



# **VISUAL IMPACT REPORT**

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HARMONY ONE PLANT  
SCOPING REPORT  
JULY 2022

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VISUAL IMPACT REPORT

**Savannah Environmental, Free State**

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Report Revision No: 1

Date Issued: 13<sup>th</sup> July 2022

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Reference: Eco Thunder Consulting (2022) Visual Impact Assessment for Harmony One Plant - Scoping Report.

## ACRONYMS, ABBREVIATIONS AND GLOSSARY

Acronyms & Abbreviations	
<b>EIA</b>	Environmental Impact Assessment
<b>EMPr</b>	Environmental Management Programme
<b>GYLA</b>	Graham Young Landscape Architect
<b>SACLAP</b>	South African Council for the Landscape Architectural Profession
<b>S&amp;EIR</b>	Scoping and Environmental Impact Report
<b>VAC</b>	Visual Absorption Capacity
<b>VIA</b>	Visual Impact Assessment
<b>Glossary</b>	
<b>Aesthetic Value</b>	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).
<b>Aesthetically significant place</b>	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).
<b>Aesthetic impact</b>	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).
<b>Cumulative Effects</b>	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
<b>Glare</b>	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. <i>See</i> Glint. (USDI 2013:314)
<b>Glint</b>	A momentary flash of light resulting from a spatially localized reflection of sunlight. <i>See</i> Glare. (USDI 2013:314)
<b>Landscape Character</b>	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.
<b>Landscape Impact</b>	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).

<b>Study area</b>	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.
<b>Project Footprint / Site</b>	For the purposes of this report the <i>Project site / footprint</i> refers to the actual layout of the Project as described.
<b>Sense of Place (Geniusloci)</b>	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. <i>A genius locus literally means 'spirit of the place'.</i>
<b>Sensitive Receptors</b>	Sensitivity of visual receptors (viewers) to a proposed development.
<b>Viewshed analysis</b>	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.
<b>Visibility</b>	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.
<b>Visual Exposure</b>	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.
<b>Visual Impact</b>	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 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.
<b>Visual Intrusion</b>	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.
<b>Visual absorption capacity</b>	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).
<b>Worst-case Scenario</b>	Principle applied where the environmental effects may vary, for example, seasonally or collectively to ensure the most severe potential effect is assessed.
<b>Zone of Potential Visual Influence</b>	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.

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## 1. INTRODUCTION

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### 1.1. Project Overview and Background

Eco-Thunder Consulting was commissioned by Savannah Environmental (Pty) Ltd to carry out a Visual Impact Assessment (VIA) of the proposed Harmony One Plant Solar PV Facility near Virginia in the Free State Province. The VIA focuses on the potential impact of the physical aspects of the proposed developments (i.e., form, scale, and bulk), and their potential impact within the local landscape and receptor context.

### 1.2. Project site and study area

Free Gold Harmony (Pty) Ltd is looking to supplement its energy supply by implementing Photovoltaic (PV) generation, aiding their transition to a more sustainable and environmentally friendly energy mix.

Located south-west of the Witpan dam, and South of the Harmony One Gold Plant operations, approximately ~14km north-west of the town of Virginia within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The PV facility is located on the Remaining Extent of the Farm Marmageli 20 and Remainder Extent of the Farm Welkom 80.

A technically feasible project site, with an extent of 100 ha has been identified by Free Gold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~75 ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 30MW, while allowing for the avoidance of environmental site sensitivities. The size of the development footprint within the development area will be confirmed in the EIA Phase once the facility layout is available for assessment.

The development footprint will contain the following infrastructure to enable the Solar PV Facility to generate up to 30MW:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Overhead Power Lines (OHPL)

Grid connection solution including an on-site 44kV facility substation, 44kV switching station, to be connected to the Brand Gold (6.6 / 132kV) Substation via a 44kV overhead power line (located ~2km north of the site).

As of 2019, the Industrial sector was the leading electricity consumer in South Africa, with up to 56 percent of the total consumption (*Ratshomo 2019*). Mining and quarrying accounted for 10% of the industrial consumption while non-ferrous metals and non-metallic both accounted for 8% and 5%, respectively (*Chamber of Mines of South Africa, 2017*).

The successful development of the renewable energy projects will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the province and South Africa. This will assist the Free State in creating green jobs and reducing Green House Gas emissions, whilst reducing the energy demand on the National Grid.



### **1.3. Objective of the Specialist Study**

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e., extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 600km<sup>2</sup> (the extent of the full-page maps displayed in this report) and includes a minimum 10km buffer zone (area of potential visual influence) from the proposed project site.

The study area includes predominantly mining land, farmland and industrial areas within the Welkom area.

### **1.4. Specialist Details**

Eco-Thunder Consulting (ETC) is a 100% woman-owned, private company that specializes in a range of specialist studies, such as Visual Impact Assessments, socio-economic research, economic development planning, development programme design and implementation as well as community trust management.

Eco-Thunder Consulting is registered with ECSA and landscape architects with interest and experience in landscape architecture, urban design, and environmental planning. The company has carried out visual impact assessments throughout Africa and specialize in project optimization in the environmental space. Aspects of this work also include landscape characterization studies, end-use studies for quarries, and computer modelling and visualization.

Based in Johannesburg, South Africa, Eco-Thunder has established itself as an expert on the conditions, needs and assets of communities that are linked to independent power generation facilities.

ETC also implements development programmes in energy communities, which ensures a comprehensive understanding of the how to drive positive social impact.

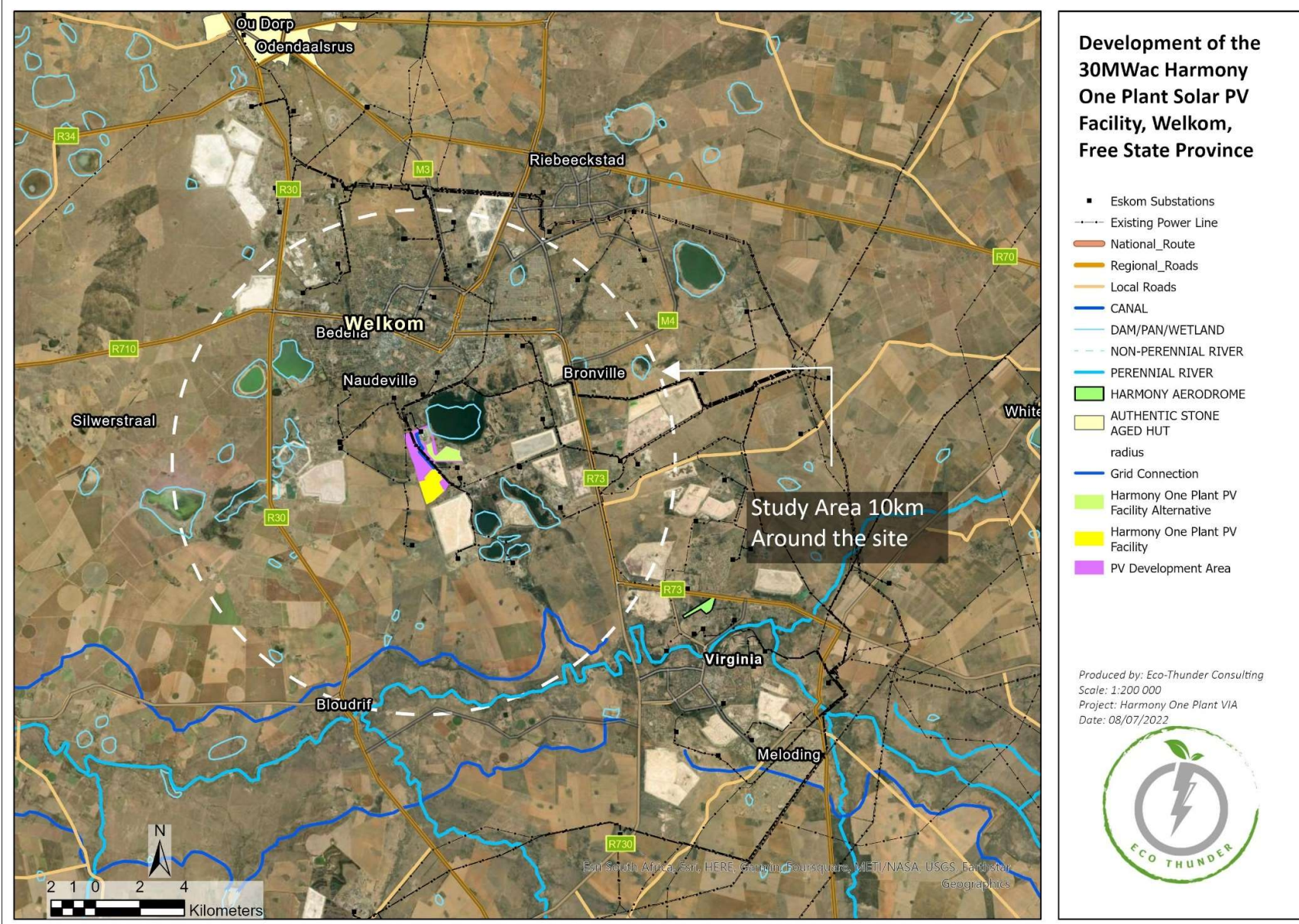


Figure 1: Proposed Development location map.

## 2. METHODOLOGY

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### 2.1. Methodology

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility.

The methodology utilized to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments or receptors upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses consider the dimensions of the proposed structures and activities.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Harmony One Plant PV facility from a desktop level.

### 3. DESCRIPTION OF THE PROJECT

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#### 3.1. Project Facilities

##### **Development of the 30MW Harmony One Plant Solar PV Facility near, Welkom, Free State Province**

The development of renewable energy facilities, overhead powerline and associated infrastructure is proposed by Freegold Harmony (Pty) Ltd.

The project entails the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure with a capacity of up to 30MW over 75ha of land and will be known as Harmony One Plant Solar PV Facility. The development will consist of a renewable energy facility, overhead powerline and associated infrastructure.

The Harmony One Plant Solar PV Facility is based south-west of the Witpan dam, and South of the Harmony One Gold Plant operations, approximately ~14km north-west of the town of Virginia within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The anticipated operational life of the plant is approximately 25 years. Beyond this duration, the proposed Project may continue to operate subject to further approvals or be decommissioned. In this assessment, it is assumed that it would be decommissioned. The construction and commissioning duration of the PV facilities and grid connection infrastructure will be approximately 12 – 18 months.

## 4. ENVIROMENTAL SETTING

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The Harmony One Plant is located near Welkom, 250km away from Johannesburg. The plant accounts for a significant portion of Harmony's gold production. The plant treats ore from the Bambanani, Masimong, Phakisa, and Tshepong shafts.

A 10km radius from the project area was evaluated. The surrounding area comprises mostly of agricultural land, mining activities and to the north industrial and residential activities from the town of Welkom. The area is located within a typical Highveld climate with moderately wet, warm summers and cold dry winters.

The regional topography of the Northern Free State can be described as relatively flat, with rolling plains and low hills extending into the Welkom area. The rolling plain elevations range from 1 260 meters above mean sea level (amsl) to 1 460 meters amsl. The general slope of the terrain ranges from 1:250 to 1:100.

The natural vegetation in the study area is dominated by two types of grasslands: the Vaal-Vet Sandy Grassland and the Highveld Alluvial Grassland. Much of these grasslands have been degraded throughout the region. Most of it has been transformed for cultivation and the rest under strong grazing pressure from cattle and sheep.

The Matjhabeng Local Municipality includes Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg with a combined population of 406 461 people. The economy of the Matjhabeng Municipality area centres around the mining activities located in and around Allanridge, Odendaalsrus, Welkom and Virginia. Manufacturing associated with the mining sector exists to a limited extent in the towns mentioned above. Other manufacturing activities are also limited. In terms of economic contribution, the Matjhabeng Local Municipality is the most important Local Municipality in the district. The Matjhabeng Local Municipality accounts for almost 72% of the district's economic output. In terms of future economic development, there is likely to be a decline in the role played by mining, which will also negatively impact employment in the Free State Province.

The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture to the south-west and broader south and western area. Agricultural activities include the production of maize, wheat and sunflower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

Towns or residential areas primarily associated with the mines in the region include:

- Welkom
- Bronville
- Naudeville
- Bedelia
- Silwerstraal
- Bloudrif
- Virginia
- Meloding
- Whites
- Riebeekstad
- Odendaalsrus

The N1 national road provides access to the region and is the main connecting route in between the Gauteng Province (Pretoria) and Welkom. The proposed PV facility site is accessible from both the M3 and the R730 via secondary roads.

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. The proposed Harmony One Plant Solar PV Facility is located approximately 11.4 km north-west of the Harmony Airfield.

There is a formally protected / conservation area just outside of the 10km range to the PV facility and approximately 11km south-east from the Openheimer Golf course (2km from the eastern border of the alternative layout facility).



Figure 2: Road View of proposed PV Facility



Figure 3: Southern View of Proposed PV Facility



Figure 4: Western View of PV facility



Figure 5: Gridline and Proposed PV Facility



Figure 6: Gridline Road Crossing



Figure 7: R30 Road View of development





Figure 8: View of Diggers in and PV facility



Figure 9: View of Proposed Alternative



Figure 10: View of Preferred PV Placement and Alternative Placement



Figure 11: View of alternative from unknown road

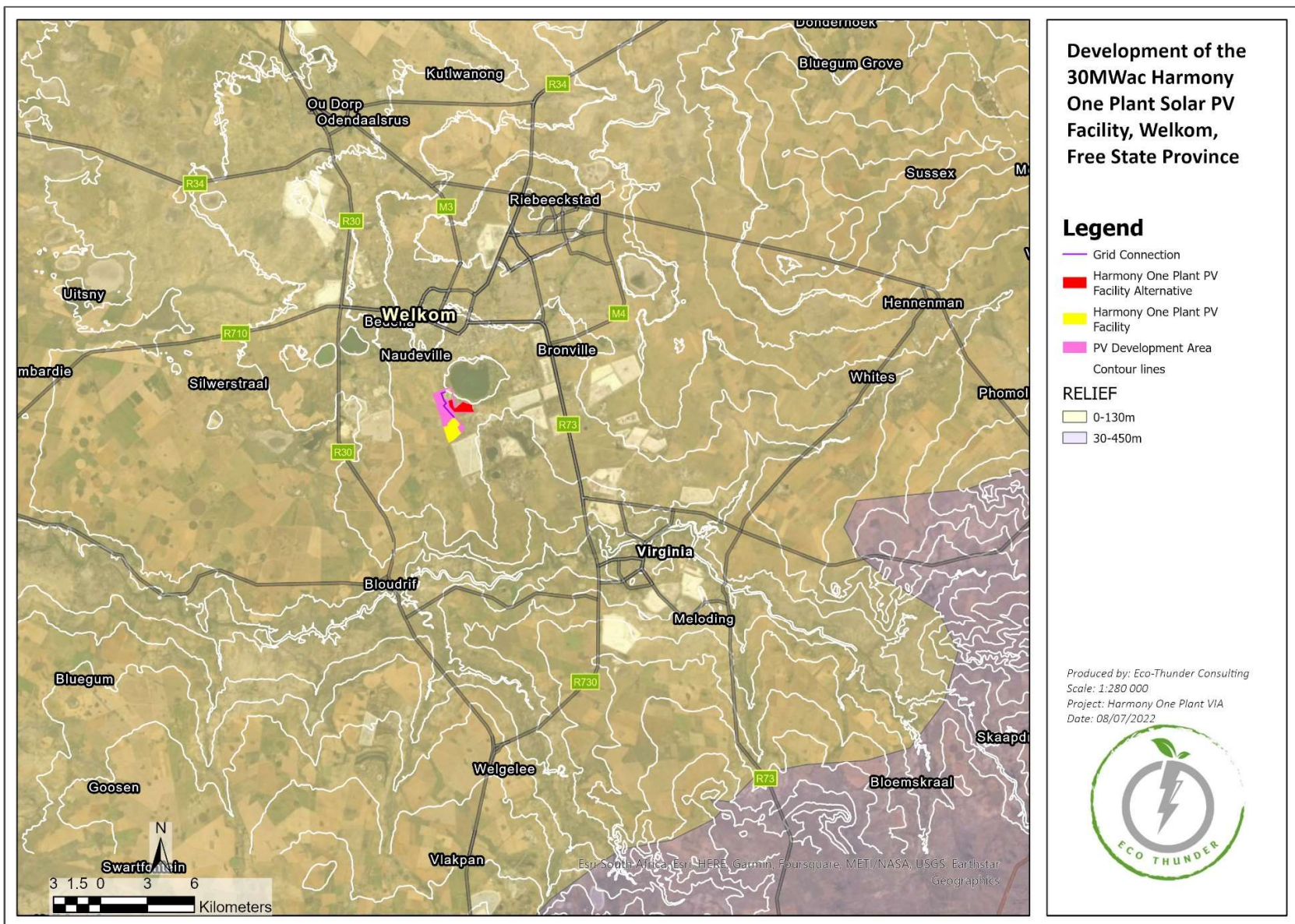


Figure 12: Site Topography and Slope

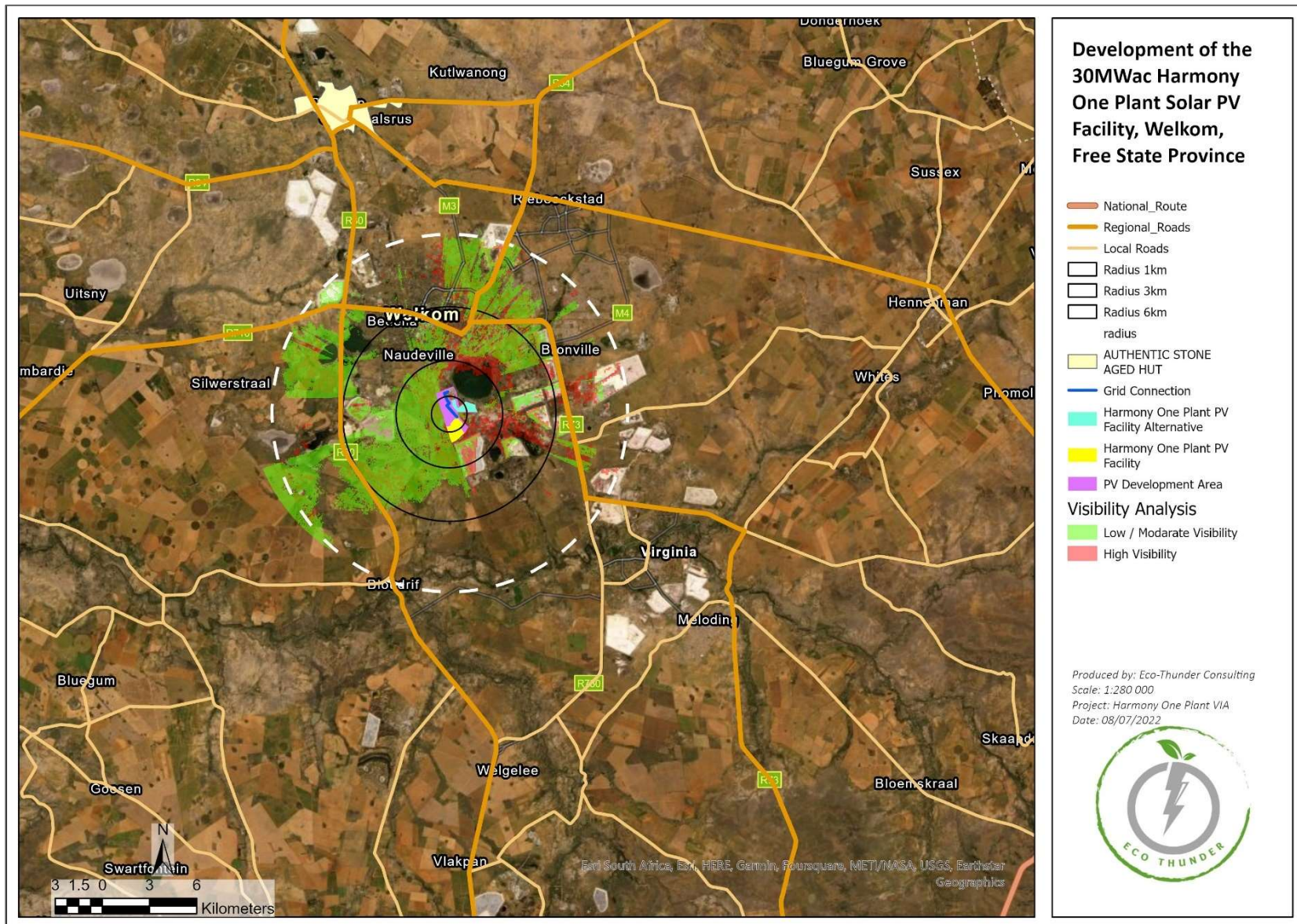


Figure 13: Viewshed Analysis

## 5. VISUAL IMPACT ASSESSMENT

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### 5.1. Impact Index

The viewshed analysis was undertaken from a number of vantage points within the development footprint at an offset of 6m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels, inverters and BESS) associated with the facility.

The viewshed analysis will be further refined once a preliminary and / or final layout is completed and will be regenerated for the actual position of the infrastructure on the site and actual proposed infrastructure during the EIA phase of the project.

### 5.2. Visual Impact Assessment

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the Project; views and concerns of interested and affected parties (I&APs); social and political norms, and the public's interest.

### 5.3. Anticipated Issues Related to the Visual Impact

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

- The visibility of the facility to, and potential visual impact on, observers travelling along the secondary road (unnamed road) in closer proximity to the proposed infrastructure.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the farm residence in closer proximity to the proposed development.
- The potential visual impact of the facility on the visual character or sense of place of the region.
- The potential visual impact of the facility on tourist routes or tourist destinations / facilities (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e., internal access roads, buildings, power line, etc.) on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable) or built structures / mining infrastructure.
- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the placement of the PV facility within a predominantly mining area.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential visual impact of solar glint and glare as a visual distraction and possible air / road travel hazard.
- Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may potentially constitute a visual impact at a local and / or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

Table 1: Impact table of Visual impacts of the proposed PV Facility

<p><b>Impact</b></p> <p>Visual impact of the facility on observers in close proximity to the proposed PV facility infrastructure and activities. Potential sensitive visual receptors include:</p> <ul style="list-style-type: none"> <li>Residents of homesteads and farm dwellings (in closer proximity to the facility)</li> <li>Observers travelling along the secondary roads traversing near the proposed development</li> </ul>			
Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the PV facility infrastructure and activities	The potential negative experience of viewing the infrastructure and activities	Primarily observers situated within a 1km (and potentially up to 3km) radius of the facility	N.A.
<p><b>Description of expected significance of impact</b></p> <p>Extent: Local  Duration: Long term  Magnitude: Moderate  Probability: Probable  Significance: Medium  Status (positive, neutral or negative): Negative  Reversibility: Recoverable  Irreplaceable loss of resources: No  Can impacts be mitigated: Yes</p>			
<p><b>Gaps in knowledge &amp; recommendations for further study</b></p> <p>A finalised layout of the PV facility and ancillary infrastructure are required for further analysis. This includes the provision of the dimensions of the proposed structures and ancillary equipment.</p> <p>Additional spatial analyses are required in order to create a visual impact index that will include the following criteria:</p> <ul style="list-style-type: none"> <li>Visual exposure</li> <li>Visual distance / observer proximity to the structures / activities</li> <li>Viewer incidence / viewer perception (sensitive visual receptors)</li> <li>Visual absorption capacity of the environment surrounding the infrastructure and activities</li> </ul> <p>Additional activities:</p> <ul style="list-style-type: none"> <li>Identify potential cumulative visual impacts</li> <li>Undertake a site visit</li> <li>Recommend mitigation measures and / or infrastructure placement alternatives</li> </ul> <p>Refer to the Plan of Study for the EIA phase of the project below.</p>			

## 6. CONCLUSION

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The fact that some components of the proposed Harmony One Plant Solar PV Facility and associated infrastructure may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 3km buffer zone from the facility need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the core PV facility as well as for the ancillary infrastructure, as these structures (e.g., the BESS structures and power line) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows:

- Visual Impact Assessment (VIA)
- Determine potential visual exposure
- Determine visual distance / observer proximity to the facility
- Determine viewer incidence / viewer perception (sensitive visual receptors)
- Determine the visual absorption capacity of the landscape
- Calculate the visual impact index
- Determine impact significance
- Propose mitigation measures
- Reporting and map display
- Site visit

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