTS

LIST OF FIGURES

PHOTOGRAPHS

Photo p5: View E along south eastern boundary
Photo p6: View N from south eastern corner with suburb developing in the east.

Photo p7: View S from high point at reservoir.
Photo p8: View S from mid slope below the reservoir
Photo p9: View NW from south-eastern corner

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PROPOSED 75MW PHOTOVOLTAIC, RENEWABLE ENERGY, SOLAR FACILITY ON THE REMAINDER OF THE FARM 271- JS AND ON THE REMAINDER OF PORTION 15 OF THE FARM 271 – JS AND ASSOCIATED POWER LINES ON THE FARM KRUISRIVIER NO. 270

EXECUTIVE SUMMARY

This visual impact study of the proposed Solar Facility on the Farm 271-JS and the farm Kruisrivier No 270 forms part of the Environmental Impact Assessment being carried out by Sharples Environmental Services cc.(SES)

The site was visited on 2 December 2013 during which the characteristics, attributes and views were recorded and photographed.

The report referred to the document “Guidelines for involving Visual and Aesthetic Specialists in EIA Processes” that was compiled for the Provincial Government of the Western Cape: Department of Environmental Affairs and Solar Facility Planning (Oberholzer, B and CSIR, 2005).

Established criteria were used for the rating assessment of the visual attributes identified and these were summarised in a table. The selected site scoped previously, including the No-go situation, are discussed and the assessment was done on the site location provided by SES.

The findings of the visual impact assessment of the proposed Zeerust Solar Facility on the setting are the following:

The reasons are as follows:

- The site, although itself visually undisturbed, is surrounded by visually intrusive elements such as roads, transmission lines and railways tracks.

- The site will be stripped of all vegetation which will leave a large visual scar.
- The view shed, the area from where the site can be seen, extends beyond 5 km. however, much is contained by the road edge vegetation along the main roads as

well as by the buildings within the town. The surrounding hilly landscape landforms limits much of the views to within 5 km.

- The scale of the solar unit (2,5m – 3,5m) will cover a large area (approximately 150ha) that will be in high contrast to the natural vegetation. The vertical height of the panel type chosen will determine the visual scale in the landscape.

The analysis of the visual criteria and the affect that the proposed Solar Facility will have on the setting has shown that the overall visual intrusion will be of **Medium Significance**, which means that the findings should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented.

The visual intrusion ratings of the Solar Facility sites assessed has been predicted with a high level of confidence.

The Project is visible from the surrounding major roads especially those west and south west due to the facility being placed on the hillside slopes. Significant sections of these roads are edged by existing trees and scrub vegetation that screens the viewer from the facility.

The visibility of the site does extend beyond the 500m radial zone for several kilometres in most directions from the site boundary the extent of which is terminated on the visual periphery by the surrounding hills. Only the area within the 500m to 1000m zones are regarded as being significantly impacted.

The overall assessment of the **visual intrusion** of the proposed development on the characteristics of the site and on views toward the site from surrounding areas is that it will have a medium level of visual intrusion and a moderate affect on the site characteristics and setting. **Refer to the definitions of ratings in Chapter 11.3.** This is due to the intermittent area from which the site can be seen and that large sections such as the urban areas are already visually modified. However, these areas have views of the site that are obscured by trees and buildings.

The height of the solar panels will affect the ratings by increasing the level of visual intrusion and the affect that the structures will have within the viewshed.

The visual intrusion is rated as high with a moderate effect on the intrusion into views of the site from within the 500m zone. This is due to the existing vegetation that offers effective view obstruction from the surrounding major roads in both directions and only limited views of portions of the solar panels will be experienced by the road user;

The visual prominence of the solar panels will be low in all views of the site and it is considered that this will have a moderate affect on the quality of existing views from the roads;

The visual intrusion on the change of the sense of place is regarded as having a level of medium and the affect of the visual intrusion considered to be moderate;

The visual intrusion of the expected landform change will be low and the visual effect will be negligible;

The visual impact of the construction phase of the project is considered to be medium and to have a moderate effect on the setting and surroundings;

The visual intrusion of the proposed project on the night scene is considered to be high due to the concentration of light in an area that presently has no conspicuous lighting. However if lighting of the site and structures is carefully planned the effect of the light intrusion will be moderate.

The overall assessment of the Significance, which is a combination of Consequence (intensity, extent, & duration) and Probability of the visual impact on the setting is as follows:

Construction phase:	Low significance negative
Operation phase:	medium significance negative
Decommissioning:	high significance positive

The **medium** significance of the negative visual impact as arrived at by the application of the criteria for evaluation means that the visual aspects should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented. This rating has taken into account the implementation of mitigation measures and the selection of the preferred site Alternative.

The visual impact mitigation measures proposed will reduce the visual intrusion described in this report within the 500m radial by improving the visual fit of the proposed development into the existing setting. However, the scale and extent of the proposed Solar Facility will exert a prominent visual presence that will change the character and sense of place within the viewsheds where it is located.

It is recommended that the mitigation measures presented are incorporated during the detail design stage, so that the engineering and aesthetic components are integrated.

In this way mitigation measures are part of the total layout and design concept and are included in the construction contracts.

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1 INTRODUCTION

In accordance with the request from Sharples Environmental Services this assessment has been prepared. This report will form part of the Environmental Impact Assessment Report that will be submitted to the Department of Environmental Affairs and the Department of Economic Development, Environment, Conservation and Tourism of the North West Province with the relevant Regulations in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), as amended.

RE Capital 2 (Pty) Ltd propose to establish a renewable energy, Photovoltaic (PV) Solar Facility (approximately 150Ha) that will produce 75MW of electricity to be connected to the Eskom Zeerust Substation. Photovoltaic's (PVs) are arrays of cells containing a solar photovoltaic material that converts solar radiation into direct current electricity. The facility will transfer light energy from the sun to generate electricity through a process known as the "photovoltaic effect". The purpose of the proposed facility is to sell the electricity to Eskom as part of the renewable energy Independent Power Producers (IPP) procurement programme. This programme was introduced by the Department of Energy (DoE) to promote the use of renewable power solutions.

RE Capital 2 (Pty) Ltd propose to construct the photovoltaic (PV) solar farm and associated infrastructure on the Remainder of the Farm Kameeldoorn, No. 271 –JP and on the Remainder of Portion 15 of the Farm 271 – JP. The power line proposed to connect to the existing Eskom Substation is proposed on Portion 14 of the Farm Kruisrivier, No. 270, Zeerust, in the North West Province.

It is proposed to produce a maximum of 75MW of electricity and to add the electricity produced into the existing Eskom grid at the Zeerust substation that is located directly adjacent to the proposed site. An application has already been submitted to the National Department of Environmental Affairs (DEA).

The proposed facility will transfer light energy from the sun to generate electricity through a process known as the "photovoltaic effect". The purpose of the proposed facility is to sell the electricity to Eskom as part of the renewable energy Independent

Power Producers (IPP) procurement programme. This proposed 75MW of clean, renewable energy will contribute to the target that has been set by the SA Government

Zeerust (Figure 1 Regional Locality Map) is a commercial town situated in Ngaka Modiri Molema district in the North West Province, South Africa. It lies in the Marico valley, approximately 240 kilometres northwest of Johannesburg. It lies on the N4, the main road link between South Africa and Botswana. There are large cattle ranches in the area, as well as wheat, maize, tobacco and citrus fruit farms. There are also fluorite and chromite mines in the vicinity. Tourism is also a developing industry. The site earmarked for the proposed photovoltaic solar Facility is located just south of where the N4 and the R49 intersect, 1km from Shalimar Park and 4km from the town of Zeerust in the North West Province of South Africa. The site is located in the Ngaka Modiri Molema District Municipality and in the Ramotshere Moiloa Local Municipality. (Figure 2 Local Locality Map)

The proposed Solar Facility, due to its scale, extent and location is expected to have a moderate visual impact on the natural environment.

With reference to the *"Guideline for involving Visual and Aesthetic Specialists in EIA Processes"* compiled for the Provincial Government of the Western Cape: Dept of Environmental Affairs and Development Planning (Oberholzer, B and CSIR 2005), the Solar Facility is classified as a Category 3.development namely 'light industry, medium-scale infrastructure' and is considered to have a moderate visual impact,

The current land use is agriculture and is primarily cattle grazing and game farming.

2 OBJECTIVES

The objective of this report is to identify the potential visual impact of the proposed Solar Facility on the existing surrounding natural and socio-economic environment. The findings will inform the EIA study about the visual impacts, their significance propose mitigation thereof. This will ensure that the Solar Facility visually 'fits' the landform and natural setting and blends with the existing and projected character of the place.

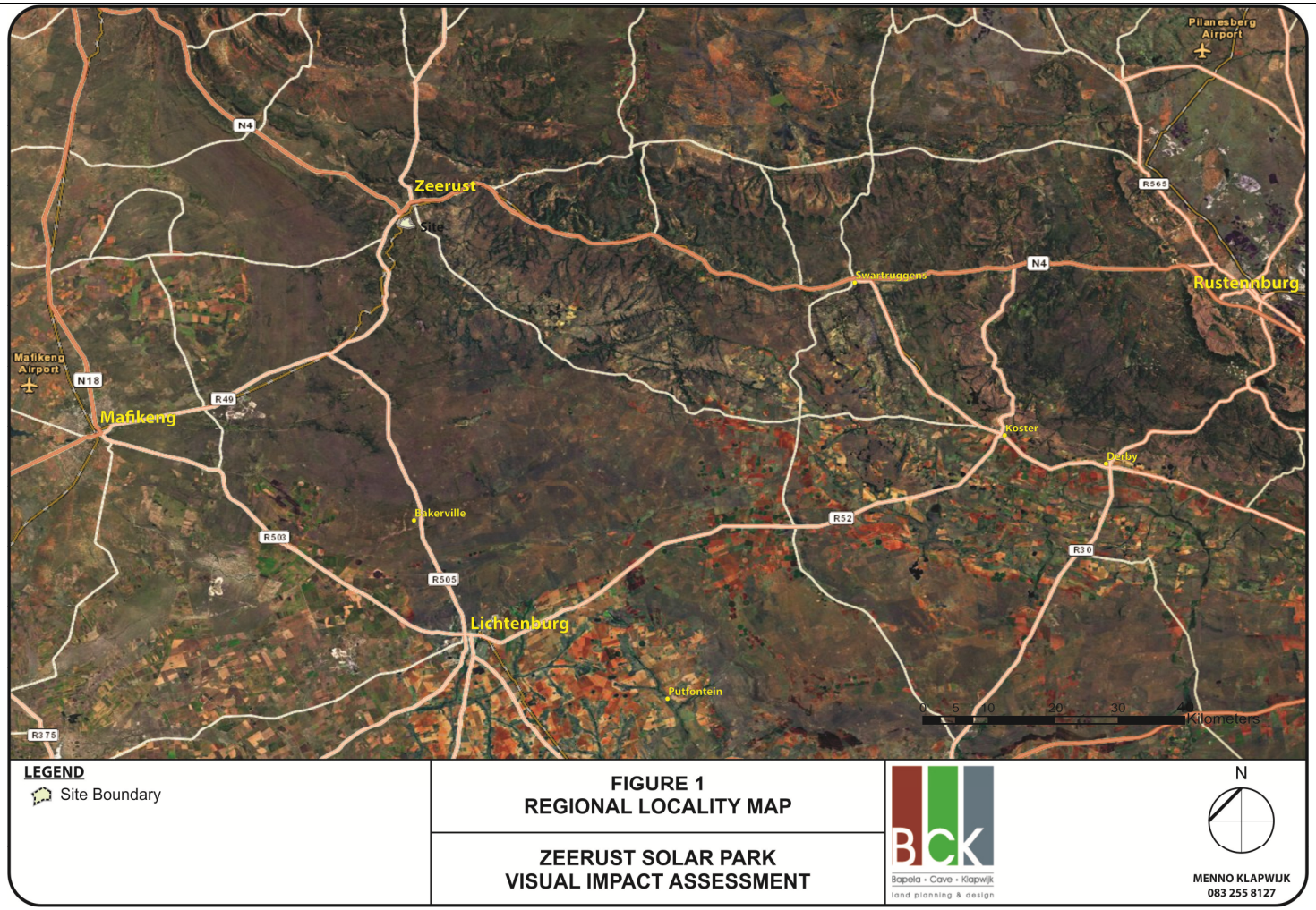

Figure 1: Regional Locality Plan

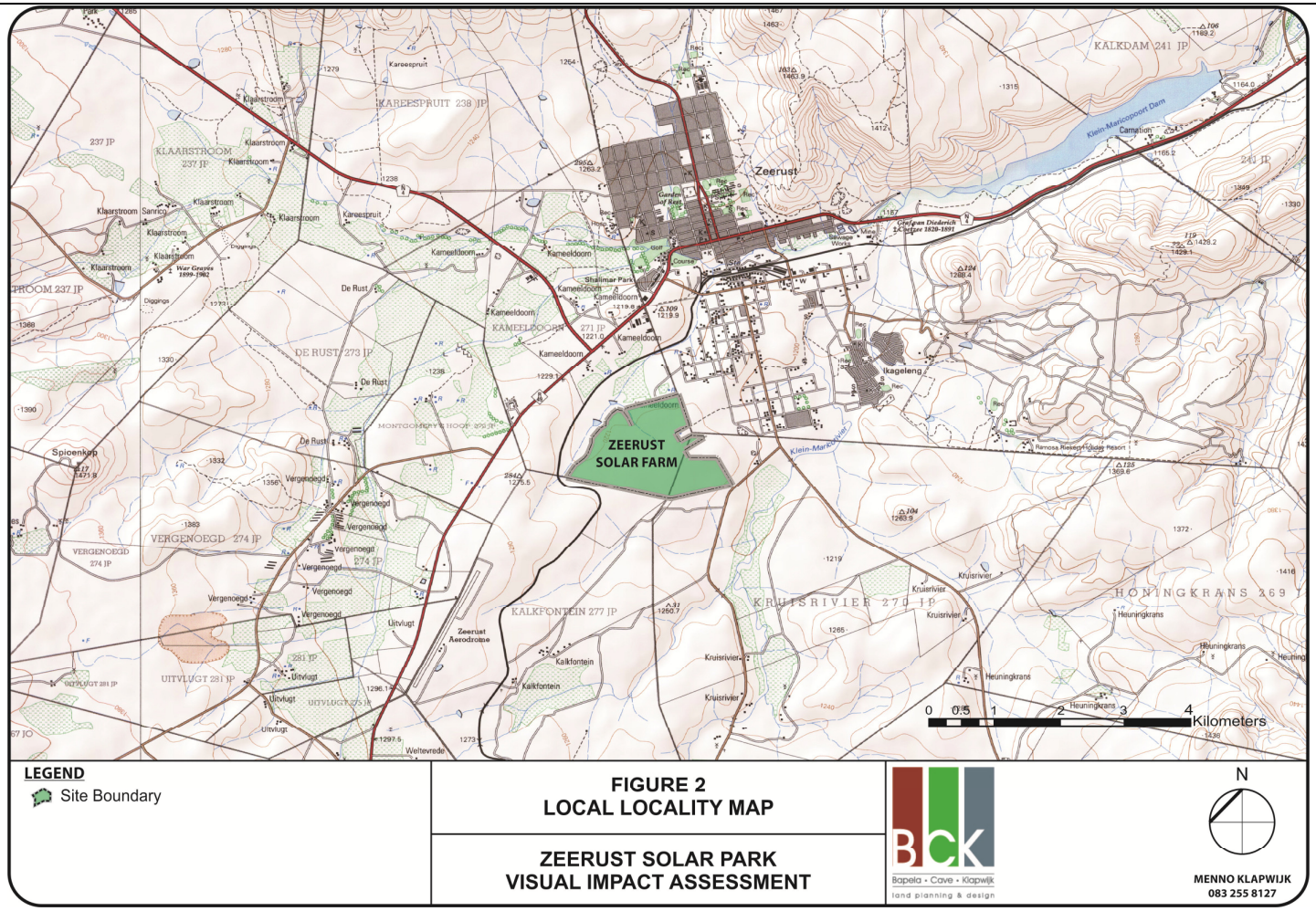

Figure 2 Local Locality Map

3 THE VISIBILITY IN CONTEXT

The proposed Solar Facility will alter the visual character and quality of the local setting.

The visual change is due to the proposed arrangement and height of the solar panels and their density over a large area (150 ha). The array of the panels are to be located on a landforms that slope gently to the west and south west away down from the reservoir located on the edge of the town. The R49 lies further to the North West with the town to the east and north east. The site is surrounded on the periphery by rising hills which tend to truncate and limit the views.

The visibility is contained effectively by the surrounding landform that provides local ridge lines prominently represented by the low ridge to the south west and the low landform to the north east. North of the ridge line one field known as 2b is in wide east-west viewshed with a prominent ridge approximately 8 km to the north.

The land use of the affected farms is primarily cattle ranching and game farming. To the north and north east are the edges of the town while to the south and south west cattle ranching and game farming occurs. The Zeerust airstrip lies to the southwest of the area. Beyond these in all directions is indigenous bushveld.

The N4 national road lies to the north of the site while the R49 lies to the west.

4 STUDY APPROACH

This report considers the visibility or views of the Site, from within a study area of 500m, 1000m, 2500m and 5000m m from the Site boundaries. The visibility of the Solar Facility will be influenced by how it will “fit” into the existing landscape form, character and scenic quality.

The document, ‘Guideline for involving Visual and Aesthetic Specialists in EIA Processes’, Provincial Government of the Western Cape: Dept of Environmental Affairs and Development Planning, Oberholzer, B and CSIR (2005) has been used as a reference for this report.

4.1 Study Approach and Method

An overall impression of the setting was obtained during a site visit on 2 December 2013 when critical viewpoints, the approximate extent of the view shed, intervening elements or vegetation which blocked views of the site, and the character, scale and visual quality of the setting were identified.

Topographical and cadastral maps were used to record ridgelines, view sheds (the areas from where the project is visible) and the scale of the landform variation.

The visibility and visual intrusion experienced by road users through the site is described.

The visual intrusion zone ratings measured from the boundary of the proposed Solar Facility. These are zone 0 -0.5 km (high), zone 0.5 – 1 km (medium), 1km – 2.5km (low) and > 2.5 km (negligible).

The level of visual intrusion of the Solar Facility was assessed in the context of the existing visual setting and the effect on views, sense of place, quality of the landscape and the visual prominence.

5 ASSUMPTIONS AND LIMITATIONS

5.1 Assumptions

The following assumptions have been made:

- The installation of the roads and panels will take approximately 6 months and there will be a site office and site laydown areas.
- The area of the Solar Facility will be lit at night as a security measure.
- The temporary access point during construction will be along existing roads that are adjacent to the site.
    - A 22kV overhead transmission line from the internal substation to the Eskom Zeerust substation.

Localized visual perceptions of the economically depressed communities have not been tested as these may be influenced rather by the economic and job opportunities that would exist rather than the direct visual perception of the project;

5.2 Alternatives

Alternative sites were identified during the scoping phase and consisted of areas A, B and C. Area A was scoped out and this study focusses on Area B and C only.

Two technology alternatives have been considered for this application, as follows:

Technology Alternative T1 – Concentrated Photovoltaic Solar Farm (CPV)

CPV technology differs from conventional photovoltaic systems (PV), in that the CPV Modules use different solar cells and include lenses which focus light energy in a more concentrated manner, hence harvesting more energy from the sun. The efficiency of the cells used provides benefits relating to capacity per module and reduced spatial requirements. CPV technology systems are much higher, thereby using less space, with the system reaching a maximum height of approximately 10m. CPV systems are generally used for large scale projects such as this one. Concentrated Solar Power generates solar thermal energy, or heat. This is done using series of mirrors in order to concentrate a large amount of solar energy into a small space. Unlike electricity, heat is quite easy to store in comparison with electricity. This heat is used to power a turbine or engine, which in turn produces electricity. CPV Installations require a large amount of water for cooling, unlike PV panels which only require water for cleaning purposes. By using CPV technology the impact on the environment will be greater largely due to the volumes of water that will be required to be trucked in on a regular basis and the 10m height of the modules. PV is also relatively easier to construct opposed to CPV.

Technology Alternative T2 – Photovoltaic Solar Farm (PV) – The preferred and proposed alternative. Photovoltaic Solar Power is solar energy which is converted into electricity using photovoltaic solar cells. This is done through the use of specialized machinery. Semiconductors only conduct electricity when exposed to light or heat (as opposed to conductors, which always conduct electricity and insulators which never conduct electricity). The captured light moves along a circuit from positive-type semiconductors to negative-type semiconductors in order to create electric voltage. Power is collected through a structure comprised of many solar cells, usually a Solar Power Panel (also called a PV Module). PV Modules / Solar Panels can be combined into an “array” of panels in order to capture a greater amount of solar energy. Photovoltaic (PV) solar panels can either be fixed (rows of tables) or they can be constructed on a double axis tracking system. The fixed tilt solar technology (table installation) is the less expensive option but it has a much lower energy yield than the double axis tracking system (free standing panel installation). With the double axis tracking system technology the sun can be tracked on more than one axis allowing for maximum radiation over the entire solar module. The tracking (tracking of the sun) system will either be a fixed system or a tracker system. The PV panels will be mounted on either a single axis (one motor) or a dual axis (two motors) tracking system that will use sun sensors to follow the movements of the sun.

Two power line alternatives are proposed for the route of the 22kV power line that is proposed between the new 88/33kV internal substation to be constructed and the existing 132kV substation at Zeerust. This has been roughly draw at this stage and will be accurately drawn on the proposed site layout plan once the existing power lines have also been surveyed and potted. Both power line alternatives are proposed above ground because of the high cost and disturbance to the environment (soil and vegetation) if installing it underground in this area.

- Alternative 1: The absolutely shortest distance from the Eskom substation to the proposed facility. All infrastructure (the solar facility and the power line) will be at least 100m away from the closest informal house and 20m outside of the Eskom servitude where the existing 132kV power lines are existing.
- Alternative 2: Installing the power line 20m outside of the existing power line servitude (either on the east or the west of the power line but east is preferred because it is closer to the substation which means less cabling and lower cost.

The "No Go" alternative is the option of not constructing the PV Solar farm. The site will more than likely remain as it is should this alternative be selected.

The "no-go" alternative will, however, result in the visual environment staying the same with the natural character of the area contributing to the present "sense of place". If the development proposal is not authorised most of the vegetation in the current natural parts will remain largely intact which is clearly a positive factor.

5.3 Limitations

The purpose of this visual assessment study is to identify the visual intrusion and visual impact of the proposed Solar Facility on the surrounding land use in relation to the existing and future landscape setting and development. However, while an effort is made to be rigorous and logical in the assessment process, the element of subjectivity does influence the ratings. It has nevertheless been reported in Mc Cool, S.F. *et al* (1986) that the professional visual impact assessor is more critical than the general public.

The viewshed map is computer generated and does not take into account local and minor visual interruptions in the landscape such as trees on the edge of roads, minor landforms, buildings, etc. As a result the visibility on these maps could be overstated. View obstruction by intervening vegetation during the viewshed analysis (Figure 3, Viewshed Analysis) has not been considered. However, there is vegetation on the eye level of the viewer along sections of the R49 roadside. This assist in screening the site from certain view points, the R49 in particular.

In terms of the Guideline for involving Visual and Aesthetic Specialists in EIA Processes, Oberholzer, B., & CSIR, the scale of Solar Facility and the large area of natural indigenous vegetation surrounding the site on all sides, the assessment is considered to be a Category 3 with a moderate visual impact expected for the 2m high panels and high for the 5m high panels. This places the study at a level 3.

This requires the following to be addressed:

Identification of the visual issues;
Description of the receiving environment and proposed project;
Establishment of view catchment areas and receptors;

An indication of the potential visual impacts using established criteria;
Inclusion of lighting impacts at night;
Description of alternatives, mitigation measures and monitoring programmes.

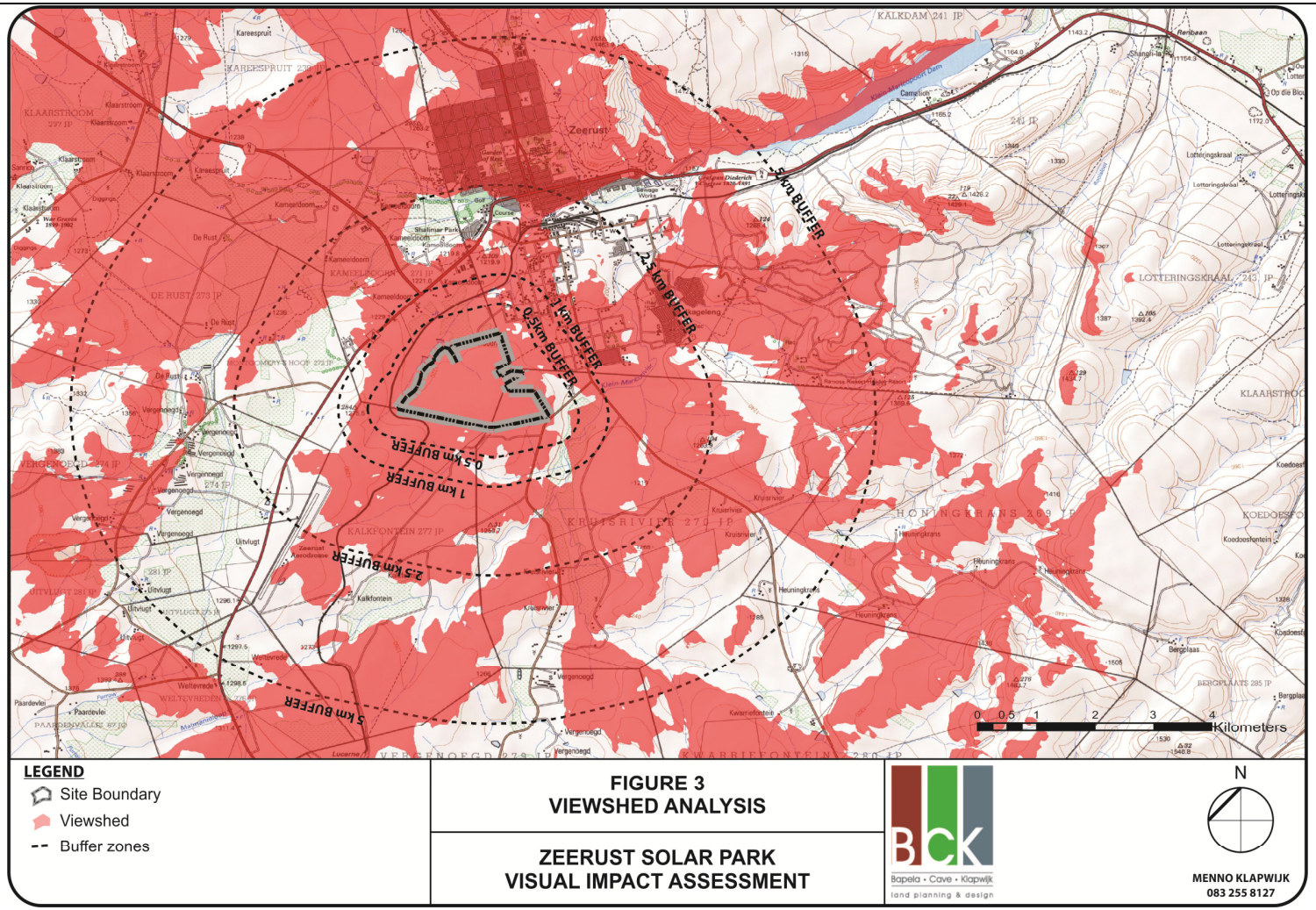

Figure 3: Viewshed Analysis

6 DESCRIPTION OF THE PROJECT

Photovoltaic Solar Power is solar energy which is converted into electricity using photovoltaic solar cells. This is done through the use of specialized machinery. Semiconductors only conduct electricity when exposed to light or heat (as opposed to conductors, which always conduct electricity and insulators which never conduct electricity). The captured light moves along a circuit from positive-type semiconductors to negative-type semiconductors in order to create electric voltage. Power is collected through a structure comprised of many solar cells, usually a Solar Power Panel (also called a PV Module). PV Modules / Solar Panels can be combined into an "array" of panels in order to capture a greater amount of solar energy. Photovoltaic (PV) solar panels can either be fixed (rows of tables) or they can be constructed on a double axis tracking system. The fixed tilt solar technology (table installation) is the less expensive option but it has a much lower energy yield than the double axis tracking system (free standing panel installation). With the double axis tracking system technology the sun can be tracked on more than one axis allowing for maximum radiation over the entire solar module. The tracking (tracking of the sun) system will either be a fixed system or a tracker system. The PV panels will be mounted on either a single axis (one motor) or a dual axis (two motors) tracking system that will use sun sensors to follow the movements of the sun.

The photovoltaic system that would be used is a flat panel collector or module that is inclined at a latitude angle (about 30 degrees north). The panels would be either be a single axis unit mounted on posts to form rows orientated east-west or a free standing two axis unit. Each row will be connected with underground cables to inverters that convert direct current to alternating current. All the panels will be at approximately 2.5m to 3.5m high and outside the wet areas, drainage lines and sensitive vegetation, identified in other specialist studies. An underground cable will connect the inverters to an internal sub-station. The ground mounting will require a level surface local to the panel and will have a 'screw type' connection into the soil or local concrete base. Refer to **Figure 4a, Example of Solar Panel Free Standing.**

The Solar Power Plant would use a telemetry system known as Supervisory Control and Data Acquisition that facilitates remote communication to relay generation and performance data to a Remote Operation Centre. This will monitor the output of the rows of panels and effectively control the Solar Facility.

The electricity will connect to the existing Eskom sub-station adjacent to the edge of the town near the corner of Kort and Loop streets.

Figure 4a: Example of Solar Panel Free Standing dual axis.(source Apsolutions)

Refer to Figure 4b, Example of Free Standing Panel Installation.

The style and character of the Solar Facility is described as follows:

Two technology options are considered, namely

T1, the Concentrated Photovoltaic Solar Farm and

T2, the Photovoltaic Solar Farm.

Technology Alternative T1 – Concentrated Photovoltaic Solar Farm (CPV)

Figure 4b: Example of Free Standing Panel Installation

CPV technology differs from conventional photovoltaic systems (PV), in that the CPV Modules use different solar cells and include lenses which focus light energy in a more concentrated manner, hence harvesting more energy from the sun. The efficiency of the cells provide benefits of capacity per module and reduced spatial requirements. CPV technology systems are much taller, and therefore use less space, with the system reaching a maximum height of approximately 10 m. CPV systems are generally used for large scale projects such as this one. Concentrated Solar Power generates solar thermal energy, or heat. This is done using series of mirrors in order to concentrate a large amount of solar energy into a small space. Unlike electricity, heat is quite easy to store in comparison with electricity. This heat is used to power a turbine or engine, which in turn produces electricity. CPV Installations require a large amount of water for cooling, unlike PV panels which only require water for cleaning purposes. By using CPV technology the impact on the environment will be greater largely due to the volumes of water that will be required to be trucked in on a regular basis and the 10m height of the modules. PV is also relatively easier to construct opposed to CPV. The CPV unit's height 10m.

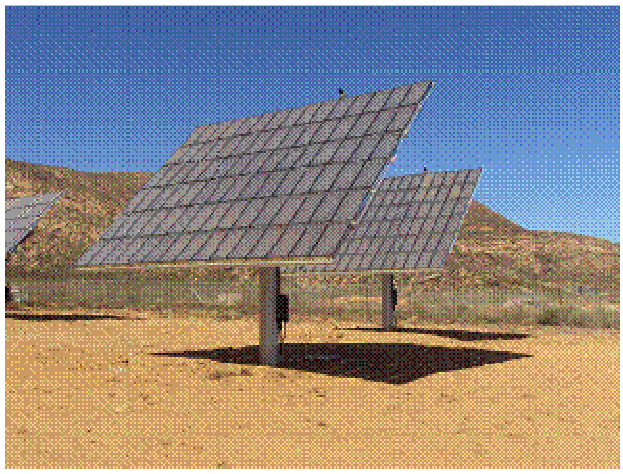

Figure 4c Example of Solar Panel Free Standing dual axis with CPV technology

And

Technology Alternative T2 – Photovoltaic Solar Farm (PV) – The preferred and proposed alternative

Photovoltaic Solar Power is solar energy which is converted into electricity using photovoltaic cells. This is done through the use of specialized machinery. Semiconductors only conduct electricity when exposed to light or heat (as opposed to conductors, which always conduct electricity and insulators which never conduct electricity). The captured light moves along a circuit from positive-type semiconductors to negative-type semiconductors in order to create electric voltage. Power is collected through a structure comprised of many solar cells, usually a Solar Power Panel (also called a PV Module). PV Modules / Solar Panels can be combined into an "array" of panels in order to capture a greater amount of solar energy. Photovoltaic (PV) solar panels can either be fixed (rows of tables) or they can be constructed on a double axis tracking system**. The fixed tilt solar technology (table installation) is the less expensive option but it has a much lower energy yield than the double axis tracking system (free standing panel installation) Refer to Figure 8**. With the double axis tracking system technology the sun can be tracked on more than one axis allowing for maximum radiation over the entire solar module. The sun tracking system will either be a fixed system or a tracker system. The PV panels will be mounted on either a single axis (one motor) or a dual axis (two motors) tracking system that will use sensors to follow the sun. The PV unit's height range is 2m – 5m

The free standing individual solar panels will be fixed as follows: Two mounting system alternatives have been considered, namely a deep seated screw system and a small concrete foundation block. The Soil Impact Assessment concluded that the impacts on agricultural resources and production of these two alternatives are considered equal, although the concrete option will require greater inputs during decommissioning in order to remove the concrete from the soil that will result in more extensive visual disruption. A deep seated screw mounting system is likely to be feasible under the

prevailing soil conditions, but will be dependent on mechanical specifications and additional geotechnical investigation will probably be required. Due to the fact that impacts on agricultural resources of the two alternatives where considered equal by the soil specialist, and due to the prevailing windy climate conditions and sandy soils, it is likely that the panels will be mounted in a small concrete foundation block. Foundation holes will be mechanically excavated to a depth of about 30cm – 50cm. The concrete foundation will be poured and be left for up to a week to cure. The choice of mounting structure will be influenced by the technology advancement and pricing.
The electricity generated by the solar panel will be directed, in underground cables that run between the rows, to the existing Eskom sub-station.

The Fixed Tilt Table will be installed in rows as shown on **Figure 5,**

Figure 5: Example of Fixed Tilt Single Axis tracking Table Installation

Two power line alternatives are proposed for the route of the 22kV power line that is proposed between the new 88/33kV internal substation to be constructed and the existing 132kV substation at Zeerust

7 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The visual impact of the proposed Solar Facility will depend on the following characteristics of the site and receiving environment.

7.1 Geology and Topography

The site is situated ancient rocks of the Timeball Hill and Rooihoogte Formations of the Pretoria Group (Fig. 1). There is also diabase in the area. These rocks are predominantly mudrocks, quartzites with some basal lavas and have been submitted to low grade metamorphism (Eriksson et al., 2006).

The soil survey done during the scoping phase indicated that for Area A (not part of this study) the soil is very shallow in most of the surface area. The “koppie” located on Area A takes up 50% of Area A and the soil here is also very shallow. The deeper soil towards the railway line can be classified as Valsrivier soil type with non calcareous A and B horizons. The field test conducted indicated that the clay content can be between 25% and 30%. He is of the opinion that Area A can only be used for natural grazing for livestock due to the fact that the land is not suitable for irrigation land or dry lands. This land is not suitable for cultivation due to very shallow soils and rocky structure of the profile. The soil depths of the soil samples ranged between 0cm and 45cm (450mm) so this site is not suitable for cultivation and can only be used for grazing. It can therefore conclude that the agricultural potential of the Area A is therefore Low and the impact to the soil is deemed to be Low. It is very likely that Area B and Area C have very similar results as to those obtained in Area A.

The affected area is located mainly on the western, south western and southern slopes sloping down from the reservoir on the south western edge of the town. A drainage line forms the western edge with the Klein Marico River lying to the south east. Rising hills surround the area from about 2 – 5 km form the site

Implications for the Project

The position of the facility on the slopes of the hill presents it to views form the surrounding hills. However, the hill formations surrounding the site assist in screening the site from large sections of the surrounding area. Views are limited to approximately 5 km to the east while the views in the other directions extend in patches to up to 10km.

7.2 Vegetation

The majority of the Vegetation located of Area B is Zeerust Thornveld. This vegetation type is distributed from the Lobatsi River in the west via Zeerust, Groot Marico and Mabaalstad to the flats between the Pilanesberg and western end of the Magaliesberg in the east. This vegetation is found in altitudes ranging from 1000m – 1250m above sea level. Zeerust Thornveld is deciduous, open to dense, short and thorny woodland species dominated by Acacias with an herbaceous layer of mainly grasses on clay soils and also on and between rocky ridges.

The vegetation type found on some of Area B and the whole of Area C, is Moot Plains Bushveld. Moot Plains Bushveld is an open to closed, often thorny Savanna dominated by various species of Acacia in the bottom valleys and plains as well as woodlands of varying height and density on the lower hillsides. Grasses also dominate the herbaceous layer.

Implications for the Project

Much of the vegetation is to be removed and will expose the panels. Existing flora on the edges of the site should be retained wherever possible to limit the visual footprint of the panelled site and to act as a visual screen.

The vegetation along the R49, due to its height and close proximity to travellers, provides substantial screening of the facility. Although not part of the site, attempts to protect a strip of vegetation along the road is recommended. A 32m buffer has been recommended along the watercourses as well as a 50m buffer around the reservoir which will further add to the screening effect

7.3 Hydrology

The Klein Marico River is located east of the site. It is evident from the topographical maps that a drainage channel flows from south to north, with intermittent seasonal valley bottom wetlands. This drainage channel will eventually lead to the Klein Marico River further north. The proposed site has excluded these two watercourses and their associated drainage channel and the proposed site will take into account an appropriate buffer zone from these seasonal watercourses. A 32m buffer has been recommended along the drainage channel.

Implications for the Project

The fact that the drainage ways have been excluded from the study area implies that hydrology will not have any impact on the visual environment. The 32m buffer will add to the screening effect of the existing vegetation. Scarring due to erosion due to the stripping of all the vegetation needs to be controlled. It has been recommended that the areas between the rows be planted with indigenous grasses which will control the erosion and assist in reducing the visual scarring.

7.4 Climate

Zeerust normally receives about 439mm of rain per year, with most rainfall occurring mainly during mid summer. It receives the lowest rainfall (0mm) in June and the highest (83mm) in January. The average midday temperatures for Zeerust range from 19.4°C in June to 30.8°C in January. The region is the coldest during July when the mercury drops to 0.6°C on average during the night.

Implications for the Project

The climate should not have any major implications for the facility.

7.5 Land Use

The land is currently zoned Agriculture. Unfortunately, there is no Integrated Development Plan prepared for Zeerust so it is not possible to determine the future land-use planning for the area. It can be assumed that under normal conditions the

status quo should not change in the foreseeable future as growth in the town is not very active.

However, the agricultural potential of the land is low and suitable for only grazing.

Implications for the Project

The proposed Solar Facility will occupy land zoned for agriculture although the agricultural potential is low.

The term 'Solar Facility' should be taken literally in the final layout design. This layout will need to take into account the identified natural constraints and opportunities to enable the solar plant to 'fit' visually into the landscape and surroundings.

7.6 Visual Characteristics

7.6.1 Character

The spirit, or sense of place, is that quality imparted by the aspects of scale, colour, texture, landform, enclosure, and in particular, the land use.

According to K. Lynch (1992) 'it 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 a particular character of its own'.

The quality of *Genius Loci* is a function of attributes such as the scenic beauty or uniqueness and distinctive character of the built and cultural landscape.

The visual quality is the visual significance given to a landscape determined by cultural values and the landscape's intrinsic physical properties (Smardon, *et al*, 1986). While many factors contribute to a landscape's visual quality, they can ultimately be grouped under three headings: vividness, intactness and unity.

The visual quality can be categorised under relative headings such as high, medium and low visual quality for the study area. High refers to those areas that have a high aesthetic appeal such as mountains, river valleys, unspoilt coastal zones and wilderness areas. The medium areas are those that have high visual diversity, but which have already been modified by human activity comprising the aesthetic appeal such as roads, minor infrastructure and settlements. The low visual quality areas are those that are relatively highly populated and which have been heavily impacted on by human activity such as industrial and mining areas or which have a low aesthetic appeal due to a lack of landscape diversity or interest.

The region exhibits a well-defined and vivid sense of spatial definition. The landscape is typical of the bushveld of the Northern Province. The hilly topography assists in containing the views. The character of the landscape can be regarded as rural agriculture predominantly cattle ranching and game farming. The immediate area is

modified by the combination of urban due to the close proximity to the town of Zeerust, mining activity, airstrip, main roads and existing transmission lines and substation.

Implications for the Project

The 'unspoilt rural spaces of the part of the Bushveld has been changed or modified by the above mentioned activities. Although the area is not a high tourism destination in itself many tourists pass by on route to Botswana, Mafikeng and the surrounding game farms and parks.

7.6.2 Visual Diversity

Landscape diversity is a function of topography, vegetation and land use. The greater the diversity, the greater is the potential for the proposed development to blend with the surrounding landscape.

The landscape diversity of the site is influenced by the vegetation and the hilly topography. The diversity can be regarded moderate due to the pattern of vegetation that creates variety in height, colour and textures.

Areas surrounding the site provide some relief in the form of rising hills that add to the visual diversity when viewed from the south and south-west. Views from the north east are tempered by the visual diversity created by the mix of houses and buildings, topography and vegetation.

Land uses on the sites are currently limited to stock grazing. Urbanisation on the north and north-eastern edges have the potential to expand and alter the existing diversity

Implications for the Project

The diversity will be substantially altered should the entire site be stripped of vegetation leaving a large uniform surface that will contrast significantly with the surrounding landscape resulting in an increased visibility.

7.6.3 Visibility

Critical views are those from the urban populated areas of the town of Zeerust and the main roads that pass mainly to the north (N4) and west (R49). There are no homesteads that are directly affected within the site but one of the suburbs is located on the eastern boundary and is directly affected.

Views are theoretically possible from distances beyond 5 km as determined by the viewshed analysis (see Figure 3) but this is tempered at the point of view by intermediate vegetation that helps to screen the site from the viewer. The higher lying

areas of the site closer to the reservoir will be the most visible due to its elevation position in the landscape.

Implications for the Project

The visibility of the facility is to a large part screened from view along the main roads and from within the town by the height of the existing vegetation and the buildings. The views onto the site that do occur are mainly intermittent and when the viewer is mobile these views are for a short duration. The lower portions of the facility will be better accommodated due to the lower position in the landscape

7.6.4 Visual Quality

The visual quality of the setting is rated as moderately scenic because of the rural character. However, this scenic quality is modified by the intrusion of the urban and industrial elements such as the existing transmission lines, railway, roads and suburbs of Zeerust.

Implications for the Project

The scenic quality will be reduced considerably once all the vegetation has been stripped and replaced with the large field of solar panels.

7.6.5 Sense of Place

The Sense of Place is directly associated with the bushveld feel of the site and the views towards the distant surrounding hills that punctuate the visual periphery.

Implications for the Project

The scale and form of the solar panels will change the sense of place and the 2.5m high panels will have a good visual fit with the landscape. The edge condition will require screening to prevent an industrial image from extending beyond the Site. The removal of the vegetation will alter the sense of place from a rural bushveld ambience to one that is far more industrial in nature.

8 IDENTIFICATION OF RISK SOURCES

A visual risk source is considered to be a future action by others such as a structure or road or landuse that will alter the visual intrusion of the proposed Solar Facility in the context of the setting.

This will apply as well to those areas beyond the site boundary.

The following visual risk sources have been identified:

The construction of a new bulk and local supply transmission lines on or near to the ridgelines that are near to or are located on the property of the proposed Solar Facility.

The expansion of the electrical sub-station to accommodate the increase in electricity supply.

The erection of any mast on the high points of the site or surrounding area.

Various risk sources for the visual impact have been identified for the construction and operation phases and can be classified as both negative and positive. The following general risks are associates with the visual intrusion in the landscape.

8.1 Risk Sources

8.1.1 Construction Phase

It is anticipated that the major risk source during construction would be:

Negative Risk Sources

Excessive clearing and stripping of topsoil for site offices, construction camps, servitudes and temporary access roads;
The relatively random and disorganised lay down of building materials, vehicles and offices;
Cut and fill slopes of access roads, if any, become highly visible if not re-vegetated and shaped to blend in with the existing topography;
The extent and intensity of the security and construction lighting at night;
Dust from construction activities;
Open and un-rehabilitated landscape scarring;
Uncontrolled exploitation of borrow pits and quarries without compliance to environmental controls related to aesthetic rehabilitation;
Location and layout of construction workers camp if located in proximity of works area.

Positive Risk Sources

Image of construction activity could lead to a perceived view of progress and benefit to the community.

8.1.2 Operational Phase

It is anticipated that the major risk source during operation would be:

Negative Risk Sources

Security night lighting could create a beacon in an unlit rural setting;

Areas and /or specific sites of high aesthetic value may be disfigured by the introduction of a highway within the viewshed resulting in a permanent change to the existing visual quality of visually sensitive areas;
The compromising of views from or the alteration of the ambience of natural areas;
Site engineering, such as cuts and fills, could remain aesthetically incompatible with the surrounding landscape if mitigation measures are not implemented. Edges may not blend in with the landscape or cut slopes may be too steep to be adequately re-vegetated;
New access roads leave permanent visual scarring;
The degradation of areas of particular visual character, such as ridges, valleys and drainage ways if the project components are placed too close by;

Positive Risk Sources

The development could be the visual affirmation of progress and prosperity for the region. Localised visual perceptions of the economically depressed communities of the population have not been tested as these may be influenced rather by the economic and job opportunities that could exist rather than the direct visual perception of the project.

9 THE VISUAL ASSESSMENT

The Visual Assessment describes the visual intrusion of the proposed Solar Facility on the existing and future setting of site and the adjacent land.

9.1 The Visual Analysis

This section describes the aspects which have been considered in order to determine the intensity of the visual impact on the area. The criteria includes the area from which the project can be seen (the viewshed), the viewing distance, the capacity of the landscape to visually absorb structures and forms placed upon it (the visual absorption capacity), and the appearance of the project from important or critical viewpoints.

9.1.1 The Viewshed

The viewshed is a topographically defined area which includes all possible observation sites from which the project will be visible. The boundary of the viewshed, which connects high points in the landscape, is the boundary of possible visual impact (Alonso, et al, 1986). Local variations in topography and man-made structures would cause local obstruction of views. The viewshed, based on the GIS assessment and fieldwork, extends for the main part varies from 1 km to greater than 20 km in several areas (**Figure 3**).

9.1.2 The Viewing Distance

The visual impact of an object in the landscape diminishes at an exponential rate as the distance between the observer and the object increases (Hull and Bishop, 1988).

Thus, the visual impact at 1000 metres would be approximately a quarter of the impact as viewed from 500 metres. Consequently, at 2000 metres, it would be one sixteenth of the impact at 500 metres. The view of the project components would appear so small from a distance of 5000 metres or more that the visual impact at this distance is insignificant. On the other hand the visual impact of the project components from a distance of 500 metres or less would be at its maximum (**Figure 6**). With reference to the distance of the viewer from an object or area their visual scale in the landscape will reduce in visual prominence by the inverse of the distance between the observer and the site. This means that as the distance of the viewer doubles, the visibility in scale of the object or area reduces by half. (Hull & Bishop, 1988). This has significance with respect to the visual intrusion of the proposed Solar Facility for distances greater than 500m away.

9.1.3 Critical Views

Views identified as being critical have been discussed under Section 7.6.2. These have been overlaid on the viewshed to determine the extent of these within the viewing zones radiating out from the project components. The view shed analysis provides a graphic representation of the areas from where it is possible to see the Site. This map is based purely on contours and does not take into account local screening elements such as, trees, other tall vegetation and structures.

The visual receptors or the persons who will have views onto the site are those who travel along the R49 and the N4, residents of Zeerust and local landowners who use the surrounding farm roads to access their properties.

In summary the critical views are those from a short section of the N4 and the R49 as well as the suburb that lies immediately to the east of the site. The visual intrusion from here will be negligible due to the existing screens of roadside vegetation. These critical views are within the 500m and 1000m zones. (See Figure 3 Viewshed Analysis) Northern sections of the town are exposed to the views but are generally beyond 2500m. These views are tempered further by the obstruction of existing trees and buildings.

The visibility of the operating Solar Facility will be the greatest at night because of the lighting of the area. The intensity and the height of the lighting will influence the degree of visual intrusion caused.

9.2 Site Assessment

9.2.1 The Visual Intrusion on the Existing Setting

The visual intrusion of the Solar Facility will be discussed in terms of the possible influence on the Sense of Place, the Character of the setting and the scale, form and density of existing setting.

Sense of Place

The facility will occupy most of site B and C. The space and texture of the area will be transformed by the panels and security fencing and the stripping of existing vegetaion.

The Sense of place will be altered significantly as a result. The change in the sense of place will be significant within the viewshed.

Character

The agricultural and rural character site will change once construction of the Solar Facility commences.

The natural character will be changed from agricultural to industrial with the security fence and the rows of solar panels. The site drainage will be not be changed.

However the additional runoff and natural drainage line may need to be modified to accept the additional water. The bushveld character will change as a result of the new industrial land use that will intrude on it.

Scale

The scale of the facility in that setting is regarded as high in the context of the extent of the area that needs to be cleared which will affect the pattern of the natural setting.

With most of the area identified for the solar panels the 2.5m tall arrays will create a visually different raised surface, the scale of which in the landscape will be extensive and tall in height.

It will be the scale of the land surface covered by the solar panels and their height that will produce the visual impact in that rural/agricultural setting.

Form

The overall form of the solar panels is rectilinear and of a constant height along its row length.

This form of the panels is dependent on an almost level surface along its length and an east west orientation for them to operate effectively. As the panel will automatically track the sun's path the position in the row is not fixed. The visual intrusion in a gently sloping landform will be caused by the height of the solar unit.

The density of the solar panels in the existing setting will present a strong visual contrast to the agricultural and natural setting.

The high density of the panels will resemble an armoured landform the height of which will depend on the solar panel selected.

Landform Change

It is anticipated that the landform will need to change to accommodate the connected solar panels. For the free standing single or double axis solar panel a small concrete footing for each will be required or maybe not at all if the soil depth is sufficient to accommodate a screw mount system. In either situation the existing surface of the land that will be modified locally.

The visual intrusion as a result of landform change may be negligible provided the solar panels are erected individually so the row orientation and the slope are immaterial.

9.2.2 The Visual Absorption Capacity

The Visual Absorption Capacity (VAC) is a measure of the landscape's ability to visually accept / accommodate or embrace a development. Areas which have a high visual absorption capacity are able to easily accept objects so that their visual impact is less noticeable. Conversely areas with low visual absorption capacity will suffer a higher visual impact from structures imposed on them. In this case the VAC has been defined as a function of three factors.

The VAC was determined, based on the author's field experience, taking the following into account:

Slope
Visual pattern (landscape texture) with regard to vegetation and structures
Vegetation height

Table 1: Visual Absorption Factors and their Numerical Values

VAC Factor		Categories		
Slope	Range Numerical Value VAC	0-3 % 3 Low	3-6 % 2 Moderate	> 6 % 1 High
Vegetation Height	Range Numerical Value VAC	< 1 m 3	1-6 m 2	6 m 1

		Low	Moderate	High
Visual Pattern	Description Numerical Value VAC	Uniform 3 Low	Moderate 2 Moderate	Diverse 1 High

It is therefore concluded that the VAC can be regarded as Having a combined rating of 6 which equates with a **Moderate VAC** due to moderate slopes, tree height of between 1-6m and the moderate visual pattern.

This implies that the areas with a **Moderate** VAC are have the visual ability to partially absorb or accommodate or accept the visual change made by the proposed road. However, should the site be cleared of vegetation the VAC reduces to Low due to the low vegetation height and uniform visual pattern, a VAC of 8.

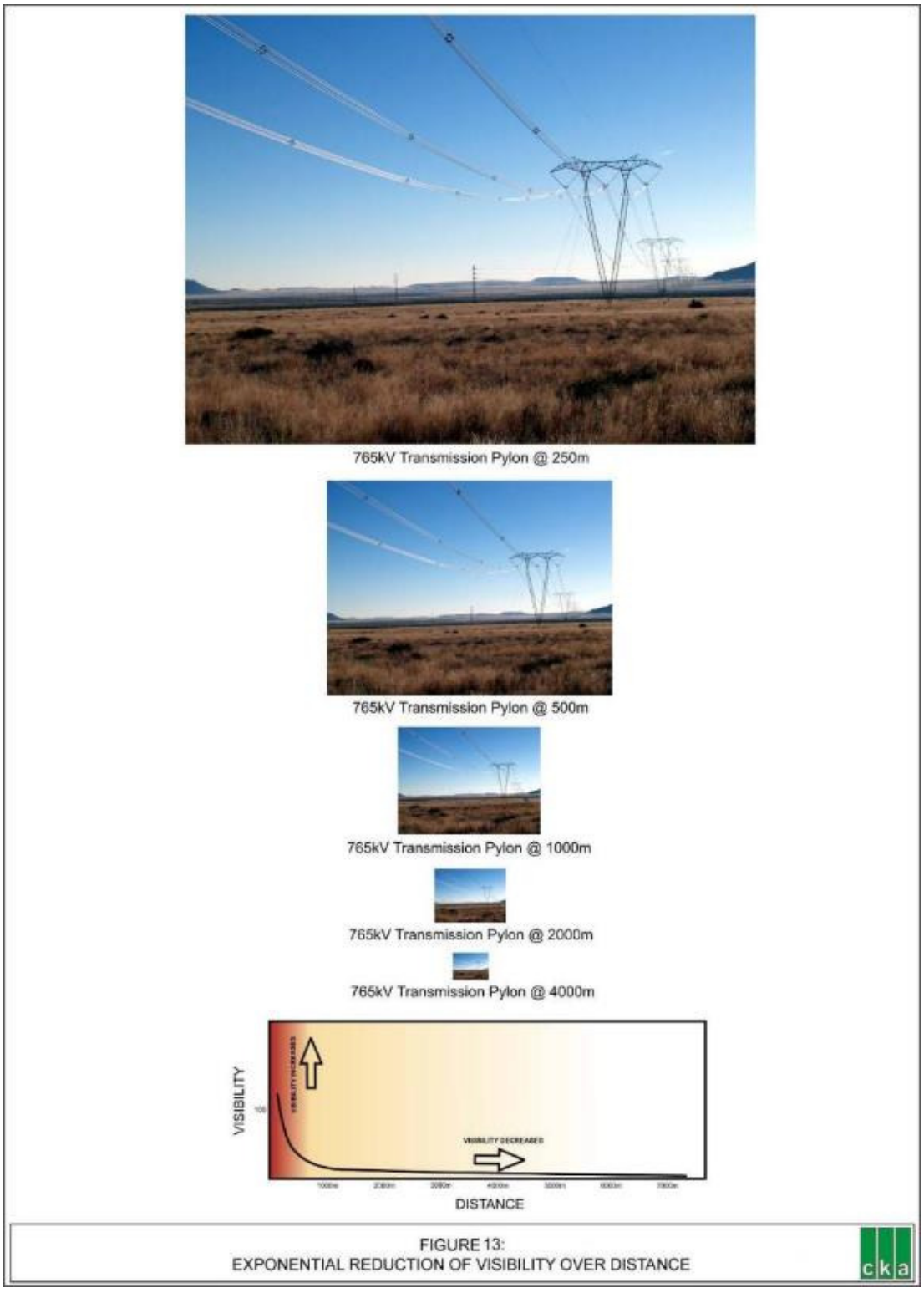

Figure 6: An example of the effect of Exponential Reduction of Visibility over Distance

9.2.3 Visual Opportunities and Constraints

The landform and existing bushveld vegetation offer the visual opportunities and constraints for the proposed Solar Facility.

Opportunities

The height of the existing vegetation on the site boundaries provides some screening of the sites as the view from the roads is obstructed by the vegetation.

The drainage lines and associated wet soils have been and these areas in turn become visual assets by providing a green corridor. However these areas do not affect the site as they have been excluded as sensitive areas as identified by other specialists.

Constraints

The constraints are the steep slopes that will visually present the solar panels prominently to the road users and other visual receptors.

10 VISUAL IMPACT CRITERIA

The following criteria and rating scales for the visual impact are consistent with those used in other specialist studies for the Environmental Impact Assessment (EIA):

10.1 Cumulative Impacts

- Low – there is still significant capacity of the environmental resources within the geographic area to respond to change and withstand further stress.
-
- Medium – the capacity of the environmental resources within the geographic area to respond to change and withstand further stress is reduced.
-
- High – the capacity of the environmental resources within the geographic area to respond to change and withstand further stress has been or is close to being exceeded.

10.2 Nature

- Positive
- Negative
- Neutral

10.3 Extent

- Local – site-specific and/or immediate surrounding areas
- Regional – the Ngaka Modiri Molema district
- National

10.4 Intensity

- Low – where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected.
- Medium – where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected.
- High – where natural, cultural or social functions and processes are altered to the extent that these will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected.

10.5 Duration

- Short term – 0 to 5 years
- Medium term – 6 to 20 years
- Long term – 21 to 35 years – where the impact will cease after the operational life of the activity either because of natural processes or by human intervention.

10.6 Probability

- Improbable – where the possibility of the impact occurring is very low.
- Probable – where there is a good possibility (< 50 % chance) that the impact will occur.
- Highly probable – where it is most likely (50-90 % chance) that the impact will occur.
- Definite – where the impact will occur regardless of any prevention measures (> 90 % chance of occurring).

10.7 Non-Reversibility

- Low – impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term.

- Medium – impacted, natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term.

- High – impacted natural, cultural or social functions and processes will never return to their pre-impacted state.

10.8 Potential for impact on irreplaceable resources.

- Low - no irreplaceable resources will be impacted.
-
- Medium - resources that will be impacted can be replaced, with effort
-
- High - there is no potential for replacing a particular vulnerable resource that will be impacted.
-
-

Consequence Rating	Intensity, Extent and Duration Rating
High Consequence	• High intensity at a regional level and endure in the long term • High intensity at a national level and endure in the medium term • Medium intensity at a national level and endure in the long term • High intensity at a regional level and endure in the medium term • High intensity at a national level and endure in the short term • Medium intensity at a national level and endure in the medium term • Low intensity at a national level and endure in the long term • High intensity at a local level and endure in the long term • Medium intensity at a regional level and endure in the long term
Medium Consequence	• High intensity at a local level and endure in the medium term • Medium intensity at a regional level and endure in the medium term • High intensity at a regional level and endure in the short term • Medium intensity at a national level and endure in

Consequence Rating	Intensity, Extent and Duration Rating
	the short term • Medium intensity at a local level and endure in the medium term • Medium intensity at a local level and endure in the long term • Low intensity at a national level and endure in the medium term • Low intensity at a regional level and endure in the long term
Low Consequence	• Low intensity at a regional level and endure in the medium term • Low intensity at a national level and endure in the short term • High intensity at a local level and endure in the short term • Medium intensity at a regional level and endure in the short term • Low intensity at a local level and endure in the long term • Low intensity at a local level and endure in the medium term • Low intensity at a regional level and endure in the short term • Low to medium intensity at a local level and endure in the short term

The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The significance of the identified impact rated according to the methodology set out below:

- Low – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented.

- Medium – should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented.

- High – would strongly influence the decision to proceed with the proposed project.

Significance Rating	Consequences x Probability
High significance	• High x Definite • High x Highly Probable • High x Probable

Significance Rating	Consequences x Probability
	• High x Improbable • Medium x Definite
Medium significance	• Medium x Highly Probable • Medium and Probable
Low significance	• Medium x Improbable • Low x Definite • Low x Highly Probable • Low x Probable • Low x Improbable

11 VISUAL IMPACT ASSESSMENT

11.1 The Project Phases and Visual Impact Description

The description of the visual impacts associated with the phases of construction and decommissioning will not be presented in detail since the visual impacts caused during the period of activity are of short duration (less than five years). These are also primary impacts (localised, of short duration and easily mitigated at the end of the phase). Rehabilitation of the entire site after decommissioning the Solar Facility will also be the subject of further study at that time.

It is the operational phase that presents the long term visual impacts. This is primarily due to the scale, form, colour and coverage of the solar panels in the landscape setting.

The Construction Phase.

Activity 1 Construction of roads, clearing of vegetation, clearing for laydown areas, local changes to landform, the excavation of trenches ,erection of site offices , sheds and the solar panels.

The visual impacts that are associated with the construction phase will be as a result of the installation of the roads, earth works and fencing initially and later the installation of the solar panel units associated buildings and cables to the existing sub-station. Most of the activities are contained within the site.

Impact Description. Dust during earthworks for roads and trenches and the movement of vehicles around the site. Visual clutter associated with the clearing of areas for material laydown and the site offices.

Impact	Nature	Extent	Duration	Intensity	Reversibility	Impact on Irreplaceable Resources	Consequence	Probability	Significance	Confidence
Impact 1: Infrastructure for Solar Facility. Visual clutter associated with site camps, laydown areas, new roads, cable trenches and associated dust:										
Impact Description: Visual intrusion of views in scenic landscape, alteration of visual quality, character and sense of place of the local area. Dust from new road construction and use.										
Without Mitigation	Negative	Local	Short	Medium	Med	Low	Med	Probable	Med	High
Mitigation Access roads planned to be along existing roads or on the edge of boundaries where ever possible. No ad hoc short cuts. Dust suppression by emulsion or water sprayed on dirt surface. Screen site camp with shade cloth on surrounding fence.										
With Mitigation	Negative	Local	short	Low	Med	Low	Low	Improbable	Low	High
Cumulative Impact: Description of impact and significance: The new access roads and cleared areas for the panels, material storage, offices, will increase the area of land disturbed and cleared of vegetation .This may lead to an increase in local soil erosion that is also a visual impact. . . Significance medium										

The Operation Phase

Activity 1 The presence of the solar panels in the landscape.

Impact Description The alteration of the landscape character and the sense of place due to the form, colour, scale and density of the solar panels in an agricultural/natural setting.

Activity 2 Site lighting for security

Impact Description

The lights within the site will increase the visibility of the facility at night. As there are few lights (homesteads), in the viewshed the visual intrusion on the night scene will be highly noticeable to the south and west. Views from the north and east will be less affected due to the street lighting of the town.

Impact	Nature	Extent	Duration	Intensity	Reversibility	Impact on Irreplaceable Resources	Consequence	Probability	Significance	Confidence
Impact 1: The presence of the solar panels will result in local change to the scenic landscape:										
Impact Description: The alteration of the scenic landscape, the visual quality, character and sense of place of the local area										
Without Mitigation	Negative	Local	Long	Medium	Medium	Low	Medium	Highly	Medium	High
Mitigation Description: The selective placement of the solar panels to blend with the form of the landscape will help to reduce the visual intrusion of the facility in the landscape.										
With Mitigation	Negative	Local	Long	Low	Medium	Low	Medium	Highly	Medium	High
Cumulative Impact: The large area (150ha) will visually dominate the view by motorists from the R49. This exposure is experienced for approximately 2.5 km because the road crosses the viewshed within 1 km of the site. This includes approximately 3 km of the road to Koster. The N4, although within the viewshed, is largely screened by vegetation and buildings. The view is tempered by the existing roadside vegetation. Significance Medium										

Impact	Nature	Extent	Duration	Intensity	Reversibility	Impact on Irreplaceable Resources	Consequence	Probability	Significance	Confidence
Impact 2: Night scene disruption due to site lighting										
Impact Description: The alteration of the local night scene due to the security lighting in an area that has no or very little lights from homesteads.										
Without Mitigation	Negative	Local	High	Long	Medium	Low	Low	Probable	Medium	High
Mitigation Description: Sensitive lighting design to reduce light spill and to reduce attraction by insects is required. Flood lighting of large areas should not be considered.										
With Mitigation	Negative	Local	High	Long	Medium	Low	Low	Probable	Medium	High
Cumulative Impact: The large extent of the site will extend the visibility of the solar Facility at night. This applies particularly to as the area on higher ground, within the viewshed. Significance Medium										

The Decommissioning Phase

Activity 1 The removal of the solar panels cables and associated infrastructure together with and the intense activity of heavy equipment.

Impact Description

Dust and clutter during activities notably vehicles, will cause a visual disturbance on the site that will be visible from the surrounding roads. This will be of relative short duration.

Activity 2 The rehabilitation of disturbed areas and filled in cable trenches.

Impact Description

The removal of the solar panels will eliminate their visual intrusion in that setting and within the local viewshed. The area will be reinstated to the original land use. This is a positive visual impact.

Impact	Nature	Extent	Duration	Intensity	Reversibility	Impact on Irreplaceable Resources	Consequence	Probability	Significance	Confidence
Impact 1: Removal of solar panels and Infrastructure and will cause visual clutter associated and dust.										
Impact Description: The visual impact of visual clutter and dust associated with the dismantling of the solar panels, the removal of the cables from trenches and access roads.										
Without Mitigation	Negative	Local	Short	Low	High	Low	Low	Probable	Low	High
Mitigation Description: The reinstatement of disturbed areas such as roads no longer in use, laydown areas, site camps and the area that accommodated the panels and infrastructure.										
With Mitigation	Negative	Local	Short	Low	High	Low	Low	Probable	Low	High
Cumulative Impact: There is unlikely to be any cumulative impact associated with the removal activities because the chances of decommissioning all/any other solar facilities in the area simultaneously is low. Significance: not applicable										

Impact	Nature	Extent	Duration	Intensity	Reversibility	Impact on Irreplaceable Resources	Consequence	Probability	Significance	Confidence
Impact 2: The Removal of infrastructure and solar panels will re instate the original land use, character, and sense of place of the landscape and setting.										
Impact Description: The visual impact of the solar panels in the landscape will be removed and the views of the landscape will not be intruded upon any longer.										
Without Mitigation	Positive	Low	Low	Low	High	Low	Low	Medium	Medium	High
Mitigation Description: There is no mitigation for a positive impact.										
With Mitigation										
Cumulative Impact: Views across the landscape within the viewshed would be improved post decommissioning. The significance is High										

11.2 Summary of Visual Intrusion of the Solar Facility

The result of the visual assessment of the proposed Solar Facility in the context of the current land use setting is explained below.

Note that the ratings refer to the situation within the viewshed as beyond it the sites will not be seen by the motorists on the surrounding roads and the inhabitants of Zeerust who are the main receivers of the setting change resulting from the Solar Facility

The following definitions of the adjectives used to describe the attributes are given.

Significant	Having a major or important effect.
Moderate	Having a reasonable or acceptable effect.
Negligible	Having a very small or minimal effect.
High	Having a greater than usual level of (visibility for example)
Medium	Having an acceptable level of visibility for example
Low	Having a less than expected level of visibility for example

11.2.1 Visibility

The site is rated as having a medium level of visibility in views from the surrounding roads of the Site within the viewshed and the affect will be moderate. The visibility of the project from within the 500m radial zone is medium and will have a moderate affect on views from within the viewshed. This is due to the screening effect of the existing bushveld vegetation along the road and the buildings within the town of Zeerust.

11.2.2 Visual Intrusion

The visual intrusion of the Solar Facility on the Site is expected as the site land use is agriculture (cattle ranching) in a natural setting.

The scale, form and colour and density of the solar units will determine the magnitude of the visual intrusion.

With reference to the low height 2.5m and small individual area of each solar panel unit (approx. 2.25m^2) and that these units will be arranged in rows over the whole Site the visual intrusion of the Solar Facility will be extensive in area (150 ha). Refer to **Figure 4a-c and 5**: Example of similar installation. The Solar Facility is rated as having a greater than usual level of visual intrusion is rated as high with a moderate affect on the intrusion in views of the Site from within the 500m radial zone. The reason is that the vegetation partially screens views from the main roads when travelling in both direction. This condition applies to all visual aspects described below.

11.2.3 Visual Prominence

The prominence of the solar units and the control building will be low (high) in all views of the site and this will have a moderate (significant) affect on the quality of views. This is due to the low (tall) height of the solar panels and existing vegetation.

11.2.4 Sense of Place

The sense of place within the 500 -1000m radial of the site will be changed. This is an expected result of any Solar Facility located in an agricultural/rural setting.

The change in the sense of place of the setting is rated as medium (medium) and the affect of this change on the existing setting is considered to be moderate (moderate). The Sense of place has already been negatively affected by the transmission lines and the nearby Eskom sub-station as well as the railway, roads and the adjacent suburbs. Future expansion of these aspects may occur in the future. However, the change will be more intense but of local extent.

11.2.5 Landform Change

The extent and magnitude of landform change will be limited. The visual intrusion of the expected change will be low (low) and the visual affect will be negligible (negligible).

This is due to the gently sloping topography of the area and that each solar panel will be independent of others so the landform need not be altered significantly.

11.2.6 Solar Facility Phases

Although the phases of the project will include planning and design, construction and operation, it is evident that the construction phase with the installation of roads and services, site clearance and the construction of the solar panels, will have the greatest negative visual intrusion on the site and setting in the short term.

The visual result of the construction phase could be more intense as a result of the large area to be serviced with roads and underground cables and inverters

The visual disruption during the period of construction will extend beyond the site boundary in the form of vehicle movement up and down the existing roads. This activity will generate dust over the short term and will be a visual intrusion to the area south of the Site.

The visual impact of this phase is considered to be medium (medium) and to have a moderate (moderate) affect on the setting and surroundings.

11.2.7 The Night Scene

The visual intrusion of light for security purposes, into an area of relatively little night lighting within the viewshed will change the character and sense of place significantly within the viewshed. Sections of the town of Zeerust

The height and density of lights that will be erected for security and maintenance may be more intense and extensive depending on the number and the intensity of the lights. This aspect will have a negative effect on the sense of place.

For this reason the visual intrusion of the lit site will need to be considered in the context of its affect on insects, mammals and birds. The level of visual intrusion of the lights is considered to be high(high) and will have a moderate(moderate) affect on the night views. The latter rating is due to the fact that sections of the urban area of the town within the viewshed are already lit at night and for these areas the significance is moderate.

11.3 Visual Issues that Relate to the Project

The visual aspects of the Solar Facility that can be intrusive or create an ambience that is not in keeping with the setting and surrounding land use are discussed below.

11.3.1 The Security Fencing

The style, type and colour of the security fence will need to be in keeping with the setting.

11.3.2 Integration of Land Use Edges

The fence will have to have an area cleared of vegetation on both sides. This is not entirely out of character for the setting as there are several sections of the boundary t,hat are already fenced and the edges have already been cleared of vegetation. However an acceptable practise to manage soil erosion (by water runoff from the panels) is an important issue in land management in that area.

11.3.3 Surface Water Runoff

The solar panels will discharge water rapidly during rainstorms and this will need to be managed to avoid erosion at the discharge edge and at the lowest point of the site. The management of the water will need to include attenuation areas, contour berms and soak-aways to reduce the speed and the volume before the point of discharge into the existing drainage line.

Table 1: Summary of the Visual Assessment of the Project's Attributes and Setting

Summary of the Visual Assessment of the Project's attributes and setting		
Attribute and Setting	Level of Visual Intrusion or Impact	Affect of Visual Intrusion or Impact
Visibility from N4, R49 and urban areas of Zeerust	Medium	Moderate
Visual intrusion in 500m zone	High	Moderate
Visual prominence in 500m zone	Low	Moderate
Sense of Place in 500m zone	Medium	Moderate
Land form change	Low	Negligible
Solar Facility phase construction	Medium	Moderate
Night scene/Lighting	High	Moderate

12 RECOMMENDED MITIGATION MEASURES

The following general visual mitigation measures are recommended to reduce the identified visual impacts.

12.1.1 Solar Facility Edges and Ridge Lines

The boundary fencing and the section closest to the top of the ridge near the existing reservoir will be the features most readily seen by the road user travelling on the R49, the N4 and the road to Koster. By selecting a product that is durable and aesthetic the visual intrusion of the fence can be reduced.

Where a site is next to or near a local ridge line e.g. near the reservoir, a visual buffer line should be established which is determined by the height of the solar panel. The line will indicate where the nearest panel can be located where the top is not visible from the other side of the ridge line. The line of sight from the road will also determine the line relative to the solar panel height. Fortunately, a 32m buffer zone will be established on the western side along the drainage line as well as ecologically sensitive areas within the site that will be fenced off. A 50m- 100m buffer zone around the reservoir at the top of the ridge will also help in reducing the visual scaring. Additional areas that will help screen and temper the visual scarring include a 40m buffer from the power lines as well all along the boundary edge. All of the vegetation will be kept within these buffer zones so the tall trees will act as great visual screens surrounding the entire site and especially from the railway side looking towards the site and from the north looking towards the site where large trees exist mostly (next to travel routes).

12.1.2 Surface Water Runoff

The volume of water that will runoff from the impervious surfaces of the solar panels will require management. Should this aspect not be considered the resulting visual degradation of the landform by erosion will occur. Significant possible long term negative impacts on land productivity and resulting damage to or the drying out of existing water springs and seasonal wet areas in the area.

It is recommended that a water runoff management plan be part of the construction and operation phase and include retention areas, settlement areas and wide grass swales to carry the runoff water.

12.1.3 Landform Change

Where landform change or earthworks are required for the rows of solar panels and ancillary buildings or structures these should be shaped to fit the existing contours wherever possible. Sharp edges and rigid geometric forms should be rounded and curved to make the new landform fit the surrounding existing form.

All cut and fill soil surfaces should be adequately protected from erosion either by vegetation or a combination of block retaining walls and vegetation or rock cladding.

The cut and fill slopes should not be steeper than 1:3 vertical to horizontal as this allows vegetation to establish more easily. This will reduce erosion of the soil surface.

It is recommended that that a suitably qualified person is appointed to give attention to the concept and design of the aesthetic aspects of the project during the design phase.

12.1.4 Colours for Roofs, Buildings and Structures

The colour of the components of the Solar Facility will make a difference to the visual fit of the project into the landscape and setting.

Tones and tints of selected complementary colours that fit the setting should be considered.

Subdued and complimentary natural shades and tints blend easily into a landscape setting.

Vivid primary or bright or reflective colours or surfaces will accentuate the visual presence of the development and should be avoided.

12.1.5 Roads and Pathways

Permanent roads and pathways paved with a durable brick of brown/sand or ochre colour will further help to blend these elements in to the setting. The light brown colour is a similar colour to existing gravel roads in the area. The light colour will also not generate high surface temperatures as an asphalt surface would.

Alternatively internal roads that will not carry very heavy loads could be constructed of gravel with geofabric to distribute the wheel loads evenly.

12.1.6 Lighting

External lights will increase the visual impact of the project at night therefore attention should be given to their selection for the specific function.

All lighting therefore should be carefully considered with regard to the extent of illumination, the intensity and colour of lights and the luminaire.

It is recommended that lighting is designed by a lighting engineer in collaboration with the landscape architect for the project. The aspects of the lighting solution should include the following:

Light fittings should have shields to eliminate sight of the light source;

Down lighting of areas is preferred to up lighting;

Any perimeter lights are to be directed downwards and inwards;

Emitted light colour should be a softer light than sodium (yellow) or mercury halide (blue-white). The light colour should also be chosen with knowledge of what colour will

attract insects. It is important that a colour type and spread of light will not cause insects to be attracted to it and in so doing deplete the insect diversity of the locality.

Florescent lights attract insects although they provide a softer illumination effect;

The use of flood lights to illuminate structures, large areas or features should not be considered. Rather incorporate concealed lights to shine downwards. Darker areas on the building elevations will provide a less visually noticeable structure;

No light fittings should spill light upwards or be directed upwards from a distance towards the area or building to be illuminated;

The lighting plan should strive to maximise the light energy use. This should include a hierarchy of lights that differentiates their function so that the best type is used. Some may be switched on only when needed;

Security lights should not flood the area with light continuously but should be activated by a motion sensor;

It is now accepted that lighting of new projects should be subdued and energy efficient.

13 CONCLUSION AND RECOMMENDATIONS

The analysis of the visual criteria and the affect that the proposed Solar Facility will have on the setting has shown that the overall visual intrusion will be of **Medium Significance**, which means that the findings should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented.

The visual intrusion ratings of the Solar Facility sites assessed has been predicted with a high level of confidence.

The Project is visible from the surrounding major roads especially those west and south west due to the facility being placed on the hillside slopes. Significant sections of these roads are edged by existing trees and scrub vegetation that screens the viewer from the facility. Should the taller solar panel be used these will be seen above the indigenous vegetation screens that exist.

The visibility of the site does extend beyond the 500m radial zone for several kilometres in most directions from the site boundary the extent of which is terminated on the visual periphery by the surrounding hills. Only the area within the 500m to 1000m zones are regarded as being significantly impacted.

The overall assessment of the **visual intrusion** of the proposed development on the characteristics of the site and on views toward the site from surrounding areas is that it will have a medium level of visual intrusion and a moderate affect on the site

characteristics and setting. **Refer to the definitions of ratings in Chapter 11.3.** This is due to the intermittent area from which the site can be seen and that large sections such as the urban areas are already visually modified. However these areas have views of the site that are obscured by trees and buildings.

The height of the solar panels will affect the ratings by increasing the level of visual intrusion and the affect that the structures will have within the viewshed.

The visual intrusion is rated as high with a moderate effect on the intrusion into views of the site from within the 500m zone. This is due to the existing vegetation that offers effective view obstruction from the surrounding major roads in both directions and only limited views of portions of the solar panels will be experienced by the road user;

The visual prominence of the solar panels will be low in all views of the site and it is considered that this will have a moderate affect on the quality of existing views from the R365;

The visual intrusion on the change of the sense of place is regarded as having a level of medium and the affect of the visual intrusion considered to be moderate;

The visual intrusion of the expected landform change will be low and the visual effect will be negligible;

The visual impact of the construction phase of the project is considered to be medium and to have a moderate effect on the setting and surroundings;

The visual intrusion of the proposed project on the night scene is considered to be high due to the concentration of light in an area that presently has no conspicuous lighting. However if lighting of the site and structures is carefully planned the effect of the light intrusion will be moderate.

The overall assessment of the Significance, which is a combination of Consequence (intensity, extent, & duration) and Probability of the visual impact on the setting is as follows:

Construction phase:	Low significance negative
Operation phase:	medium significance negative
Decommissioning:	high significance positive

The **medium** significance of the negative visual impact as arrived at by the application of the criteria for evaluation means that the visual aspects should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented. This rating has taken into account the implementation of mitigation measures.

The visual impact mitigation measures proposed will reduce the visual intrusion described in this report within the 500m radial by improving the visual fit of the proposed development into the existing setting. However, the scale and extent of the proposed Solar Facility will exert a prominent visual presence that will change the character and sense of place within the viewsheds where it is located.

It is recommended that the mitigation measures presented are incorporated during the detail design stage, so that the engineering and aesthetic components are integrated.

In this way mitigation measures are part of the total layout and design concept and are included in the construction contracts.

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PHOTOGRAPHS FROM POINTS ON FIGURE 6

Photo p1: View southeast form west of reservoir site 1

Photo p2: View south from near power line connection in SE corner

Photo p3: View south from southern boundary

Photo p4: View east along south eastern boundary

Photo p5: View E along south eastern boundary.

Photo p6: View N from south eastern corner with suburb developing in the east.

Photo p7: View S from high point at reservoir.

Photo p8: View S from mid slope below the reservoir.

Photo p9: View NW from south-eastern corner.