BARWON SOLAR FARM

PRELIMINARY LANDSCAPE AND VISUAL IMPACT ASSESSMENT

24TH MARCH 2023

FINAL PRELIMINARY ASSESSMENT REPORT
PREPARED FOR ELGIN ENERGY

URBIS

URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

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Report Number	Barwon Solar Farm LVIA_20230324

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INTRODUCTION

Elgin Energy (the applicant) plans to submit a Planning Application for the development of a solar installation at Little River-Ripley Road, Balliang. The Project is located approximately 30 kilometres (km) north of Geelong and approximately 45 km west of Melbourne (refer to ***Figure 1***).

The Barwon Solar Project (the Project) involves the erection of approximately 507,630 individual solar panels on the approximately 735 ha site, as well as the installation of inverters, transformers and the construction of a substation and a battery energy storage system.

The site will encompass the following properties: 1000, 1050, 1085-1135, 1145-1215, 1150-1190, 1240, 1320 Little River-Ripley Road, Little River/Balliang VIC 3211 (the site). The development will be situated on both the north and south side of Little River-Ripley Road.

This report has been prepared by Urbis Pty Ltd (Urbis) to provide a preliminary landscape visual impact assessment (LVIA) for inclusion in the Planning Application.

Figure 1 – Site location (Source: Google Earth).

1. APPROACH

While there are no specific legislative requirements for the methodology of an assessment such as this in Victoria, the profession typically refers to the guidance offered by:

- Guidance for Landscape and Visual Impact Assessment (GLVIA), Third Edition, Landscape Institute and Institute of Environmental Management & Assessment (2013).

The methodology used for this Project, described below, conforms generally to the direction offered by the above guidelines as well as other proven assessment methodologies.

This preliminary assessment report assesses the landscape and visual impact of the Project, that is the day-to-day visual effects on people's views.

The method to measure visual impacts is based on the combination of the sensitivity of viewers to the proposed change and the magnitude of the Project on that visual setting or view.

The following study components were included as part of this assessment:

- Review the Project with regard to potential visual impacts.
- Characterisation of the existing landscape and visual setting.
- Qualitatively assess:
  - Visual modification at key viewpoints – How would the Project contrast with the landscape character of the surrounding setting?
  - Visual sensitivity at key viewpoints – How sensitive would viewers be to the Project?
  - Potential night-lighting impacts.
  - Potential glare or glint impacts.
- Propose visual impact mitigation and management measures.

1.1. ASSESSMENT OF LANDSCAPE AND VISUAL IMPACTS

The landscape and visual impact assessment is based on a detailed analysis of the landscape and visual setting and an assessment of the potential impacts of the Project on its viewshed.

The critical issues considered for this LVIA were:

- The number and location of sensitive viewing locations;
- The duration of the view – either static (generally long term - > 1 hour) and mobile (generally short term continually moving and static for no longer than 5 minutes);
- The degree to which the proposed works would be visible;
- The quality of the landscape setting; and
- The degree to which the Project contrasts or is compatible with the visual character of the setting – the visual modification level.

The assessment method assumed that if the Project would not be seen, there is no impact.

Level of Visual Impact N/A = Not Apparent, VL = Very Low, L = Low, M = Moderate, H = High		Viewer Sensitivity		
		H	M	L
Level of Visual Modification	H	H	H	M
	M	H	M	L
	L	M	L	L
	VL	L	VL	VL
	N/A	N/A	N/A	N/A

Table 1 – Visual Impact Matrix

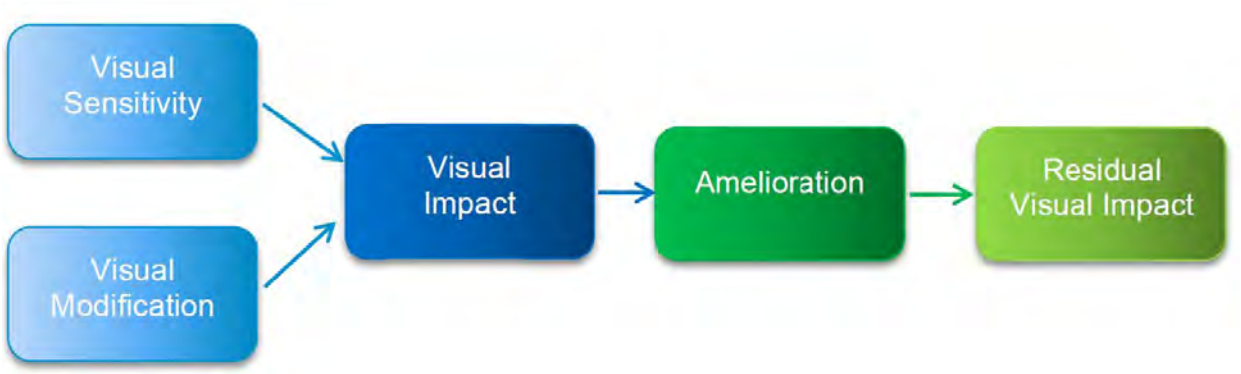


Diagram 1 – Visual Assessment Process

1.1.1. Visual sensitivity

In this report, the approach to the visual sensitivity is consistent with the visual management system (United States Department of Agriculture Forest Service, 1995), Landscape Aesthetics – A Handbook for Scenery Management, Agricultural Handbook No. 701.

The visual sensitivity of development depends on a range of viewer characteristics. The primary characteristics used in this report include:

- Land use;
- Distance of the development from viewers; and
- Visibility from sensitive land use areas.

Visual sensitivity is a measure of how critically a change to the existing environment would be viewed from various land uses (refer to ***Table 2***). Different activities have different sensitivity levels. For example, tourists on holiday would generally view changes to a landscape more critically than industrial workers in the same area. Similarly, individuals would view changes to the visual setting of their homes more critically than changes to the broader area in which they travel or work.

The next critical component to rating the visual sensitivity is the distance of the development from the identified visual use area. There are three viewing situations to consider:

- foreground (0 - 1 km);

- middleground (1 km – 5 km), and
- background (> 5 km).

As the distance increases from a proposed development to a sensitive land use area, the level of viewer sensitivity decreases based on a perceptual dis-association based on a reduction in relative proximity.

VISUAL USE AREA	FOREGROUND		MIDDLEGROUND		BACKGROUND
	Local Setting		Sub–Regional Setting		Regional Setting
	0 – 0.5 km	0.5 – 1 km	1 – 2 .5 km	2.5 – 5 km	> 5 km
State/Regional Parks*	H	H	H	H	M
Residences/Townships	H	H	H	M	L
Tourist/Recreation Areas	H	M	M	L	L
Highways/Tourist Routes	H	M	M	L	L
Sporting Areas	M	L	L	L	L
Education/Conservation	M	L	L	L	L
Secondary Roads	M	L	L	L	VL
Local Roads	L	L	L	VL	VL
Agricultural Areas	L	L	L	VL	VL
Legend - H = High, M = Moderate, L = Low, VL = Very Low **Sensitivity reduces to low in distances greater than 10kms*					

Table 2 – Typical Viewer (visual) Sensitivity

1.1.2. Visual modification to the existing setting

The level of visual modification resulting to a setting from a proposed development, or the degree to which the setting is modified, can be best measured as an expression of the visual interaction, or the level of visual contrast between the project and the existing visual environment.

A high level of magnitude, or a high degree of visual modification, will result if the major components of the project contrast strongly with the existing landscape.

A low level of magnitude, or a low degree of visual modification, will occur if there is little or minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the proposed development and the environment in which it sits. In this situation, the proposed development may be noticeable, but does not markedly contrast with the existing, already modified landscape.

The degree of magnitude or modification would generally decrease as the distance from the Project to various viewing locations increases.

1.2. LIGHTING IMPACTS

Australia does not have standards for the assessment of lighting impacts based on a range of night-time lighting environments. Therefore, the assessment of the impacts of lighting at night-time has been based on the United Kingdoms, Institute of Lighting Engineers (ILE) Guidance Notes for the Reduction of Obtrusive Light. This guidance note identifies four environmental zones for exterior lighting which are categorised by

the degree of artificial lighting within an area. For example, national parks would be categorised as an intrinsically dark landscape (Category E1), where as a city centre with high levels of night-time activity would be categorised as a high district brightness area (Category E4).

Australian Standards do exist for the minimisation of light spill. Regardless of the existing brightness of a particular setting, it is a widely accepted principal that light spill, particularly upward light spill, be minimised wherever possible.

1.2.1. Lighting impact scenarios

Glow
Light glow is typically an upward projection of light that results in illumination of the night sky above a lighting source. It is intensified, or more visually apparent when foggy or cloudy as the light reflects or disperses of water droplets in the atmosphere. Glow is visible over significant distances.

Spill
Spill is light that falls on adjacent sensitive surfaces, both vertical and horizontal, and is most intrusive where it illuminates private open spaces or spills through windows.

Hot spots
Hot spots relate to concentrated areas of bright light in an otherwise less well illuminated setting. Hot spots will be most visible where are elevated.

Kinetic / movement
Lights that change colour or flash can draw the attention of a viewer. As the speed of the colour change or blink increases in speed, so too will its prominence of ability to draw attention.

1.2.2. Glare and glint impacts

Photovoltaic panels are designed to absorb sunlight and convert it to electricity. Minimising the light reflected from the panels is a goal of panel design, manufacture and installation. The dark, non-reflective nature of a solar array is generally considered to help minimise their visual contrast with the surrounding landscape.

The glare and glint assessment has been undertaken utilising ForgeSolar software, with the annual hours for green and yellow glare calculated for identified observation points, typically roads and residences.

Green glare has a low potential to cause an after-image when observed prior to a typical blink response time.

Yellow glare has the potential to cause an after-image when observed prior to a typical blink response time.

The analysis does not consider obstacles between the observation points and the proposed solar array that may obstruct observed glare, such as trees, topography and, buildings, etc., and can, therefore, be considered a worst-case scenario.

1.2.3. Residual impact

The effectiveness of the measures proposed in mitigating the landscape and visual impacts resulting from the Project is demonstrated by comparing the visual impact during initial operation with the residual impact when the proposed landscape measures have mostly matured, which is typically ten (10) years following initial establishment.

Generally, residual impacts would be reduced by at least one level where landscape measures have been proposed and matured due to filtering or inhibiting views to the Project.

1.3. LIMITATIONS OF THE ASSESSMENT

There are these following limitations associated with this assessment:

- The LVIA process aims to be objective and, as such, seeks to describe any changes factually. Potential changes resulting from the project have been defined. However, the significance of these changes requires qualitative (subjective) judgements to be made. Therefore, the conclusions to this assessment combine both objective measurement and subjective professional interpretation. This assessment has attempted to be objective, however it is recognised that visual assessment can be highly subjective, and individuals are likely to associate different visual experiences to the study area;
- The impact assessment is focused on the current land uses and zoning; and

- Methodology of the construction works are currently unknown and dependent upon planning approvals. However, we have assumed that the impacts during construction and would result in a similar degree of visual impact to that of the operational phase assessment findings, pre-amelioration.

2. SITE CONTEXT AND APPRAISAL

2.1. SITE CONTEXT

The Project is located immediately adjacent to both the north and south of Little River - Ripley Road, a local access road, with Bacchus Marsh – Geelong Road, located approximately 1 km to the west of the Project.

The settlement of Balliang lines both sides of Bacchus Marsh – Geelong Road.

The Little River forms a sinuous northern boundary to the Project, flowing to the township of Little River, approximately 9 km to the southeast.

The Ford Proving Ground abuts part of the Project's southern boundary. The northernmost boundary of the You Yangs Regional Park is located 3.3 km to the south of the Project.

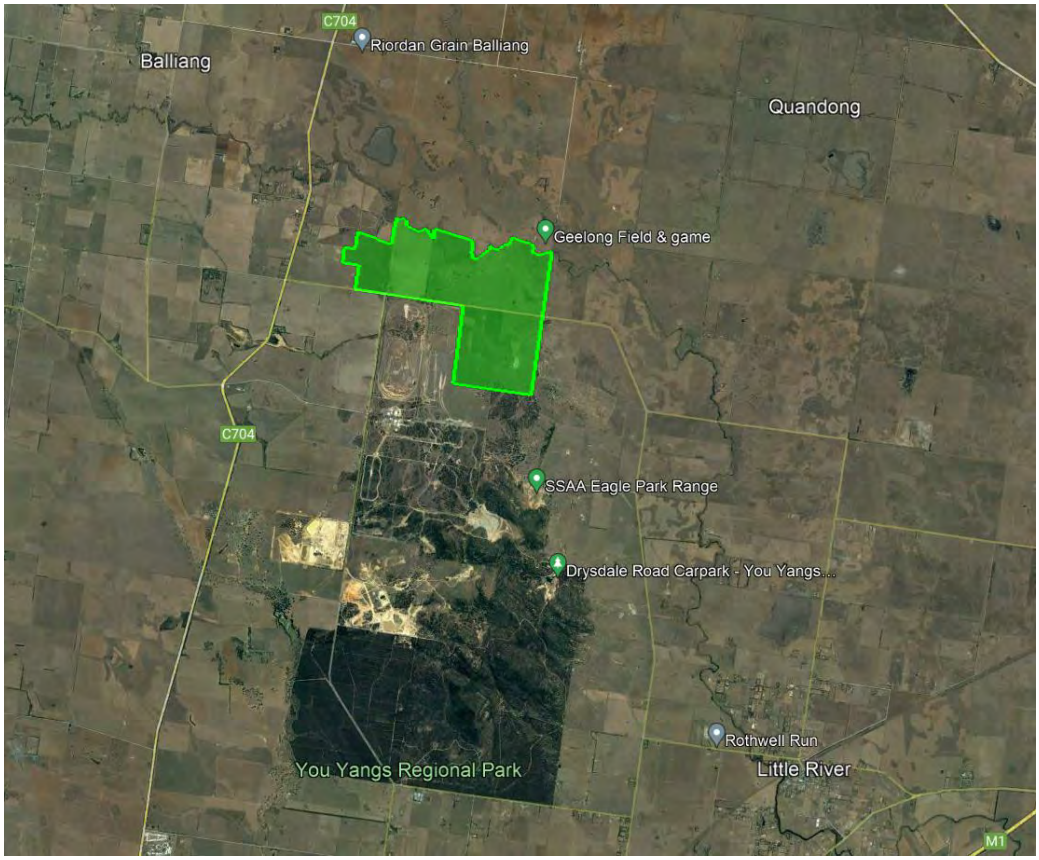


Figure 2 – Site context (Source: Google Earth).

2.2. LAND USE AND ZONING

2.2.1. Land use

The land use of the Project site and surrounding area is highly varied and includes grazing and cropping to the north and west, the Ford Proving Ground (refer to ***Figure 3***) and shooting ranges and extractive and landfill uses to the south and the Mt Rothwell Biodiversity Interpretation Centre to the east.

The You Yangs Regional Park further to the south provides for conservation and recreation uses, including picnicking and bushwalking, horse riding and mountain biking.

The Wurdi Youyang Bushland Reserve, located between the You Yangs Regional Park and the Ford Proving Ground, is primary for conservation purposes, and incorporates extractive uses (refer to ***Figure 4***). Directly southeast of the Project site and north of the Wurdi Youyang Bushland Reserve, is the Mt Rothwell Biodiversity Interpretation Centre.

The infrastructure associated with the region includes roads, major high voltage (HV) powerlines and other smaller power lines of varying voltages and scales (refer to ***Figure 5***).

The most significant road within the viewshed of the Project is Bacchus Marsh – Geelong Road, a primary state arterial road, located approximately 1 km to the west of the Project.

Little River, Lara and Werribee, the largest proximate areas of settlement, are located outside of the sensitive viewshed of the Project.

Figure 3 – The elevated formation of the Ford Proving Ground test track to the south of the Project partially screens views to the You Yangs.

Figure 4 – The extractive industry at Hillview Sand is prominent in views from the Flinders Peak lookout.

Figure 5 – HV powerlines bisect the Project from southwest to northeast.

2.2.2. Zoning

The Project is located within the City of Greater Geelong Council, with the Moorabool Shire Council adjoining the Project site to the north of the Little River.

The entirety of the Project site is zoned Farming Zone (FZ) within the City of Greater Geelong Planning Scheme (refer to ***Figure 6***).

The surrounding land use of the area is zoned predominantly FZ, with Rural Conservation Zone (RCZ) abutting the Project site to the northwest of the intersection of Mt Rothwell Road and Little River-Ripley Road.

The You Yangs Regional Park located x km to the south is zoned Public Conservation and Resource Zone (PCRZ). An area of extractive industry (Hillview Sand) to the northwest of the You Yangs Regional Park is zoned Special Use Zone (SUZ).

None of the objectives of the planning scheme for FZ land relate to the protection of landscape or visual values.

The relevant objectives of the PCRZ zoned land of the You Yangs Regional Park are:

- To protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values.

Relevant objective of the RCZ are:

- To provide for agricultural use consistent with the conservation of environmental and landscape values of the area.
- To conserve and enhance the cultural significance and character of open rural and scenic non urban landscapes.

2.3. VEGETATION AND LANDSCAPE FORM

The Project site is mostly flat and treeless, with any substantial vegetation confined to road and paddock boundaries or waterways. The Little River, which forms the Project site's northern boundary, is sinuous and lightly incised below the plain. Its banks are lined with relatively dense, tall vegetation. Scattered trees across are primarily grouped into three main areas on the Project site, including along a sinuous drainage line in the central northern part of the site.

The elevation of the Project site ranges from approximately 95 m at its lowest point on the most northerly extent of the eastern boundary, to approximately 110 m on the most southerly extent of the eastern boundary, where the landform rises with the foothills of the You Yangs (refer to ***Figure 7***).

The You Yangs, to the south of the Project, are the dominant feature of the regional landscape. They rise progressively from the north to a maximum elevation of 319 m at Flinders Peak, located to the south of the range.

The site is partially visually contained in views from the east and almost completely contained in views from the west. by rising topography at the Project site's eastern and western boundaries.

The HV line which bisects the project site, in conjunction with the elevated formation of the Ford Proving Ground, results in a significant modification to the landscape of the setting.

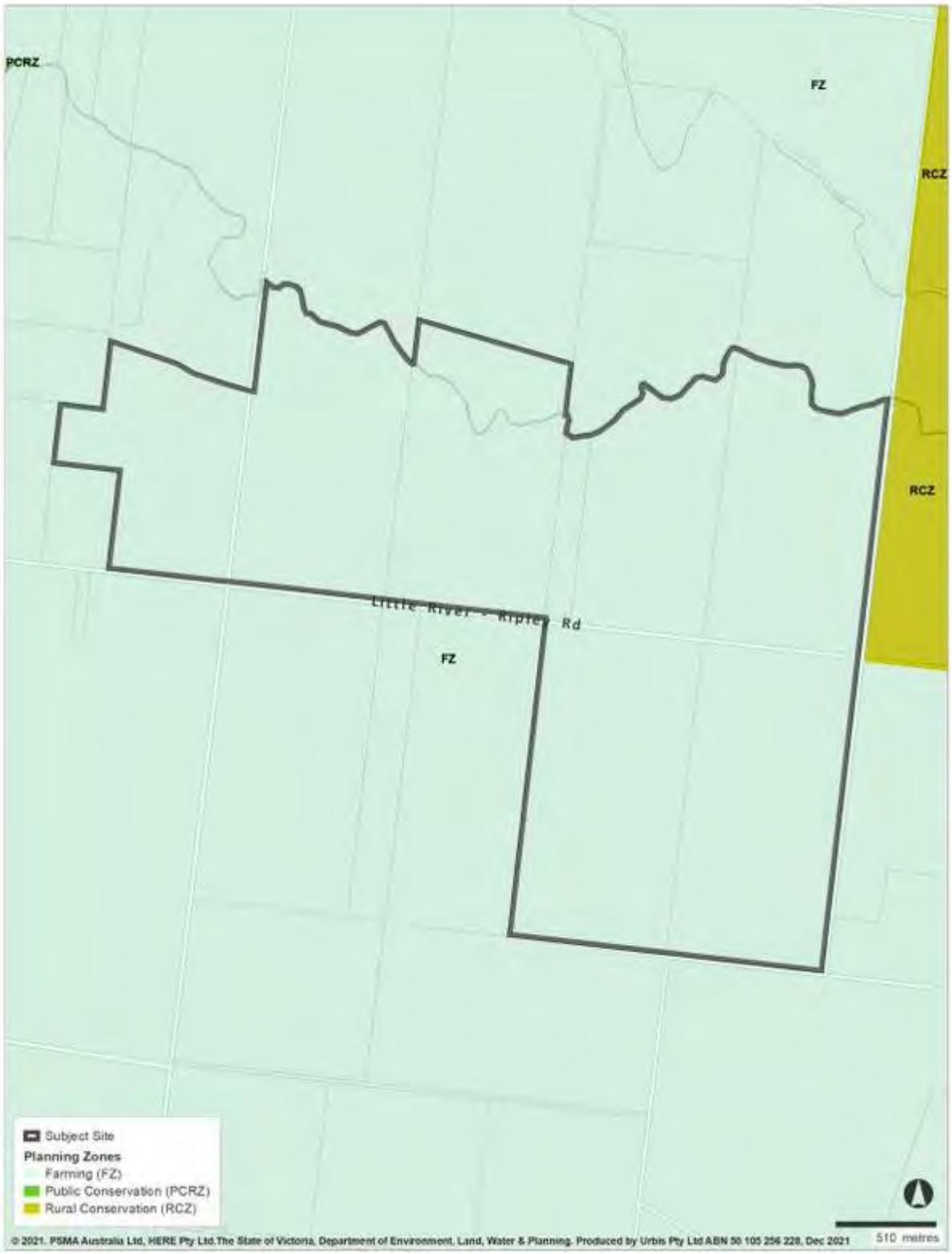


Figure 6 – Land use zoning.

Figure 7 – The You Yangs are the most prominent landscape feature in the region, decreasing in elevation from the south to the north.

2.4. LANDSCAPE CHARACTER TYPE

Within the regional setting of the Project the landscape character type has been identified using the classification system devised by Leonard and Hammond (1984)[1]. The landscape character type is described below:

Western Plains

The landscape type is extensive, extending approximately 320 km from Melbourne in the east to the South Australian border in the west. It is bounded by the Great Dividing Range to the north and the coastline and Otway Ranges to the south. The landscape is virtually flat, with occasional stream networks, punctuated by volcanic cones. The rugged peaks and wooded slopes of the granitic You Yangs to the east are an anomaly in the otherwise basaltic plain.

The highly modified agricultural landscape of inland areas contains pockets of remnant vegetation comprised of brown stringybark and yellow gum eucalypts away from waterways and red gums along the waterways.

[1] Leonard, M., Hammond, R., (1984). Landscape Character Types of Victoria.

2.5. SCENIC QUALITY

The scenic quality of the landscape character type of the Project area and its surrounds, as described by Leonard and Hammond, are outlined below.

WESTERN PLAIN	**YOU YANGS SUBTYPE**
Description	**High Scenic Quality**
Landforms	▪ Isolated peaks or ranges with distinctive form and colour that become focal points. ▪ Major rock outcroppings.
Vegetation	▪ Strongly defined patterns resulting from eucalypt forest and barren rock visible in clearings.
Waterforms	▪ None present.

WESTERN PLAIN	**PLAINS SUBTYPE**
Description	**Low to Moderate Scenic Quality**
Landforms	▪ Flat to slightly undulating landform with occasional small, rounded hills. ▪ Lightly incised waterways.
Vegetation	▪ Scattered trees with little diversity, arranged along property boundaries and with occasional areas of grouping. ▪ Scattered vegetation along waterways. ▪ Extensive agricultural clearings.
Waterforms	▪ Permanent and intermittent waterways.

2.6. ABSORPTIVE CAPABILITY

The definition of landscape absorptive quality is closely related to that of visual modification levels. It is generally applied at a broader scale than visual modification and is an assessment of how well a landscape setting is able to accommodate change or a development.

The key factors considered in determining absorptive capability are topography and vegetation. In areas of flatter topography, overlooking is not possible and a low and thin band of vegetation is able to screen views to a development from a given viewpoint. In areas of undulating or elevated topography, overlooking can occur and vegetation needs to be higher and denser to achieve effective screening. Intervening undulating topography also has the potential to block views in certain landscapes.

The landscape setting of the Project is generally flat to slightly undulating with vegetation confined to a rectilinear pattern reflecting property boundaries and roads and more extensive natural patterns of vegetation following water courses. Within this landscape, overlooking is generally not possible from most sensitive viewpoints, and even relatively low vegetation (up to eye-height) is effective at screening views.

2.6.1. Plains Subtype

Topography – High capability due to mostly flat topography, with minimal potential for overlooking.

Existing Vegetation – Generally low for cleared agricultural areas. Moderate to high capability where vegetation exists.

2.6.2. You Yangs Subtype

Topography – Low capability due to highly elevated topography, with potential for overlooking.

Existing Vegetation – Moderate capability where taller vegetation exists.

3. COMPONENTS OF THE PROJECT

3.1. KEY FEATURES

As illustrated in ***Figure 8***, the Project involves the development of a solar energy facility and BESS on approximately 510 ha of the approximately 735 ha site. The works and components associated with the Project include:

- Approximately 540,690 single portrait, single axis tracking solar panels arranged in a generally regular, rectilinear pattern comprised of modules of multiple panels;
- 74 inverters/transformers;
- A battery energy storage system of upto approximately 500 MW (136 inverters) with 4m high acoustic fence;
- A substation;
- A 35m high voltage lattice transmission tower allowing for connection between the substation and the HV network and;
- Installation of an all-weather access road (minimum width of 4 metres) around the site to provide access to panels, inverters and transformers;
- 2.3 m high perimeter security fencing; and
- Visual amelioration screen planting.

Lighting is not required for normal operations. However, localised lighting may be required for occasional night-time repairs or maintenance.

3.2. DETAIL OF PROJECT COMPONENTS

Solar Panels

Solar PV panels will be installed across the Project attached onto a single-axis tracker.

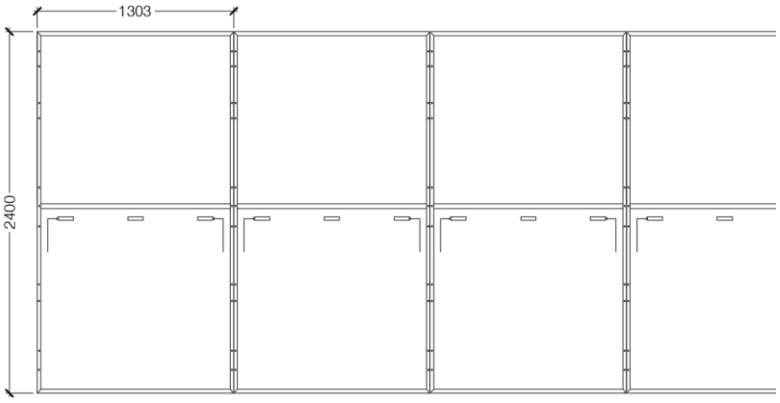
Each panel will be of the following approximate dimensions: 2.4 metres (length) x 1.3 metres (width). Once mounted on the frames and fully tilted the panels will be capable of reaching an overall height of no more than approximately 3.20 metres above ground level.

The glass surfaced panels are coated to maximise daylight absorption, and thus minimise glare potential. Other materials are an encapsulant, a rear layer and a frame around the outer edge There will be approximately 507,630 modules.

Mounted single-axis bifacial tilting panels.

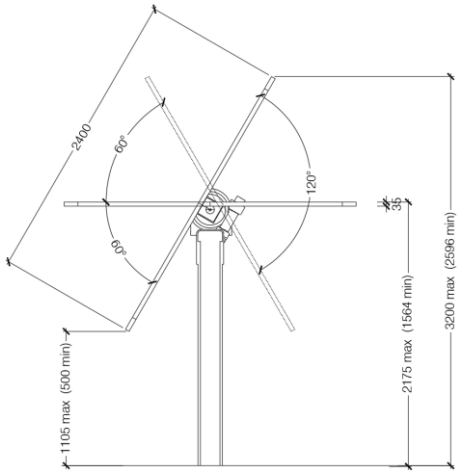
Mounting Frames

The panels will be attached in a single in-portrait configuration to horizontal mounting frames. The panels will 'track' the sun in an east to west plane to maximise solar exposure. The mounting frames will be made of either galvanized aluminium or steel and will have a rough matte finish, rather than a polished finish.



Solar panel module row – Plan

The mounting frames are pile driven into the ground, and no concrete foundations are required. The base of the frame piles are thin shapes, thus they have very little impact on the ground and do not require any prior excavation. The frames are driven to a depth of approximately 1.5m. At the end of their operational life when the site is decommissioned, the frame piles are simply pulled out from the ground causing minimal ground disturbance.



Self-powered tracker – Side elevation

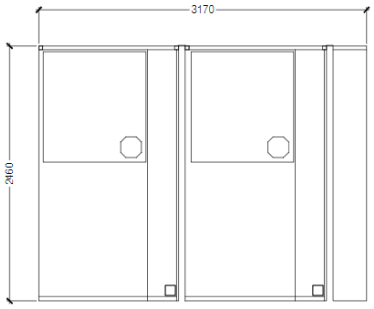
Transformer and Inverter

The panels generate Direct Current (DC) electricity which must be converted into Alternating Current (AC) before being fed into the local electricity grid network.

Transformer – Side elevation

The transformer transforms electrical energy from one circuit to another and allows for the energy generated to be fed into the local grid network

The inverters and transformers are housed in cabin-like structures mounted on a concrete base.

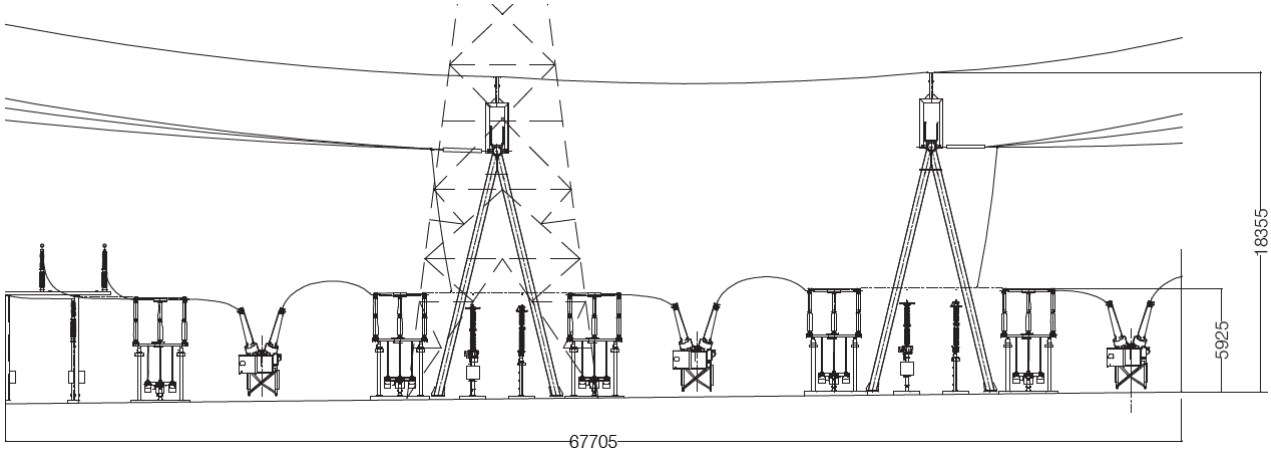


Inverter – side elevation

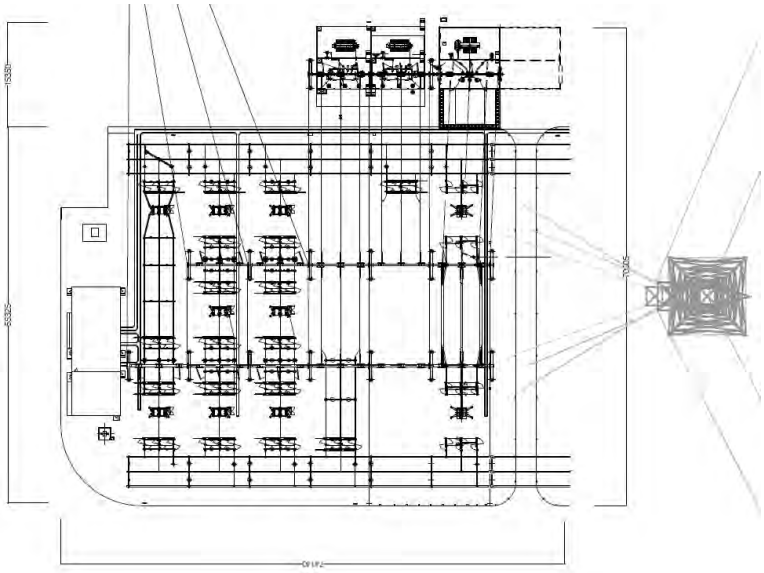
Substation

The substation will have a footprint of approximately 74 metres x 70 metres and a maximum height of 18.5 metres.

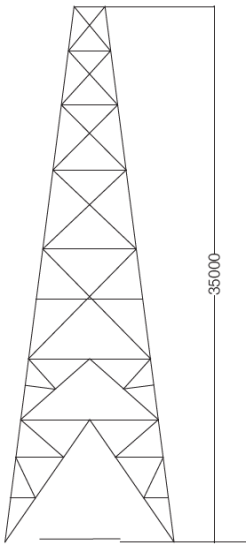
The tower connecting the substation to the HV network will be a lattice structure 35m high.



Substation – front elevation



Substation – plan

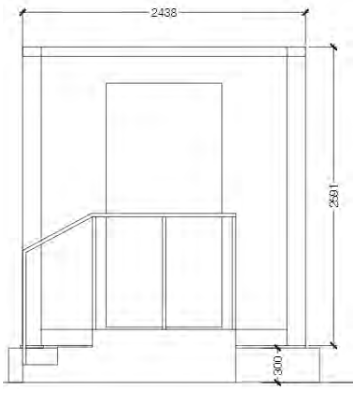


Substation tower - elevation

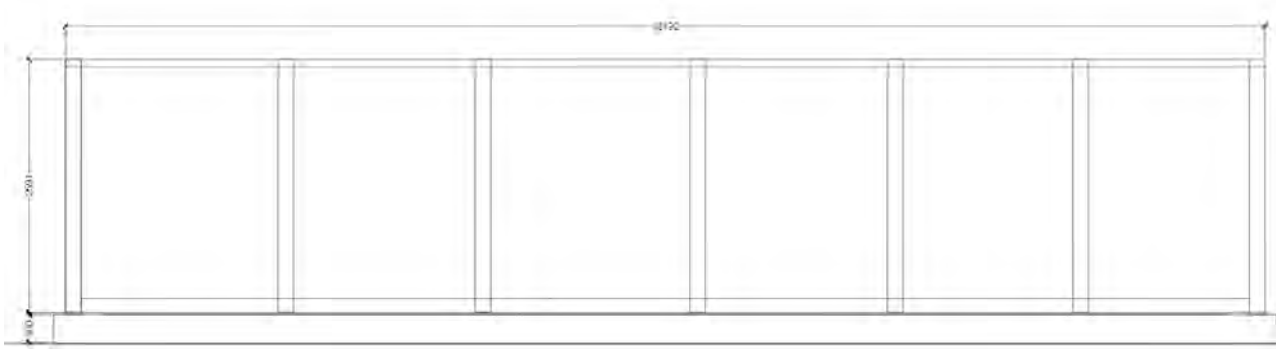
Battery Energy Storage System (BESS)

Installation of batteries housed inside a structure with the appearance of a shipping container constructed of steel measuring approximately 12 metres (length) x 2.4 metres (width) x 2.9 metres (height).

The BESS compound will be enclosed by a 3m high acoustic fence.



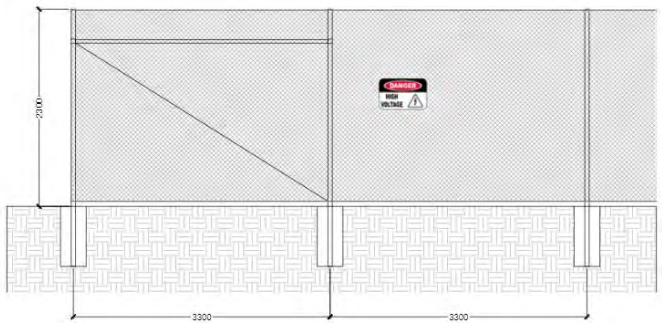
BESS – side elevation



BESS – front elevation

Perimeter Fence

A 2.3 m high chain mesh fence will be installed around the solar farm. The purpose of the fence is to deter theft or vandalism and prevent unauthorised access to the solar farm.



Drawing of proposed perimeter fencing.

Security Cameras

In order to monitor the site and detect any unauthorised access, motion sensor CCTV cameras will be erected around the site perimeter on poles of approximately 3 m in height. The cameras are directed into the solar farm, avoiding impinging on the privacy of nearby properties, and employ infrared technology so no lighting is required.

CCTV camera in centre of above photo.

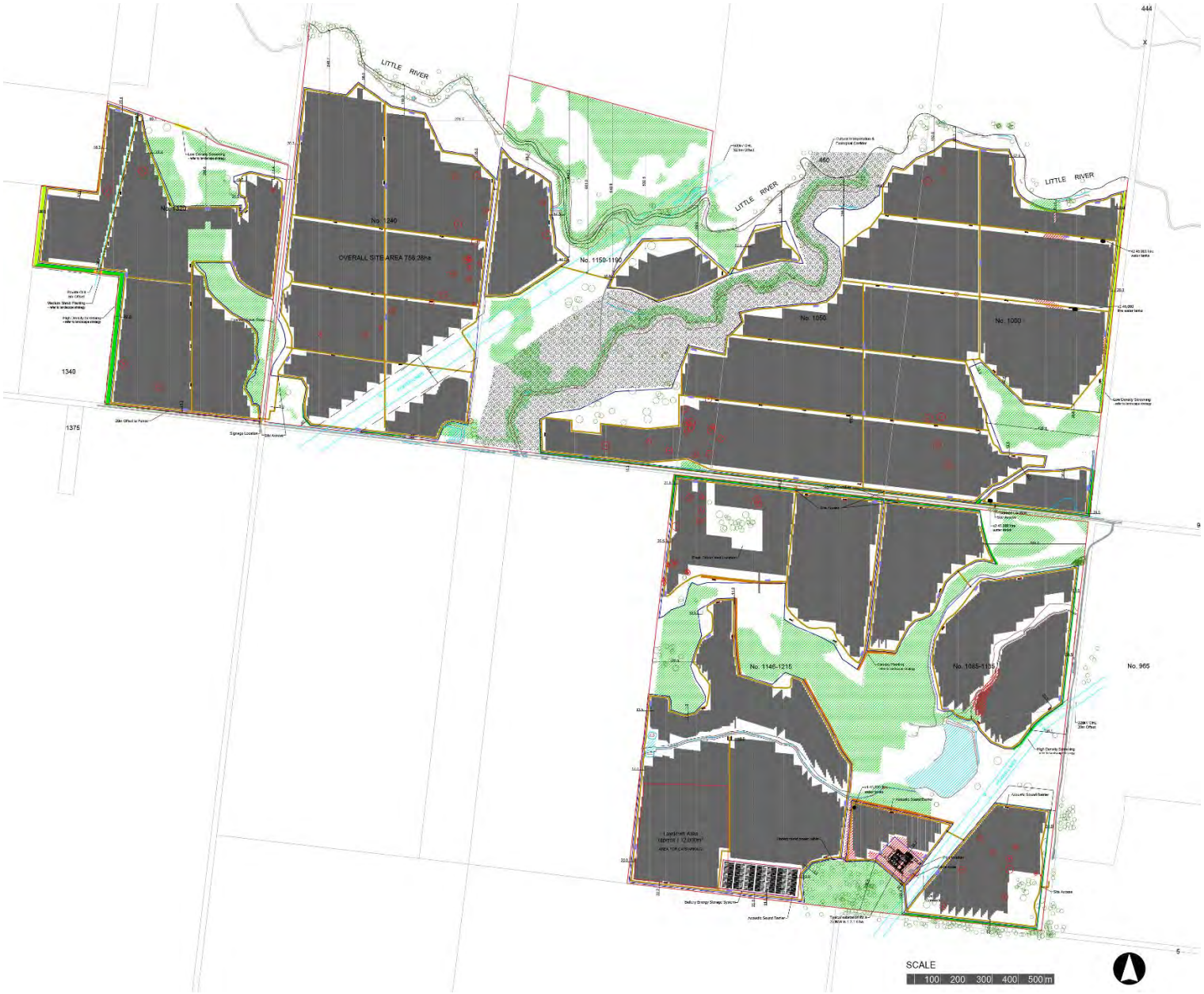


Figure 8 – Proposed development layout (Source: Elgin Energy).

4. VISUAL IMPACT ASSESSMENT

4.1. VISIBILITY OF THE PROPOSAL

The viewshed is the area from which views of a proposed development may be possible. Given the relatively low profile of the components of the Project above ground level, the visual catchment will be limited and also partially confined by scattered vegetation.

Figure 9 indicates the theoretical viewshed of the Project. It should be noted that the viewshed analysis is based on topography only and does not take into account the screening effects of vegetation. As a result, it is essentially demonstrating a worst-case scenario. In reality, bands of vegetation throughout the landscape and residential areas will further contribute to the screening of views towards the Project from most viewpoints.

The locations selected for photography and assessment are within the public realm, proximate to sensitive, privately owned land use areas.

4.2. SENSITIVE VIEWPOINTS

The viewpoint (VP) locations that are included in this assessment are from uses considered to be of higher sensitivity, such as State Parks, transport routes and rural residences (refer to ***Table 2*** and ***Figure 9***). Due to the typically low-profile form of the Project, the detailed assessment of viewpoints is confined to sensitive locations within 1.5 km of the Project, the area within which the Project will be most visible. However, more distant elevated sensitive locations, such as Flinders Peak in the You Yangs, have been assessed due to the potential for overlooking.

The residence/s of involved parties have not been assessed.

The locations selected for photography and assessment are mostly within the public realm, within proximity to the sensitive, privately owned visual use area. Photosimulations have been prepared for the potentially highest impact viewpoints, these being VP2, VP3 and VP4. Access was permitted by landowners to the properties for VP2 and VP4

The photosimulations demonstrate the Project at the completion of construction without any landscaping and at 5 years following the establishment of landscape.

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4.3. VISUAL IMPACT

This section includes a detailed assessment of the Project from the selected, highest sensitivity viewpoints, with a rating given for the level of visual modification and sensitivity which, when combined, result in a determination of the degree of overall visual impact for each viewing location.

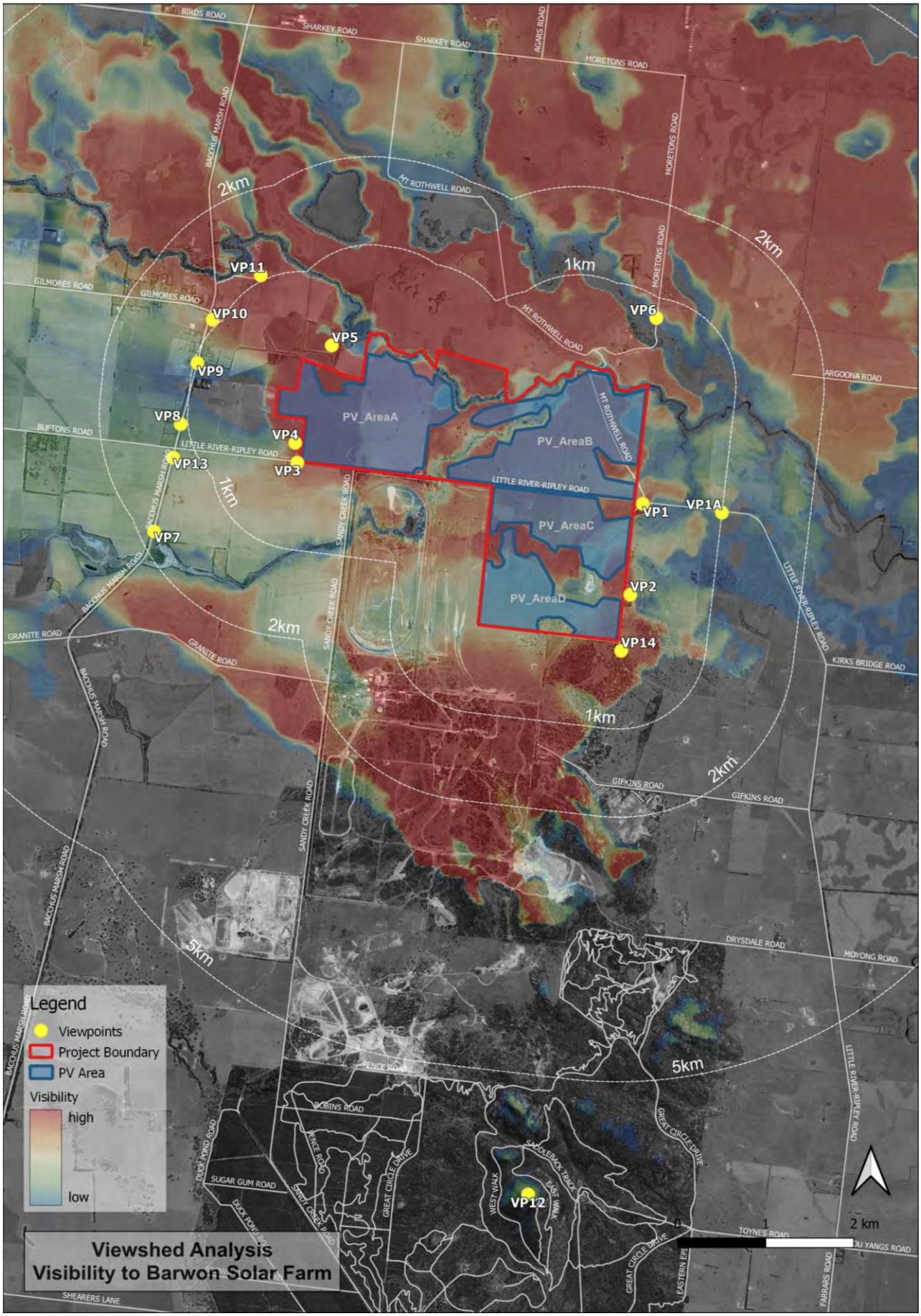

Figure 9 – Theoretical viewshed of the Project and assessed sensitive viewpoint locations.

VIEWPOINT 1 – LITTLE RIVER – RIPLEY ROAD

Photo Location	West-bound verge (refer to ***Figure 9***).
Viewing Distance	50m to the Project (solar panels).
Duration of View and Frequency of View	Duration: Mobile. Frequency: Low.
Visual Use Area	Local road through rural area.
Visual Sensitivity	**LOW** - Sensitivity of users is low based on the use of a local road through a rural area.
Visual Modification	**HIGH** – From this viewpoint, the Project will be highly apparent, with existing no existing screening vegetation (refer to ***Figure 10*** and ***Figure 12***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be high.
Visual Impact	**MODERATE**– Given the high visual modification level of the Project within the landscape setting, combined with a low visual sensitivity level, the potential visual impact will be Moderate.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**LOW –** The ameliorative screen planting along the Project boundary will be consistent with other road or paddock side planting throughout the area. The residual visual impact will reduce to very low as amelioration planting establishes over time.

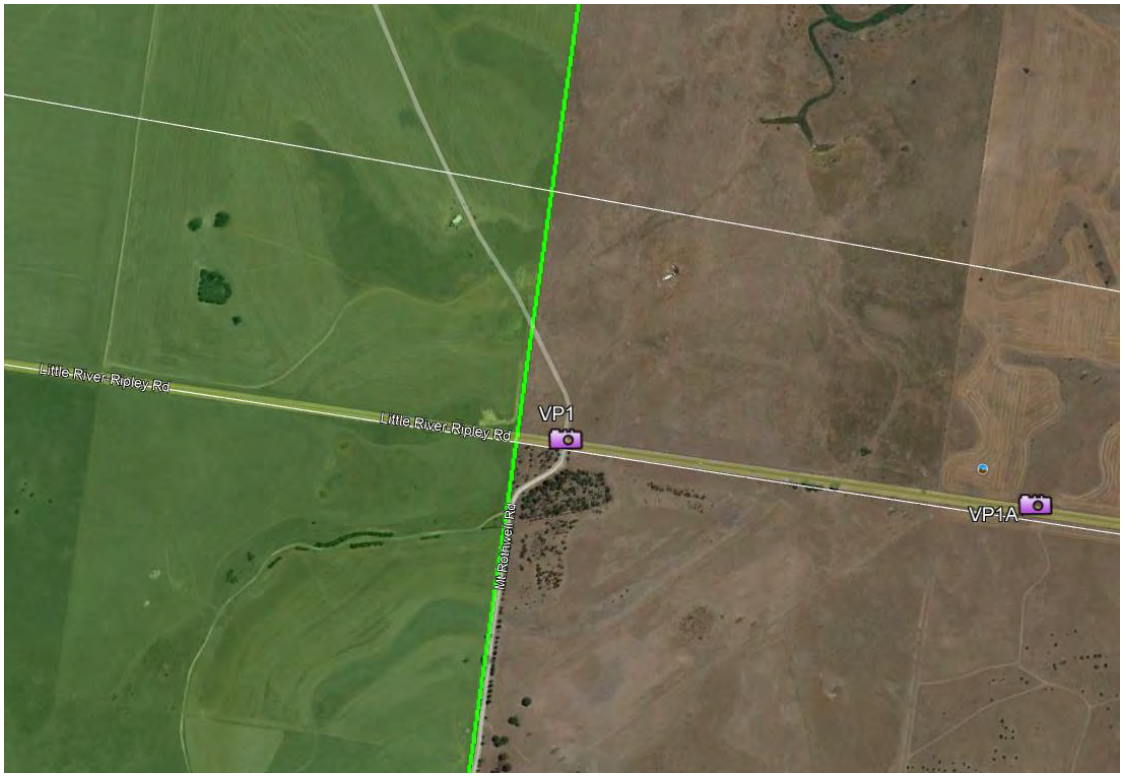

Figure 10 – The landscape setting of VP1 and VP1A (Source: Google Earth).

Figure 11 – VP1A - Views towards the Project, on approach from the east, are screened by undulating topography.

Figure 12 – VP1 - View west from Little River – Ripley Road with the Project visible on both sides. On approach from the east, views to the Project are finally possible from the roadway only once proximate to the Project boundary.

VIEWPOINT 2 – MT ROTHWELL ESTATE

Photo Location	Mt Rothwell Road adjacent to the residence (refer to ***Figure 9***).
Viewing Distance	170 m to the Project (solar panels).
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – partially screened setting (refer to ***Figure 13***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the rural residential use.
Visual Modification	**HIGH** – From this viewpoint, although well setback from the residence, the Project will be highly apparent, despite scattered vegetation located around the residence (refer to **Figure 14, *15*** and ***16***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be high.
Visual Impact	**HIGH** – Given the high visual modification level of the Project within the landscape setting, combined with a high visual sensitivity level, the potential visual impact will be high.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**MODERATE–** The ameliorative screen planting along the Project boundary will be set well away from the residence and designed to allow for views to the distant Brisbane Ranges. It will appear consistent with other road or paddock side planting throughout the area (refer to ***Figure 17***). The residual visual impact will reduce to moderate as amelioration planting establishes over time.

Figure 13 – VP2 – The landscape of the setting (Source: Google Earth).

Figure 14 – Views towards the Mt Rothwell Estate residence from Mt Rothwell Road.

Figure 15 – VP2 – View west towards Project from Mt Rothwell Estate residence.

Figure 16 – VP2 – Photosimulation view west towards the Project from Mt Rothwell Estate residence.

Figure 17 – VP2 - Photosimulation view west towards the Project from Mt Rothwell Estate residence with establishing ameliorative vegetation at 5 years.

VIEWPOINT 3 – RESIDENCE AT 1375 LITTLE RIVER-RIPLEY ROAD

Photo Location	To the southwest of the Project within the southern road verge (refer to ***Figure 9***).
Viewing Distance	125 m to the Project (solar panels) from the residence. 45 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually screened setting (refer to ***Figure 18***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the rural residential use.
Visual Modification	**LOW to MODERATE** – From this viewpoint, the Project will be partially screened by vegetation located around the residence (refer to **Figures 18** and ***19***). **Figures 20**, **21** and **22** show a view from the adjacent road verge, outside of the screening vegetation surrounding the residence. As a result of the surrounding vegetation, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be low to moderate.
Visual Impact	**MODERATE to HIGH** – Given the low to moderate visual modification level of the Project within the landscape setting, combined with a high visual sensitivity level, the potential visual impact will be moderate to high (refer to ***Figure 21***).
Proposed Amelioration	Perimeter screen planting
Residual Impact	**LOW –** The ameliorative screen planting along the Project boundary will be consistent with other road or paddock side planting throughout the area (refer to ***Figure 22***). The residual visual impact will reduce to low as amelioration planting establishes over time.

Figure 18 – VP3 – The landscape of the setting (Source: Google Earth).

Figure 19 – VP3 - Views towards the residence. Existing vegetation on the property provides partial screening of views to the Project.

Figure 20 – VP3 - View towards Project area from the road verge on Little River-Ripley Road, southwest of the Project.

Figure 21 – VP3 – Photosimulation view northeast towards the Project from the road verge on Little River-Ripley Road, near VP3.

Figure 22 – VP3 - Photosimulation view northeast towards the Project from the road verge on Little River-Ripley Road, near VP3.with establishing ameliorative vegetation at 5 years.

VIEWPOINT 4 – RESIDENCE AT 1340 LITTLE RIVER-RIPLEY ROAD

Photo Location	To the southwest of the Project within the northern road verge (refer to ***Figure 9***).
Viewing Distance	100 m to the Project (solar panels) from the residence.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually open setting (refer to ***Figure 23***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the rural residential use.
Visual Modification	**LOW to MODERATE** – From this viewpoint, the Project will be partially screened by vegetation located around the residence and adjacent Project site boundary (refer to **Figure 24, *25*** and ***26***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be low to moderate.
Visual Impact	**MODERATE to HIGH** – Given the low to moderate visual modification level of the Project within the landscape setting, combined with a high visual sensitivity level, the potential visual impact will be moderate to high.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**LOW –** The ameliorative screen planting along the Project boundary will be consistent with other paddock side planting throughout the area (refer to ***Figure 27***). The residual visual impact will reduce to low as amelioration planting establishes over time.

Figure 23 – VP4 – The landscape of the setting (Source: Google Earth).

Figure 24 – VP4 - Views towards the residence from the road verge Little River-Ripley Road. Existing vegetation on the property provides partial screening of views to the Project.

Figure 25 – VP4 - View towards Project area from the driveway adjacent to the residence.

Figure 26 – VP4 – Photosimulation of view to Project from the driveway adjacent to the residence.

Figure 27 – VP4 – Photosimulation of view to Project from the driveway adjacent to the residence, with establishing amelioration vegetation at 5 years of growth

VIEWPOINT 5 – RESIDENCE 2425 BACCHUS MARSH – GEELONG ROAD

Photo Location	The residence is located a significant distance from any publicly accessible point. As a result, no ground-based photography has been taken at this point (refer to ***Figure 9***).
Viewing Distance	275 m to the Project (solar panels) from the residence.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – treed setting (refer to ***Figure 28***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the rural residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vegetation surrounding the residence, as well as intervening vegetation along the adjoining Project boundary. As a result, it is anticipated that the degree of visual modification for this viewpoint will be very low.
Visual Impact	**LOW** – Given the relative lack of visibility of the Project, resulting in a very low visual modification level, when combined with a high level of sensitivity, the potential visual impact will be low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Ameliorative screen planting along the Project boundary will further screen views to the Project and reduce the residual visual impact to very low as it establishes over time.

Figure 28 – VP5 - The landscape of the setting (Source: Google Earth).

VIEWPOINT 6 – LITTLE RIVER GAME RANCH (444 MORETONS ROAD)

Photo Location	To the north of the Project within the centre of Moretons Road (refer to ***Figure 9***).
Viewing Distance	630 m to the Project (solar panels) from the club house. 770 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Moderate.
Visual Use Area	Sports (shooting) – visually open setting (refer to ***Figure 29***).
Visual Sensitivity	**LOW** - Sensitivity of users is moderate based on the sporting use and distance of the social facilities from the Project.
Visual Modification	**MODERATE** – The clubhouse is located within an area of dense vegetation with views to the Project mostly screened (refer to ***Figure 30***). From the shooting range, the Project will appear as a horizontal line through the landscape, partly visible in breaks, between and over, intervening scattered vegetation located along the Little River. As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be moderate.
Visual Impact	**LOW** – Given the relative lack of visibility of the Project, resulting in a moderate visual modification level, when combined with a low level of sensitivity, the potential visual impact will be low.
Proposed Amelioration	Perimeter screen planting.
Residual Impact	**VERY LOW –** Ameliorative screen planting along the Project boundary will reduce the residual visual impact to very low as it establishes over time.

Figure 29 – VP6 - The landscape of the setting (Source: Google Earth).

Figure 30 – VP6 - View south towards the clubhouse / social facilities from Moretons Road, with the Project in the distant background.

VIEWPOINT 7 – RESIDENCE 2230 BACCHUS MARSH – GEELONG ROAD

Photo Location	To the southwest of the Project within the eastern verge of Bacchus Marsh-Geelong Road (refer to ***Figure 9***).
Viewing Distance	1,500 m to the Project (solar panels) from the residence. 1,800 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually enclosed setting (refer to ***Figure 31*** and ***Figure 32*****).**
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vegetation surrounding the residence, as well as intervening rising topography near the western boundary of the Project site (refer to ***Figure 33*** and ***Figure 34***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**LOW** – Given the very low visual modification level, when combined with the high level of sensitivity, the potential visual impact will be low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a low visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to very low.

Figure 31 – The broader landscape setting of VP7 (Source: Google Earth).

Figure 32 – The immediate landscape setting of VP7 (Source: Google Earth).

Figure 33 – VP7 – View towards the residence at 2230 Bacchus Marsh – Geelong Road.

Figure 34 – VP7 - View towards the Project from the road verge to the west of the residence

VIEWPOINT 8 – RESIDENCE 2345 BACCHUS MARSH – GEELONG ROAD

Photo Location	To the west of the Project within the western verge of Bacchus Marsh-Geelong Road (refer to ***Figure 9***).
Viewing Distance	1,000 m to the Project (solar panels) from the residence. 1,200 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually enclosed setting (refer to ***Figure 35*** and ***Figure 36*****).**
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vegetation surrounding the residence, as well as intervening vegetation along the roadway, as well as rising topography at the western boundary of the Project site (refer to ***Figure 37*** and ***Figure 38***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**LOW** – Given the very low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be very low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a low visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to very low.

Figure 35 – The broader landscape setting of VP8 (Source: Google Earth).

Figure 36 – The immediate landscape setting of VP8 (Source: Google Earth).

Figure 37 – VP8 – View towards the residence at 2345 Bacchus Marsh – Geelong Road.

Figure 38 – VP8 - View towards the Project from Bacchus Marsh – Geelong Road adjacent to residence.

VIEWPOINT 9 – RESIDENCE 2415 BACCHUS MARSH – GEELONG ROAD

Photo Location	To the west of the Project within the western verge of Bacchus Marsh-Geelong Road (refer to ***Figure 9***). This viewpoint is representative of other adjacent residences to the north and northeast.
Viewing Distance	1,000 m to the Project (solar panels) from the residence. 980 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually enclosed setting (refer to ***Figure 39*** and ***Figure 40*****).**
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vegetation surrounding the residence, as well as intervening vegetation along the roadway, as well as rising topography at the western boundary of the Project site (refer to ***Figure 41*** and ***Figure 42***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**LOW** – Given the very low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be very low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a low visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to very low.

Figure 39 – The broader landscape setting of VP9 (Source: Google Earth).

Figure 40 – The immediate landscape setting of VP9 (Source: Google Earth).

Figure 41 – VP9 – View towards the residence at 2415 Bacchus Marsh – Geelong Road.

Figure 42 – VP9 - View towards the Project from Bacchus Marsh – Geelong Road adjacent to residence.

VIEWPOINT 10 – RESIDENCE ON BACCHUS MARSH – GEELONG ROAD

Photo Location	To the west of the Project within the western verge of Bacchus Marsh-Geelong Road (refer to ***Figure 9***).
Viewing Distance	1,100 m to the Project (solar panels) from the residence. 1,200 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – visually enclosed setting (refer to ***Figure 43*** and ***Figure 44*****).**
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vegetation and outbuildings surrounding the residence, as well as intervening vegetation between the viewpoint and the Project (refer to ***Figure 45*** and ***Figure 46***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**LOW** – Given the very low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be very low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a low visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to very low.

Figure 43 – The broader landscape setting of VP10 (Source: Google Earth).

Figure 44 – The immediate landscape setting of VP10 (Source: Google Earth).

Figure 45 – VP10 – View towards the residence on Bacchus Marsh – Geelong Road.

Figure 46 – VP10 - View towards the Project from Bacchus Marsh – Geelong Road adjacent to residence.

VIEWPOINT 11 – RESIDENCE ON MATFINS ROAD

Photo Location	To the northwest of the Project within the road verge of Matfins Road (refer to ***Figure 9***).
Viewing Distance	1,050 m to the Project (solar panels) from the residence. 1,100 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Low.
Visual Use Area	Rural residence – partially visually enclosed setting (refer to ***Figure 47*** and ***Figure 48*****).**
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by vehicles and outbuildings surrounding the residence, as well as intervening vegetation between the viewpoint and the Project (refer to ***Figure 49*** and ***Figure 50***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**LOW** – Given the very low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be very low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a low visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to very low.

Figure 47 – The broader landscape setting of VP11 (Source: Google Earth).

Figure 48 – The immediate landscape setting of VP11 (Source: Google Earth).

Figure 49 – VP11 – View towards the residence on Matfins Road.

Figure 50 – VP11 - View towards the Project from Matfins Road adjacent to residence.

VIEWPOINT 12 – FLINDERS PEAK (YOU YANGS REGIONAL PARK

Photo Location	Lookout on the summit of Flinders Peak (refer to ***Figure 9***).
Viewing Distance	6,500 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Moderate.
Visual Use Area	Regional Park – visually open setting (refer to ***Figure 51***, ***Figure 52*** and ***Figure 53*****).**
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the recreational park use and distance from the Project.
Visual Modification	**LOW** – From this viewpoint, the Project will be party obscured from view by other peaks in the You Yangs to the north, between the viewpoint and the Project (refer to ***Figure 54***). Additionally, views to the landscape of the surrounding plains contain extensive areas of disturbance from extractive industries (refer to ***Figure 55***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be low (refer to ***Figure 56***).
Visual Impact	**LOW** – Given the low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be low.
Proposed Amelioration	Due to the ability for overlooking, perimeter screen planting would be ineffective
Residual Impact	**LOW –** The residual impact will not reduce due to the lack of effectiveness of perimeter screen planting.

Figure 51 – The broader landscape setting of VP12 (Source: Google Earth).

Figure 52 – The immediate landscape setting of VP12 (Source: Google Earth).

Figure 53 – VP12 – View towards the lookout on Flinders Peak.

Figure 54 – VP12 - View north towards the Project from Flinders Peak lookout.

Figure 55 – VP12 – Extractive industries are visible in views from the summit.

Figure 56 – VP12 – Photosimulation view northeast towards the Project from Flinders Peak lookout.

VIEWPOINT 13 – BACCHUS MARSH – GEELONG ROAD

Photo Location	To the west of the Project within the eastern verge of Bacchus Marsh-Geelong Road (refer to ***Figure 9***).
Viewing Distance	1,250 m to the Project (solar panels) from the photo location.
Duration of View and Frequency of View	Duration: Mobile. Frequency: Moderate to high.
Visual Use Area	Secondary Road (refer to ***Figure 57***).
Visual Sensitivity	**LOW** - Sensitivity of users is low based on the secondary road use and distance from the Project.
Visual Modification	**VERY LOW** – From this viewpoint, the Project will be mostly obscured from view by intervening rising topography at the western boundary of the Project site (refer to ***Figure 58***). Along other sections of the road to the north, roadside vegetation and vegetation around residences and property boundaries further screens views. As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be very low.
Visual Impact	**VERY LOW** – Given the very low visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be very low.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**VERY LOW –** Given the Project results in a very low visual impact, ameliorative screen planting along the Project boundary will have minimal effect in the further reduction of the level of residual impact.

Figure 57 – The landscape setting of VP13 (Source: Google Earth).

Figure 58 – VP13 - View north towards the Project from Bacchus Marsh-Geelong Road, south of Little River – Ripley Road.

VIEWPOINT 14 – Mt ROTHWELL BIODIVERSITY INTERPRETATION CENTRE

Photo Location	To the southeast of the Project on Mt Rothwell Road (refer to ***Figure 9***).
Viewing Distance	90 m to the Project (solar panels) from the centre.
Duration of View and Frequency of View	Duration: Stationary. Frequency: Moderate
Visual Use Area	Education/Conservation – partially visually enclosed setting (refer to ***Figure 59*** and ***Figure 60***).
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the education/conservation use.
Visual Modification	**LOW to MODERATE**– From this viewpoint, the Project will be partially screened from view by vegetation surrounding the centre, (refer to ***Figure 61***). As a result, it is anticipated that the degree of visual modification to the visual setting from this viewpoint will be low to moderate.
Visual Impact	**LOW to MODERATE** – Given the low to moderate visual modification level, when combined with the moderate level of sensitivity, the potential visual impact will be low to moderate.
Proposed Amelioration	Perimeter screen planting
Residual Impact	**LOW to VERY LOW –** Given the Project results in a low to moderate visual impact, ameliorative screen planting along the Project boundary will further reduce the level of residual impact to low to very low.

Figure 59 – The broader landscape setting of VP14 (Source: Google Earth).

Figure 60 – The immediate landscape setting of VP14 (Source: Google Earth).

Figure 61 – VP14 – View south towards the Biodiversity Centre from Mt Rothwell Road.

4.3.1. Lighting impacts

The applicable environmental lighting zone for the Project area based on the ILE guidelines is Category E2, which is a low district lighting area, which applies to rural residential areas and areas with secondary and local roads.

Within the Category E2 area the Project does not result in an increased lighting impact due to there being no requirement for operational lighting.

Some components may have external security lights. However, these are only used for urgent maintenance works during hours of darkness and are not permanently illuminated.

4.3.2. Glare and glint impacts

A Glint & Glare assessment has been prepared by Urbis in this section:

Definitions, impacts and guidelines

Currently, there are no guidelines set by the Australian Government's Civil Aviation Safety Authority (CASA) to assess glint and glare, therefore guidelines issued by the United States Federal Aviation Administration (FAA) will be used.

According to the FAA's Technical Guidance for Evaluating Selected Solar Technologies on Airports (v1.1 April 2018), the following definitions for reflectivity, glint and glare are as follows:

Reflectivity: *Light that is reflected off surfaces*

Glint: *A momentary flash of bright light*, reflected off a surface.

Glare: *A continuous source of bright light*, reflected off a surface.

The degree of potential ocular impacts are calculated based on retinal irradiance and subtended angle (size) of the glare source and based on the results, the potential ocular impacts can fall into one of three categories, being:

- Green - low potential to cause after-image (flash blindness)
- Yellow - potential to cause temporary after-image
- Red - potential to cause retinal burn (permanent eye damage)

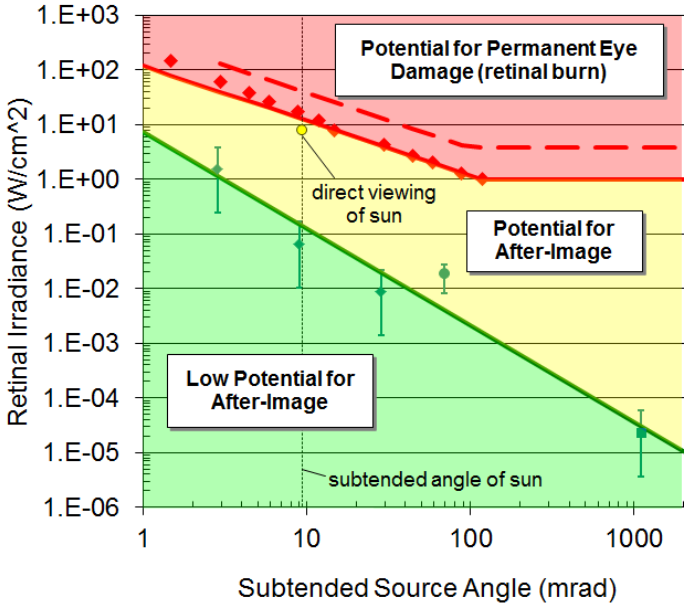

Figure 62 – Glare hazard plot defining ocular impact (Ho et al, 2011)

These coloured ranges are widely accepted and were adopted by the FAA as part of their 'Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports' (Oct 2013). Refer to ***Figure 62***. The policy also required that any proposed solar energy system must meet the following standards:

1. No potential for glint or glare in the existing or planned ATCT

2. No potential for glare or ‘‘low potential for after-image’’ green in ***Figure 62***) along the final approach path for any existing landing threshold or future landing thresholds. The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath.

Under the FAA’s recently revised final policy (May 2021), only airports with Airport Traffic Control Towers (ATCTs) are now required to have glint and glare assessments, with the focus on potential impacts towards the ATCTs. The final policy no longer states requirements relating to final approach paths, stating that:

‘Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass facade buildings, parking lots, and similar features.’

Additionally, there are a number of airports around the world that have installed solar projects to support their operations, including the recently constructed and operational Melbourne Airport solar farm located about 1km north from its north-south runway.

Receptors

All roads and dwellings within 1km of the proposed facility boundaries will be assessed. Additionally, dwellings and viewpoints sitting just outside of this 1km zone will also be assessed. These additional receptors are identified by Receptor IDs OP7, OP11 and OP13. Refer to **Table 3 and *Figure 63* .**

The Project will also be assessed for potential glare towards the two nearest aviation facilities, which are as follows:

- Bacchus Marsh Airport is approximately 14 kilometres to the north and serves as the home of the Geelong and Melbourne Gliding Clubs of Victoria, and an aero club.

- Avalon Airport is approximately 15 kilometres to the south-east and caters for commercial passenger and freight aviation.

Each of these airports contain one or two runways, each containing two approach-paths at either end and are individually identified with Receptor IDs FP1-FP6.

A total of 25 receptors have been identified and will be assessed. Refer to **Table 3** and ***Figure 63***

Table 3 – Project receptors and routes

Receptor ID	Receptor Type	Receptor details	Distance to Project
FP 1	aerodrome	Bacchus Marsh Airport (01)	14.2km
FP 2	aerodrome	Bacchus Marsh Airport (19)	15.0km
FP 3	aerodrome	Bacchus Marsh Airport (09)	14.9km
FP 4	aerodrome	Bacchus Marsh Airport (27)	14.8km
FP 5	aerodrome	Avalon Airport (18)	15km
FP 6	aerodrome	Avalon Airport (36)	17.8km
OP 1	dwelling	VP4 - 1340 Little River - Ripley Road	70m
OP 2	dwelling	VP3 - 1375 Little River - Ripley Road	125m
OP 3	dwelling	VP2 - Residence Mt Rothwell Estate	70m
OP 4	dwelling	Residence Mt Rothwell Road	125m
OP 5	dwelling	VP5 - Residence 2425 Bacchus Marsh - Geelong Road	280m
OP 6	dwelling	VP6 - Little River Game Ranch (444 Moretons Road)	670m
OP 7	dwelling	VP7 - Residence 2230 Bacchus Marsh - Geelong Road	1.6km
OP 8	dwelling	2360 Bacchus Marsh-Geelong Rd	900m
OP 9	dwelling	2430 Bacchus Marsh-Geelong Rd	880m
OP 10	dwelling	2410 Bacchus Marsh-Geelong Rd	820m
OP 11	dwelling	2480 Bacchus Marsh-Geelong Rd	1.07km
OP 12	dwelling	2360 Bacchus Marsh-Geelong Rd	820m
OP 13	dwelling	VP5 - Residence on Eleven Mile Creek Road	1.08km
Route 1	road	Mt Rothwell Road	<10m
Route 2	road	Little River - Ripley Road	<20m
Route 3	road	Travellers Way	<10m
Route 4	road	Sandy Creek Road	<20m
Route 5	road	Bacchus Marsh Road	950m
Route 6	road	Moreton Road & Mt Rothwell Road	180m

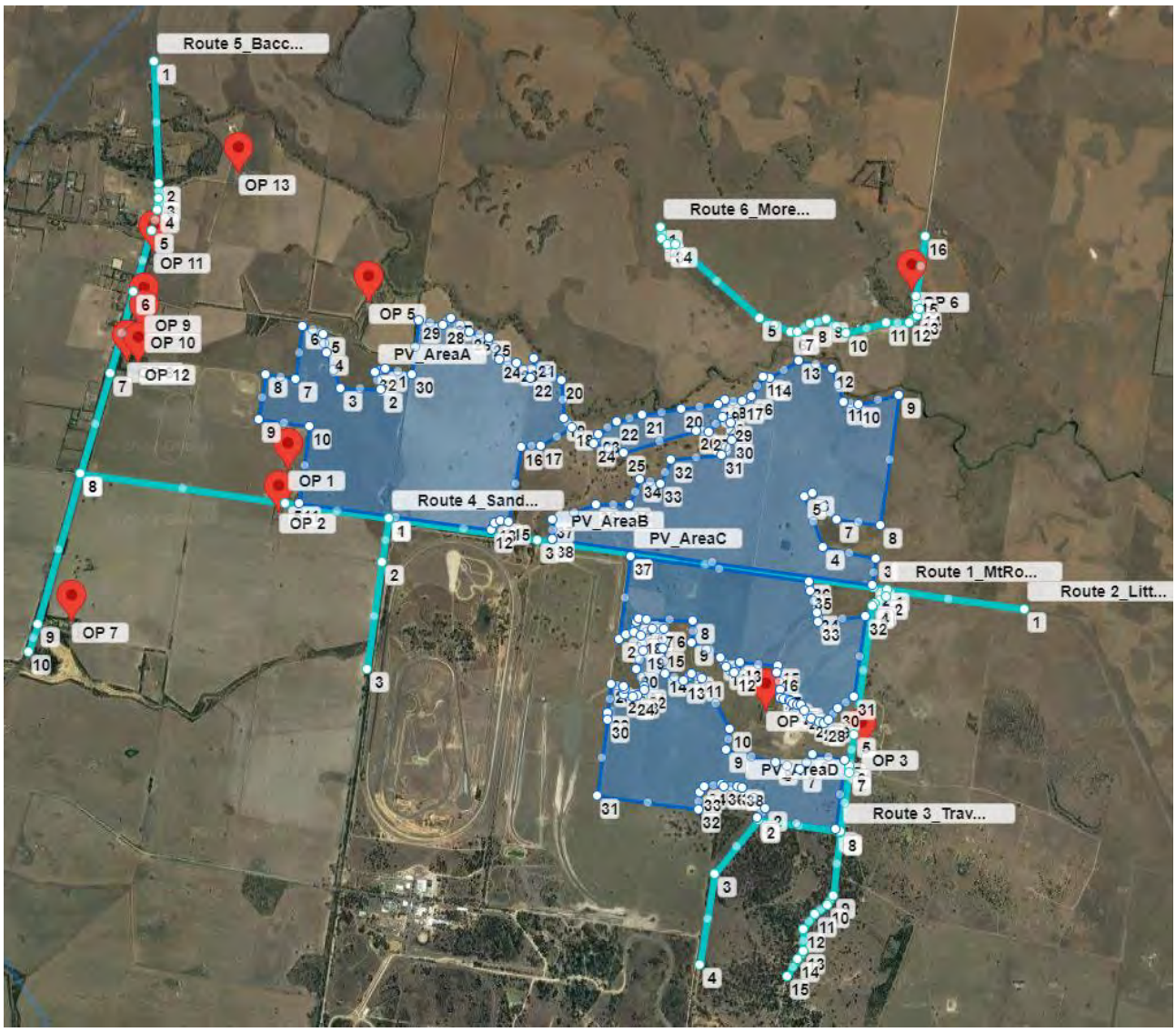

Figure 63 – Project receptors and routes *(note : airports out of range - not shown)*

Glare Modelling

Glare in this report has been assessed using ForgeSolar's GlareGauge software, which is widely used to predict glare and is based on the Solar Glare Hazard Tool (SGHAT) developed by Sandia National Laboratories in conjunction with the FAA.

The parameters used as inputs for the modelling are set out in **Table 4**.

Table 4 – Modelling input parameters

Parameter	Value	Units	Comment
Site Settings			
Timezone offset	+10	UTC	Australian Eastern Standard Time (AEST)
Time interval	1	minute	Default (unchanged) Modelling interval
Peak DNI	1000	W/m²	Default (unchanged) The maximum Direct Normal Irradiance at the given location at solar noon.
DNI Varies?	yes	-	Default (unchanged) DNI will be scaled based on sun position
Advanced			
Sun Angle	9.3	mrad	Default (unchanged)
Ocular transmission coefficient	0.5	-	Default (unchanged)
Pupil diameter	0.002	m	Default (unchanged)
Eye focal length	0.017	m	Default (unchanged)
PV Arrays			
Panel Configuration & Tracking			
Tracking	Single-axis	type	Proposed system will track from east to west
Backtracking method	Shade-slope	type	Proposed system supports backtracking
Tracking axis orientation	0	deg	Azimuthal position of tracking axis points north
Maximum tracking angle	+/-60°	deg	East/West rotation limit of panels. Total 120°
Resting angle	various	deg	Various scenarios tested (0°,5°,15°,30°,45°,60°)
Ground Coverage Ratio (GCR)	0.442	-	Ratio between panel area and ground area
Material & Power			
Module surface material	Smooth glass with ARC	type	Proposed panels are smooth glass with Anti-reflective coating
Reflectivity varies with incidence angle	yes	-	Default (unchanged)

Correlate slope error with module surface type	yes	-	Default (unchanged)
Rated power (optional)	0	kW	Optional - Not used
Receptors (point, route and 2-mile flight path)			
View angle	50°	deg	Default (unchanged)
PV Array height	2.175	m	Height of PV array above ground (at panel centroid), determined by panel dimensions at maximum 60° tilt whilst retaining a ground clearance of 500mm.
Standing height at Observation Points (OPs)	1.65	m	Height of person standing above natural ground level at observation points (OPs)
Driver height (road)	1.5	m	Average height of driver above road
Glide slope (flight-path approach)	3	deg	Default (unchanged)

To more accurately define the Project's PV areas within the model, coordinates that define PV Areas A-D have been extracted from the digital CAD files and imported into the model with up to a maximum of 40 coordinates per area. Elevations for all points have also been determined using higher resolution local datasets with all levels entered as AHD levels, overriding the modelling software's built-in elevations, which would otherwise be obtained through Google Maps. All elevations for road routes, dwellings and airports have also been prepared in the same way.

Assumptions and Limitations

GlareGauge has some of the following limitations:

- The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results.
- The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
- The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modelling methods.

Results

The results from running the modelling found that green glare is predicted along two of the roads adjacent to the Project, namely:

- ROUTE 1 - Mt Rothwell Road
- ROUTE 3 - Travellers Way

No glare is predicted for the remainder receptors within 1km of the Project boundaries, including all assessed dwellings, airports and the four remainder roads, including Bacchus Marsh Road. See **Table 5**.

For more detailed results, the report outputs from the GlareGauge software is provided as **Appendix B.**

Table 5 – Summary of results: Total predicted glare

			Green Glare (min/year)				Yellow Glare (min/year)			
Receptor ID	**Receptor Type**	**Receptor**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**
FP 1	aerodrome	Bacchus Marsh Airport (01)	0	0	0	0	0	0	0	0
FP 2	aerodrome	Bacchus Marsh Airport (19)	0	0	0	0	0	0	0	0
FP 3	aerodrome	Bacchus Marsh Airport (09)	0	0	0	0	0	0	0	0
FP 4	aerodrome	Bacchus Marsh Airport (27)	0	0	0	0	0	0	0	0
FP 5	aerodrome	Avalon Airport (18)	0	0	0	0	0	0	0	0
FP 6	aerodrome	Avalon Airport (36)	0	0	0	0	0	0	0	0
OP 1	dwelling	VP4 - 1340 Little River - Ripley Road	0	0	0	0	0	0	0	0
OP 2	dwelling	VP3 - 1375 Little River - Ripley Road	0	0	0	0	0	0	0	0
OP 3	dwelling	VP2 - Residence Mt Rothwell Estate	0	0	0	0	0	0	0	0
OP 4	dwelling	Residence Mt Rothwell Road	0	0	0	0	0	0	0	0
OP 5	dwelling	VP5 - Residence 2425 Bacchus Marsh - Geelong Road	0	0	0	0	0	0	0	0
OP 6	dwelling	VP6 - Little River Game Ranch (444 Moretons Road)	0	0	0	0	0	0	0	0

			Green Glare (min/year)				Yellow Glare (min/year)			
Receptor ID	**Receptor Type**	**Receptor**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**
OP 7	dwelling	VP7 - Residence 2230 Bacchus Marsh - Geelong Road	0	0	0	0	0	0	0	0
OP 8	dwelling	2360 Bacchus Marsh- Geelong Rd	0	0	0	0	0	0	0	0
OP 9	dwelling	2430 Bacchus Marsh- Geelong Rd	0	0	0	0	0	0	0	0
OP 10	dwelling	2410 Bacchus Marsh- Geelong Rd	0	0	0	0	0	0	0	0
OP 11	dwelling	2480 Bacchus Marsh- Geelong Rd	0	0	0	0	0	0	0	0
OP 12	dwelling	2360 Bacchus Marsh- Geelong Rd	0	0	0	0	0	0	0	0
OP 13	dwelling	VP5 - Residence on Eleven Mile Creek Road	0	0	0	0	0	0	0	0
Route 1	road	Mt Rothwell Road	0	0	0	4786	0	0	0	0
Route 2	road	Little River - Ripley Road	0	0	0	0	0	0	0	0
Route 3	road	Travellers Way	0	0	0	30473	0	0	0	0
Route 4	road	Sandy Creek Road	0	0	0	0	0	0	0	0
Route 5	road	Bacchus Marsh Road	0	0	0	0	0	0	0	0
Route 6	road	Moreton Road & Mt Rothwell Road	0	0	0	0	0	0	0	0

In order to understand the amount of predicted glare from the Project towards all the identified receptors, a number of scenarios were analysed, and it was found that the key factor in determining the level of Project glare was the resting angle of the system. The resting angle is defined as the angle of rotation of panels when the sun is outside its tracking range and backtracking rotation has settled. The change in total predicted glare by changing the resting angle indicates that a significant portion of glare predicted are not due to times of the day when the sun is within the tracking range (-60° to +60°) but at times when the sun is outside of the tracking range when the panels have returned to its predefined resting angle.

A total of eight scenarios based on resting angle were simulated covering the full range of motion of 0° to +/-60°. Starting with the software default resting angle setting of 0° (horizontal), it was initially found that yellow glare and green glare was detected for the Project. However, upon further investigation we found that when the resting angle is set to 30° or greater that yellow glare to all receptors for the Project could be eliminated but with some predicted green glare remaining. The scenario that minimises the total amount of glare across the Project is when the resting angle is set to 45°. See **Table 6**.

Table 6 – Summary results: Total predicted glare based on resting angle.

	Green Glare (min/year)					Yellow Glare (min/year)				
Resting Angle	**Total**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**	**Total**	**PV Area A**	**PV Area B**	**PV Area C**	**PV Area D**
0 degrees	33996	0	0	2820	31176	69290	12633	21998	3011	31648
5 degrees	40890	0	0	3683	37207	29281	2512	2401	1986	22382
15 degrees	37738	0	0	0	37738	15414	0	0	0	15414
20 degrees	40018	0	0	0	40018	10018	0	0	0	10018
25 degrees	41292	0	0	0	41292	1859	0	0	0	1859
30 degrees	37207	0	0	0	37207	0	0	0	0	0
45 degrees	35259	0	0	0	35259	0	0	0	0	0
60 degrees	54038	0	0	0	54038	0	0	0	0	0

We therefore recommend that the Resting Angle for the Project is set to 45° to minimise potential glare.

Under the scenarios with the resting angle between 30°-60° (which includes 45°) only green glare is predicted, which is defined as having a low potential for temporary after-image.

For the areas identified to have predicted green glare this can be mitigated through the provision of boundary screen planting or ensuring the identified areas are clear of PVs. Refer to ***Figure 64*** and below:

ROUTE 1 : Mt Rothwell Road

Potential green glare predicted at a single point along Mt Rothwell Road:

Between April and September between 9am-10:30am for a duration of up to 45min.

Mitigation via screen planting recommended or ensure layout is clear of PVs in this area.

ROUTE 3 : Travellers Way

Potential green glare predicted along the length of Travellers Way Road running parallel with the Project's southern boundary:

Between late-Feb and mid-October between 8:20am-11:30am and 1:45pm-4:45pm for a daily duration of up to 225min.

Mitigation via screen planting recommended or ensure layout is clear or PVs in this area.

Figure 64 – Areas of potential glare

Other than the two areas in close proximity to the Project that have been identified, there are no other glare impacts to any other receptors within 1km of the Project. As a result, there would also be no interference expected for viewpoints located at greater distances from the project site. Outside of the two areas identified, under the scenario with resting angle at 45°, no additional glare screening will be required.

Furthermore, risk of glare and glint for road users and surrounding residences around the project may be eliminated by proposed perimeter buffer landscaping which, once established, will ensure that surfaces of the panels are not visible, screening any reflections that would have occurred across the terrain.

Other studies which have assessed the potential glare and glint impact of a similar solar panel configuration (single axis tracking), concluded that for the single axis tracking system, there was no predicted glare.

This is a result of the tilting panels typically tracking the sun, ensuring the panel surfaces remain mostly perpendicular to the angle of the sun. Therefore, glare or glint impacts on surrounding areas is unlikely.

5. AMELIORATION STRATEGIES

Actions exist to potentially ameliorate the landscape and visual impacts of the Project. These are outlined in the following sections.

5.1. ON-SITE ACTIONS

On-site actions relate to initiatives which can be undertaken within the boundaries of the Project area (refer to the ***Landscape Plan Report*** and ***Figure 61***).

5.1.1. Perimeter screen planting

The most effective way to ameliorate views from high sensitivity viewpoints is to establish screen planting around the perimeter of the Project. The Project has exposed boundaries to the east, south and west which could potentially be planted with screening species to ameliorate views. The northern boundary is partially screened by vegetation lining the Little River.

A 2.3 m high chain mesh security fence will be installed 5 m inside the perimeter of the Project boundary. The 5 m offset outside of the security fence will allow for screen planting.

Planting along the western and eastern boundaries, as well sections of the boundaries adjacent to Little River-Ripley Road, will mitigate impacts to VP2, VP3 and VP4, receptors with the highest levels of visual impact.

The Project has been set back from VP2. Additionally, the planting has also been set back from the property boundary to allow for foreground views and with species selected to ensure that the Project is screened, while maintaining views over the Project to the distant Brisbane ranges.

The Project and screen planting have been set back from VP4 to allow for foreground views.

The low-profile form of the majority of the Project, primarily the solar array, which is approximately 3.2 m in height at full tilt, will ensure that planting will be able to provide screening within a relatively short period of time.

5.1.2. Material selection

Although the majority of the Project is of a low profile, with a reflective finish through necessity, taller elements such as transformers and switching substations should be clad with non-reflective materials and be finished in a natural or neutral colour, as found in the landscape of the setting.

5.2. OFF-SITE ACTIONS

These actions relate to initiatives which can be undertaken outside of the project area and would require the consent of relevant landowners, utilities or authorities. However, the assessment has found that all required amelioration can be achieved on the Project site, and no off-site actions are required.

5.2.1. Powerlines

All powerlines for this site are proposed to be trenched. There are no overhead powerlines being proposed for this site.

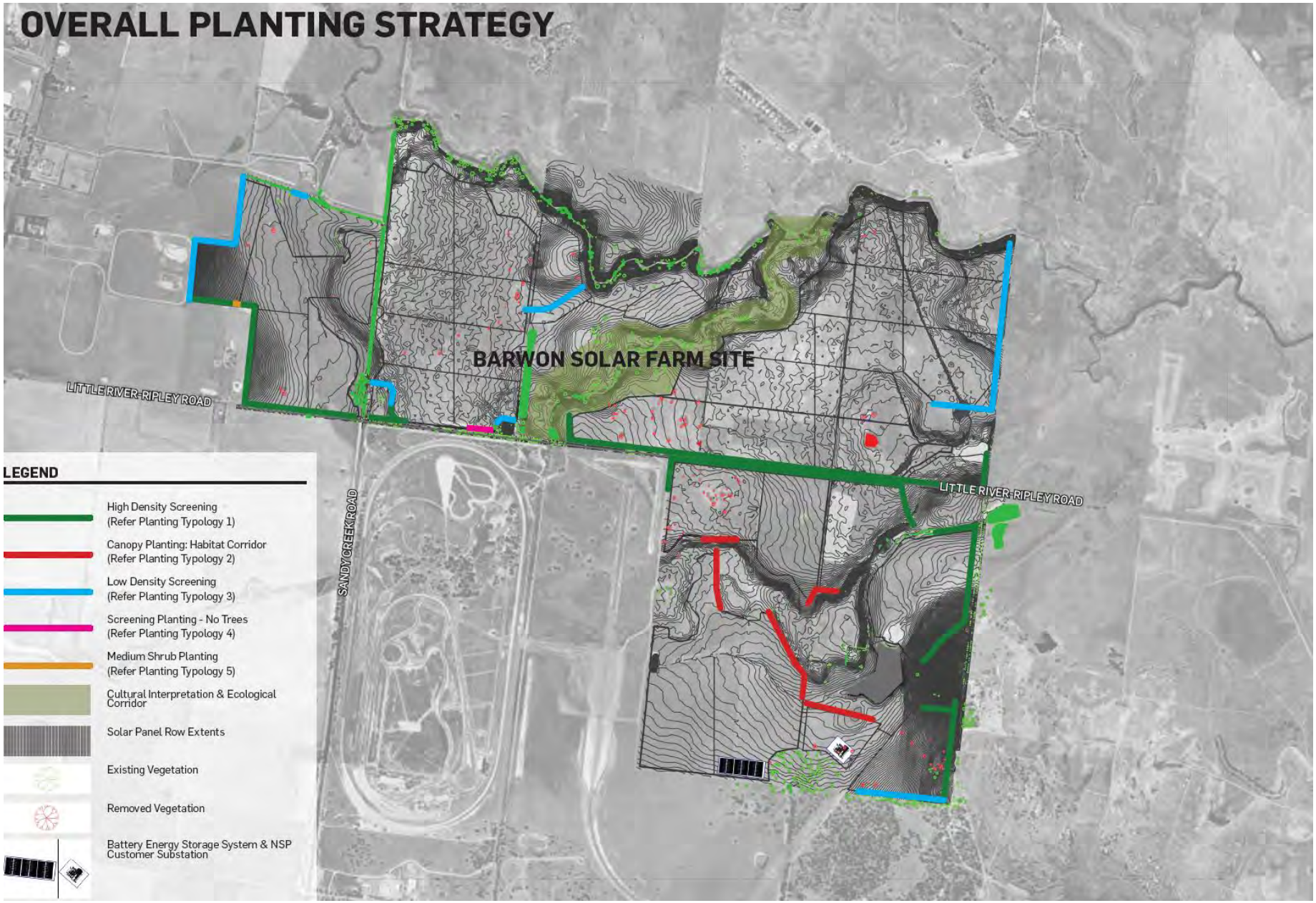

Figure 65 – Landscape Master Plan

6. CONCLUSION

6.1. LANDSCAPE CHARACTER IMPACTS

Although the Project results in a significantly different landscape character from the existing setting when viewed from the air, its low profile will ensure that from ground-based viewing locations, only localised changes to the landscape character will result.

The most visible changes to the landscape character of the existing setting will result to views from three adjacent residences. However, following amelioration, comprised of the establishment of locally indigenous screening vegetation along the Project boundaries, the landscape character will appear similar to the remainder of the regional agricultural landscape and other bands of vegetation that occur through the landscape of the region.

The landscape of the Project setting has a generally high landscape absorptive capacity, as the flat topography does not allow for significant overlooking and the scattered, and occasionally dense vegetation in the area surrounding the Project, provides visual screening, with the extent of screening increasing with distance from the Project.

6.2. VISUAL IMPACTS

Prior to amelioration, three sensitive uses proximate to the Project will result in high levels of impact. These are:

- VP2 – Mt Rothwell Estate residence – High visual impact.
- VP3 – Residence at 1375 Little River-Ripley Road - Moderate to high visual impact.
- VP4 – Residence at 1340 Little River-Ripley Road - Moderate to high visual impact.

Apart from the above, overall, the Project is assessed as having a low level of visual impact on surrounding sensitive viewpoints, primarily due to the limited number of sensitive viewpoints and the relative lack of visibility resulting from existing vegetation throughout the landscape and rising topography. The residual visual impact will typically reduce to very low after the establishment of amelioration measures.

6.3. LIGHTING IMPACTS

Within the Category E2 environmental lighting zone the Project does not result in an increased lighting impact due to there being no requirement for operational lighting. Therefore, the lighting impacts are considered low.

6.4. REFLECTION AND GLARE IMPACTS

Given the tilting solar panels, the flat topography with no opportunities for overlooking of the Project, the potential for impact resulting from reflection or glare is considered to be low. A resting angle of 45° for the Project will minimise predicted glare. Additionally, proposed screen planting around the perimeter of the Project will mitigate this impact.

DISCLAIMER

This report is dated 24th March 2023 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd's (**Urbis**) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of Elgin Energy (**Instructing Party**) for the purpose of a Development Application (**Purpose**) and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements which may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

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This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

APPENDIX A PHOTOSIMULATIONS

URBIS

BARWON SOLAR FARM, LITTLE RIVER

VISUAL ASSESSMENT - PHOTO-SIMULATIONS

PREPARED FOR
ELGIN ENERGY
MARCH 2023

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

PHOTO-SIMULATIONS - VIEW LOCATION MAP

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_MAP
REV: -

ORIGINAL PHOTO EXTENT - 24MM WIDE ANGLE VIEW

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 2 (PHOTO 7144) LOOKING WEST, MT ROTHWELL ESTATE | EXISTING PHOTO : 2022-02-02 14:03 AEDT

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_02A
REV: -

DISTANCE TO PROJECT - 120M
ORIGINAL PHOTO EXTENT - 24MM WIDE ANGLE VIEW

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 2 (PHOTO 7144) LOOKING WEST, MT ROTHWELL ESTATE | PHOTO-SIMULATION - PROPOSED

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_02B
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 2 (PHOTO 7144) LOOKING WEST, MT ROTHWELL ESTATE | PHOTO-SIMULATION - PROPOSED WITH 5YR VEGETATION

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_02C
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 3 (PHOTO 6944) LOOKING ENE, LITTLE RIVER-RIPLEY ROAD | EXISTING PHOTO : 2022-02-02 14:15 AEDT

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_03A
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 3 (PHOTO 6944) LOOKING ENE, LITTLE RIVER-RIPLEY ROAD | PHOTO-SIMULATION - PROPOSED

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_03B
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 3 (PHOTO 6944) LOOKING ENE, LITTLE RIVER-RIPLEY ROAD | PHOTO-SIMULATION - PROPOSED WITH 5YR VEGETATION

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_03C
REV: -

ORIGINAL PHOTO EXTENT - 24MM WIDE ANGLE VIEW

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 4 (PHOTO 7187) LOOKING ESE, RESIDENCE - LITTLE RIVER-RIPLEY ROAD | EXISTING PHOTO : 2022-07-11 11:46 AEST

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_04A
REV: -

DISTANCE TO PROJECT - 70M
ORIGINAL PHOTO EXTENT - 24MM WIDE ANGLE VIEW

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 4 (PHOTO 7187) LOOKING ESE, RESIDENCE - LITTLE RIVER-RIPLEY ROAD | PHOTO-SIMULATION - PROPOSED

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_04B
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 4 (PHOTO 7187) LOOKING ESE, RESIDENCE - LITTLE RIVER-RIPLEY ROAD | PHOTO-SIMULATION - PROPOSED WITH 5YR VEGETATION

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_04C
REV: -

ORIGINAL PHOTO EXTENT - 24MM WIDE ANGLE VIEW

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 12 (PHOTO 6886) LOOKING NORTH, FLINDERS PEAK - YOU YANGS REGIONAL PARK | EXISTING PHOTO : 2022-02-02 14:56 AEDT

DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_12A
REV: -

URBIS

BARWON SOLAR FARM - VISUAL ASSESSMENT

VP 12 (PHOTO 6886) LOOKING NORTH, FLINDERS PEAK - YOU YANGS REGIONAL PARK | PHOTO-SIMULATION - PROPOSED

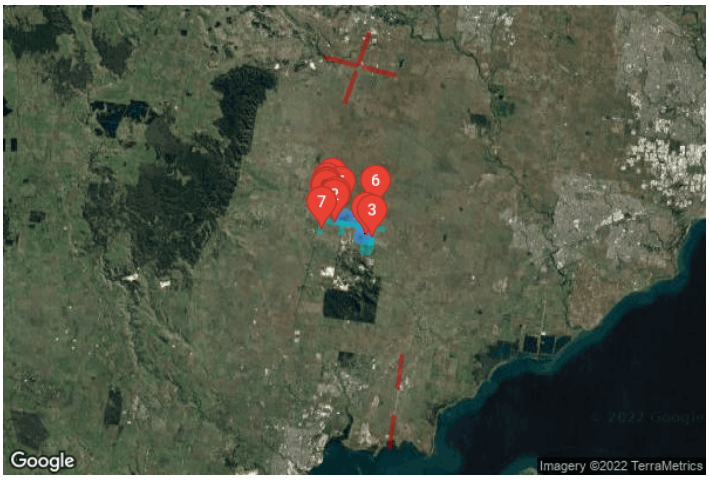
DATE: 2023-03-24
JOB NO: P0031400
DWG NO: VP_12B
REV: -

APPENDIX B GLINT AND GLARE ANALYSIS SOLAR FORGE RESULTS: – 45° RESTING ANGLE SCENARIO

FORGESOLAR GLARE ANALYSIS

Project: **P0031400_BarwonSolarFarm**
Site configuration: **BarwonSF_Layout_20221013_45DegRest**

Created 13 Oct, 2022
Updated 13 Oct, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 77483.13239
Category 100 MW to 1 GW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2



Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV_AreaA	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaB	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaC	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaD	SA tracking	SA tracking	35,259	587.6	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

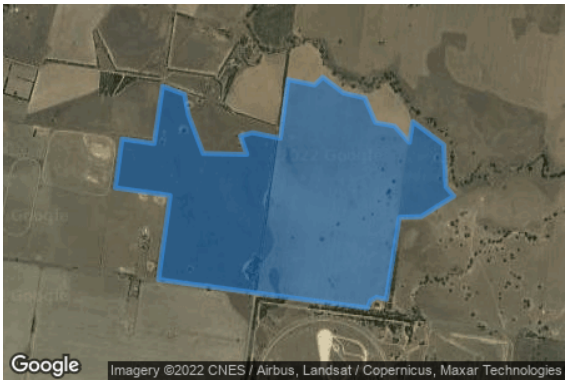
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	4,786	79.8	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 3_TravellersWay	30,473	507.9	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV_AreaA
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Ground Coverage Ratio: 0.442
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

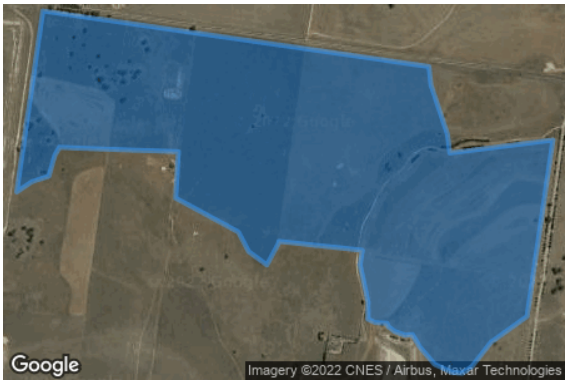


Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.867726	144.403757	100.00	2.17	102.17
2	-37.868724	144.404193	99.40	2.17	101.58
3	-37.868671	144.401188	101.80	2.17	103.97
4	-37.866585	144.400177	102.30	2.17	104.47
5	-37.865476	144.399899	102.30	2.17	104.47
6	-37.865033	144.398399	103.50	2.17	105.67
7	-37.868136	144.397820	103.30	2.17	105.47
8	-37.867883	144.395613	112.40	2.17	114.58
9	-37.870530	144.395150	114.70	2.17	116.88
10	-37.870945	144.398922	103.00	2.17	105.17
11	-37.875495	144.398116	104.20	2.17	106.38
12	-37.877033	144.412473	94.50	2.17	96.67
13	-37.876629	144.412699	94.30	2.17	96.47
14	-37.876447	144.413100	93.70	2.17	95.88
15	-37.876560	144.413779	93.30	2.17	95.47
16	-37.872122	144.414679	94.50	2.17	96.67
17	-37.872088	144.416179	94.30	2.17	96.47
18	-37.870978	144.418422	93.00	2.17	95.17
19	-37.870459	144.417865	92.10	2.17	94.27
20	-37.868206	144.417727	90.60	2.17	92.77
21	-37.866946	144.415595	93.60	2.17	95.77
22	-37.868077	144.415361	93.70	2.17	95.88
23	-37.867188	144.414341	95.10	2.17	97.27
24	-37.867001	144.413033	95.80	2.17	97.97
25	-37.865673	144.412308	94.80	2.17	96.97
26	-37.865398	144.410832	95.70	2.17	97.88
27	-37.864544	144.409409	97.80	2.17	99.97
28	-37.864972	144.408853	98.20	2.17	100.38
29	-37.864673	144.407027	95.70	2.17	97.88
30	-37.867850	144.406490	99.30	2.17	101.47
31	-37.867546	144.404570	99.90	2.17	102.08
32	-37.867726	144.403757	100.00	2.17	102.17

Name: PV_AreaB
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Ground Coverage Ratio: 0.442
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.877589	144.416961	93.30	2.17	95.47
2	-37.880302	144.440831	92.10	2.17	94.27
3	-37.878731	144.441108	87.00	2.17	89.17
4	-37.878026	144.437157	87.00	2.17	89.17
5	-37.875047	144.435831	88.20	2.17	90.38
6	-37.874880	144.436358	88.80	2.17	90.97
7	-37.876391	144.438184	89.40	2.17	91.58
8	-37.876736	144.441477	88.90	2.17	91.08
9	-37.869075	144.442801	83.30	2.17	85.47
10	-37.869645	144.439806	85.80	2.17	87.97
11	-37.869474	144.438680	87.00	2.17	89.17
12	-37.867502	144.437874	84.70	2.17	86.88
13	-37.867086	144.435372	86.60	2.17	88.77
14	-37.868084	144.433192	86.40	2.17	88.58
15	-37.867977	144.432719	84.20	2.17	86.38
16	-37.869146	144.431852	84.20	2.17	86.38
17	-37.869451	144.431129	85.10	2.17	87.27
18	-37.869378	144.429876	84.60	2.17	86.77
19	-37.869652	144.429396	84.30	2.17	86.47
20	-37.869911	144.426647	87.10	2.17	89.27
21	-37.870272	144.423736	91.90	2.17	94.08
22	-37.870658	144.421836	92.40	2.17	94.58
23	-37.871387	144.420401	92.30	2.17	94.47
24	-37.871944	144.420074	91.70	2.17	93.88
25	-37.872480	144.422280	90.40	2.17	92.58
26	-37.871171	144.427756	86.70	2.17	88.88
27	-37.871277	144.428679	84.40	2.17	86.58
28	-37.870361	144.429740	84.80	2.17	86.97
29	-37.870738	144.430274	85.00	2.17	87.17
30	-37.871717	144.430365	88.30	2.17	90.47
31	-37.872597	144.429636	89.40	2.17	91.58
32	-37.872913	144.425801	88.20	2.17	90.38
33	-37.874338	144.425106	89.50	2.17	91.67
34	-37.874019	144.423555	89.70	2.17	91.88
35	-37.875502	144.422764	91.60	2.17	93.77
36	-37.875562	144.420285	92.00	2.17	94.17
37	-37.876444	144.416960	93.10	2.17	95.27
38	-37.877589	144.416961	93.30	2.17	95.47

Name: PV_AreaC
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Ground Coverage Ratio: 0.442
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.878583	144.422854	92.00	2.17	94.17
2	-37.883472	144.421957	96.50	2.17	98.67
3	-37.883198	144.422477	96.00	2.17	98.17
4	-37.883043	144.423063	96.20	2.17	98.38
5	-37.882470	144.423272	94.60	2.17	96.77
6	-37.882265	144.423423	93.90	2.17	96.08
7	-37.882289	144.424068	93.60	2.17	95.77
8	-37.882385	144.427512	91.10	2.17	93.27
9	-37.883642	144.427419	93.00	2.17	95.17
10	-37.884555	144.429574	92.40	2.17	94.58
11	-37.885084	144.429926	93.50	2.17	95.67
12	-37.885446	144.430553	94.50	2.17	96.67
13	-37.884851	144.430957	92.80	2.17	94.97
14	-37.884808	144.430965	92.60	2.17	94.77
15	-37.885049	144.433835	93.90	2.17	96.08
16	-37.885439	144.433753	94.00	2.17	96.17
17	-37.886445	144.434029	93.60	2.17	95.77
18	-37.886910	144.434026	93.60	2.17	95.77
19	-37.887003	144.434276	92.90	2.17	95.08
20	-37.887020	144.434677	92.10	2.17	94.27
21	-37.887118	144.434732	92.10	2.17	94.27
22	-37.887244	144.434946	92.00	2.17	94.17
23	-37.887346	144.435315	92.00	2.17	94.17
24	-37.887324	144.435553	92.00	2.17	94.17
25	-37.887676	144.435819	92.80	2.17	94.97
26	-37.888132	144.436319	95.60	2.17	97.77
27	-37.888357	144.436936	99.00	2.17	101.17
28	-37.888370	144.437269	100.90	2.17	103.08
29	-37.888191	144.437598	102.40	2.17	104.58
30	-37.887533	144.438254	104.00	2.17	106.17
31	-37.886836	144.439493	102.80	2.17	104.97
32	-37.882070	144.440383	92.90	2.17	95.08
33	-37.882422	144.436840	92.20	2.17	94.38
34	-37.881919	144.436759	92.30	2.17	94.47
35	-37.880585	144.436191	88.10	2.17	90.27
36	-37.880085	144.436121	87.30	2.17	89.47
37	-37.878583	144.422854	92.00	2.17	94.17

Name: PV_AreaD
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Ground Coverage Ratio: 0.442
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.892190	144.431172	93.80	2.17	95.97
2	-37.893428	144.432867	95.90	2.17	98.08
3	-37.893967	144.432304	95.90	2.17	98.08
4	-37.894632	144.438105	109.30	2.17	111.47
5	-37.890548	144.438841	109.30	2.17	111.47
6	-37.890234	144.436436	97.00	2.17	99.17
7	-37.891136	144.435416	94.70	2.17	96.88
8	-37.890712	144.433624	93.00	2.17	95.17
9	-37.889981	144.430001	92.80	2.17	94.97
10	-37.888769	144.430200	94.20	2.17	96.38
11	-37.885750	144.428164	95.10	2.17	97.27
12	-37.885497	144.427396	94.90	2.17	97.08
13	-37.885903	144.426819	94.70	2.17	96.88
14	-37.885510	144.425389	94.80	2.17	96.97
15	-37.884033	144.425236	95.30	2.17	97.47
16	-37.882856	144.425284	95.30	2.17	97.47
17	-37.882862	144.424501	95.40	2.17	97.58
18	-37.883258	144.423647	95.70	2.17	97.88
19	-37.884134	144.423786	95.40	2.17	97.58
20	-37.885190	144.423260	95.40	2.17	97.58
21	-37.886240	144.423878	95.10	2.17	97.27
22	-37.886422	144.423863	95.10	2.17	97.27
23	-37.886797	144.423372	95.10	2.17	97.27
24	-37.886861	144.422966	95.10	2.17	97.27
25	-37.886683	144.422330	95.40	2.17	97.58
26	-37.886391	144.422366	95.70	2.17	97.88
27	-37.886215	144.422290	95.70	2.17	97.88
28	-37.886117	144.421397	95.80	2.17	97.97
29	-37.887793	144.421120	95.20	2.17	97.38
30	-37.888220	144.421086	95.10	2.17	97.27
31	-37.892636	144.420322	97.20	2.17	99.38
32	-37.893483	144.427933	95.80	2.17	97.97
33	-37.892496	144.427948	94.90	2.17	97.08
34	-37.892155	144.428364	94.60	2.17	96.77
35	-37.892017	144.429630	94.10	2.17	96.27
36	-37.892132	144.429816	94.10	2.17	96.27
37	-37.892125	144.430812	93.80	2.17	95.97
38	-37.892190	144.431172	93.80	2.17	95.97

Route Receptors

Name: Route 1_MtRothwellRd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.880556	144.441948	94.86	1.50	96.36
2	-37.880944	144.441854	95.19	1.50	96.69
3	-37.881336	144.441053	95.29	1.50	96.79
4	-37.881520	144.440866	95.50	1.50	97.00
5	-37.889048	144.439469	114.98	1.50	116.48
6	-37.890925	144.439110	109.92	1.50	111.42
7	-37.891283	144.439104	109.71	1.50	111.21
8	-37.894828	144.438434	110.39	1.50	111.89
9	-37.898544	144.437943	113.74	1.50	115.24
10	-37.899105	144.437502	116.29	1.50	117.79
11	-37.899612	144.436576	120.30	1.50	121.80
12	-37.900530	144.435692	123.98	1.50	125.48
13	-37.901841	144.435692	122.53	1.50	124.03
14	-37.902274	144.435319	121.45	1.50	122.95
15	-37.903290	144.434483	121.49	1.50	122.99

Name: Route 2_LittleRiver-RipleyRoad
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.881705	144.452171	87.50	1.50	89.00
2	-37.880440	144.440917	93.50	1.50	95.00
3	-37.877600	144.415887	91.00	1.50	92.50
4	-37.876344	144.404841	99.60	1.50	101.10
5	-37.875476	144.397112	104.10	1.50	105.60
6	-37.873728	144.381841	109.00	1.50	110.50

Name: Route 3_TravellersWay
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.894766	144.438446	110.70	1.50	112.20
2	-37.894073	144.432352	96.30	1.50	97.80
3	-37.897278	144.429069	102.70	1.50	104.20
4	-37.902608	144.428020	122.40	1.50	123.90

Name: Route 4_SandyCreekRd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.876339	144.404794	104.70	1.50	106.20
2	-37.878922	144.404307	102.20	1.50	103.70
3	-37.885235	144.403163	100.00	1.50	101.50

Name: Route 5_BacchusMarshRd
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.849444	144.387270	109.20	1.50	110.70
2	-37.856624	144.387639	105.50	1.50	107.00
3	-37.857536	144.387652	107.00	1.50	108.50
4	-37.858170	144.387571	107.50	1.50	109.00
5	-37.859373	144.387146	107.90	1.50	109.40
6	-37.863011	144.385791	110.00	1.50	111.50
7	-37.867809	144.384020	109.00	1.50	110.50
8	-37.873728	144.381841	109.00	1.50	110.50
9	-37.882570	144.378598	106.90	1.50	108.40
10	-37.884190	144.377948	107.00	1.50	108.50

Name: Route 6_Moreton-MtRothwellRds
Path type: Two-way
Observer view angle: 50.0°

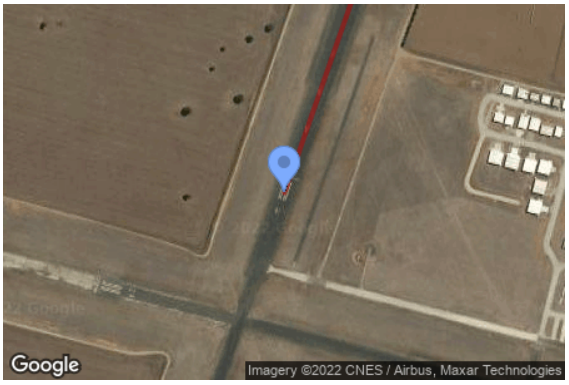
Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.859201	144.425085	96.63	1.50	98.13
2	-37.859869	144.425161	96.08	1.50	97.58
3	-37.860191	144.425580	94.35	1.50	95.85
4	-37.860240	144.426176	93.24	1.50	94.74
5	-37.864554	144.432407	90.24	1.50	91.74
6	-37.865335	144.434785	89.02	1.50	90.52
7	-37.865342	144.435290	88.41	1.50	89.91
8	-37.864876	144.436230	86.83	1.50	88.33
9	-37.864655	144.437426	87.94	1.50	89.44
10	-37.865424	144.438915	87.82	1.50	89.32
11	-37.864840	144.441877	88.96	1.50	90.46
12	-37.864843	144.443565	86.62	1.50	88.12
13	-37.864429	144.444243	83.50	1.50	85.00
14	-37.864005	144.444354	79.48	1.50	80.98
15	-37.863281	144.444126	84.04	1.50	85.54
16	-37.859767	144.444783	90.81	1.50	92.31

Flight Path Receptors

Name: FP 1_BacchusMarsh01
Description: None
Threshold height: 15 m
Direction: 19.2°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-37.736874	144.420027	159.30	15.20	174.50
Two-mile	-37.764171	144.407960	152.70	190.50	343.20

Name: FP 2_BacchusMarsh19
Description: None
Threshold height: 15 m
Direction: 199.3°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-37.729081	144.423482	155.00	15.20	170.20
Two-mile	-37.701795	144.435585	139.10	199.80	338.90

Name: FP 3_BacchusMarsh09
Description: None
Threshold height: 15 m
Direction: 104.6°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-37.730376	144.420515	157.40	15.30	172.70
Two-mile	-37.723113	144.385089	214.70	126.60	341.30

Name: FP 4_BacchusMarsh27
Description: None
Threshold height: 15 m
Direction: 284.5°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-37.732293	144.429918	153.00	15.20	168.20
Two-mile	-37.739537	144.465351	149.30	187.60	336.90

Name: FP 5_Avalon18
Description: None
Threshold height: 15 m
Direction: 187.6°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-38.027431	144.469396	11.00	15.20	26.20
Two-mile	-37.998770	144.474231	21.00	173.90	194.90

Name: FP 6_Avalon36
Description: None
Threshold height: 15 m
Direction: 7.4°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-38.054234	144.464874	10.00	15.20	25.20
Two-mile	-38.082905	144.460126	0.00	193.90	193.90

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.873482	144.397246	111.70	1.65
OP 2	2	-37.876011	144.396575	104.00	1.65
OP 3	3	-37.889959	144.440004	117.40	1.65
OP 4	4	-37.887639	144.432912	97.40	1.65
OP 5	5	-37.863706	144.403269	100.20	1.65
OP 6	6	-37.863016	144.443749	84.80	1.65
OP 7	7	-37.882419	144.381104	107.00	1.65
OP 8	8	-37.867113	144.385211	108.70	1.65
OP 9	9	-37.864371	144.386567	109.10	1.65
OP 10	10	-37.865368	144.386534	109.00	1.65
OP 11	11	-37.860713	144.387226	108.80	1.65
OP 12	12	-37.867289	144.386108	109.30	1.65
OP 13	13	-37.856071	144.393528	105.40	1.65

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV_AreaA	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaB	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaC	SA tracking	SA tracking	0	0.0	0	0.0	-
PV_AreaD	SA tracking	SA tracking	35,259	587.6	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	4,786	79.8	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 3_TravellersWay	30,473	507.9	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV: PV_AreaA no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	0	0.0	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 3_TravellersWay	0	0.0	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV_AreaA and Route 1_MtRothwellRd

Receptor type: Route
No glare found

PV_AreaA and Route 2_LittleRiver-RipleyRoad

Receptor type: Route
No glare found

PV_AreaA and Route 3_TravellersWay

Receptor type: Route
No glare found

PV_AreaA and Route 4_SandyCreekRd

Receptor type: Route
No glare found

PV_AreaA and Route 5_BacchusMarshRd

Receptor type: Route
No glare found

PV_AreaA and Route 6_Moreton-MtRothwellRds

Receptor type: Route
No glare found

PV_AreaA and FP 1_BacchusMarsh01

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and FP 2_BacchusMarsh19

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and FP 3_BacchusMarsh09

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and FP 4_BacchusMarsh27

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and FP 5_Avalon18

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and FP 6_Avalon36

Receptor type: 2-mile Flight Path
No glare found

PV_AreaA and OP 1

Receptor type: Observation Point
No glare found

PV_AreaA and OP 2

Receptor type: Observation Point
No glare found

PV_AreaA and OP 3

Receptor type: Observation Point
No glare found

PV_AreaA and OP 4

Receptor type: Observation Point
No glare found

PV_AreaA and OP 5

Receptor type: Observation Point
No glare found

PV_AreaA and OP 6

Receptor type: Observation Point
No glare found

PV_AreaA and OP 7

Receptor type: Observation Point
No glare found

PV_AreaA and OP 8

Receptor type: Observation Point
No glare found

PV_AreaA and OP 9

Receptor type: Observation Point
No glare found

PV_AreaA and OP 10

Receptor type: Observation Point
No glare found

PV_AreaA and OP 11

Receptor type: Observation Point
No glare found

PV_AreaA and OP 12

Receptor type: Observation Point
No glare found

PV_AreaA and OP 13

Receptor type: Observation Point
No glare found

PV: PV_AreaB no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	0	0.0	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 3_TravellersWay	0	0.0	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV_AreaB and Route 1_MtRothwellRd

Receptor type: Route
No glare found

PV_AreaB and Route 2_LittleRiver-RipleyRoad

Receptor type: Route
No glare found

PV_AreaB and Route 3_TravellersWay

Receptor type: Route
No glare found

PV_AreaB and Route 4_SandyCreekRd

Receptor type: Route
No glare found

PV_AreaB and Route 5_BacchusMarshRd

Receptor type: Route
No glare found

PV_AreaB and Route 6_Moreton-MtRothwellRds

Receptor type: Route
No glare found

PV_AreaB and FP 1_BacchusMarsh01

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and FP 2_BacchusMarsh19

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and FP 3_BacchusMarsh09

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and FP 4_BacchusMarsh27

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and FP 5_Avalon18

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and FP 6_Avalon36

Receptor type: 2-mile Flight Path
No glare found

PV_AreaB and OP 1

Receptor type: Observation Point
No glare found

PV_AreaB and OP 2

Receptor type: Observation Point
No glare found

PV_AreaB and OP 3

Receptor type: Observation Point
No glare found

PV_AreaB and OP 4

Receptor type: Observation Point
No glare found

PV_AreaB and OP 5

Receptor type: Observation Point
No glare found

PV_AreaB and OP 6

Receptor type: Observation Point
No glare found

PV_AreaB and OP 7

Receptor type: Observation Point
No glare found

PV_AreaB and OP 8

Receptor type: Observation Point
No glare found

PV_AreaB and OP 9

Receptor type: Observation Point
No glare found

PV_AreaB and OP 10

Receptor type: Observation Point
No glare found

PV_AreaB and OP 11

Receptor type: Observation Point
No glare found

PV_AreaB and OP 12

Receptor type: Observation Point
No glare found

PV_AreaB and OP 13

Receptor type: Observation Point
No glare found

PV: PV_AreaC no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	0	0.0	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 3_TravellersWay	0	0.0	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV_AreaC and Route 1_MtRothwellRd

Receptor type: Route
No glare found

PV_AreaC and Route 2_LittleRiver-RipleyRoad

Receptor type: Route
No glare found

PV_AreaC and Route 3_TravellersWay

Receptor type: Route
No glare found

PV_AreaC and Route 4_SandyCreekRd

Receptor type: Route
No glare found

PV_AreaC and Route 5_BacchusMarshRd

Receptor type: Route
No glare found

PV_AreaC and Route 6_Moreton-MtRothwellRds

Receptor type: Route
No glare found

PV_AreaC and FP 1_BacchusMarsh01

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and FP 2_BacchusMarsh19

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and FP 3_BacchusMarsh09

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and FP 4_BacchusMarsh27

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and FP 5_Avalon18

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and FP 6_Avalon36

Receptor type: 2-mile Flight Path
No glare found

PV_AreaC and OP 1

Receptor type: Observation Point
No glare found

PV_AreaC and OP 2

Receptor type: Observation Point
No glare found

PV_AreaC and OP 3

Receptor type: Observation Point
No glare found

PV_AreaC and OP 4

Receptor type: Observation Point
No glare found

PV_AreaC and OP 5

Receptor type: Observation Point
No glare found

PV_AreaC and OP 6

Receptor type: Observation Point
No glare found

PV_AreaC and OP 7

Receptor type: Observation Point
No glare found

PV_AreaC and OP 8

Receptor type: Observation Point
No glare found

PV_AreaC and OP 9

Receptor type: Observation Point
No glare found

PV_AreaC and OP 10

Receptor type: Observation Point
No glare found

PV_AreaC and OP 11

Receptor type: Observation Point
No glare found

PV_AreaC and OP 12

Receptor type: Observation Point
No glare found

PV_AreaC and OP 13

Receptor type: Observation Point
No glare found

PV: PV_AreaD low potential for temporary after-image

Receptor results ordered by category of glare

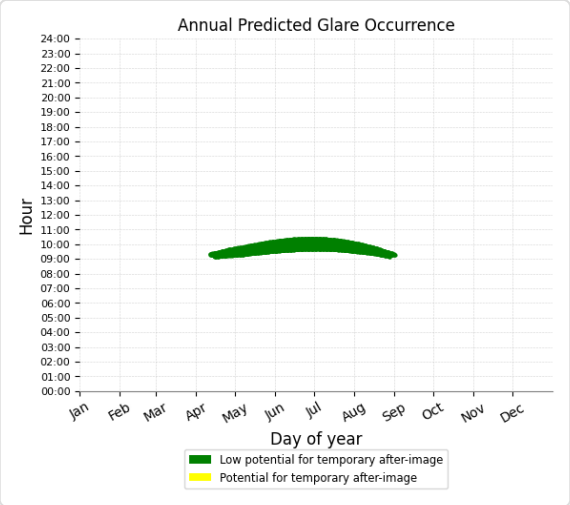
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1_MtRothwellRd	4,786	79.8	0	0.0
Route 3_TravellersWay	30,473	507.9	0	0.0
Route 2_LittleRiver-RipleyRoad	0	0.0	0	0.0
Route 4_SandyCreekRd	0	0.0	0	0.0
Route 5_BacchusMarshRd	0	0.0	0	0.0
Route 6_Moreton-MtRothwellRds	0	0.0	0	0.0
FP 1_BacchusMarsh01	0	0.0	0	0.0
FP 2_BacchusMarsh19	0	0.0	0	0.0
FP 3_BacchusMarsh09	0	0.0	0	0.0
FP 4_BacchusMarsh27	0	0.0	0	0.0
FP 5_Avalon18	0	0.0	0	0.0
FP 6_Avalon36	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

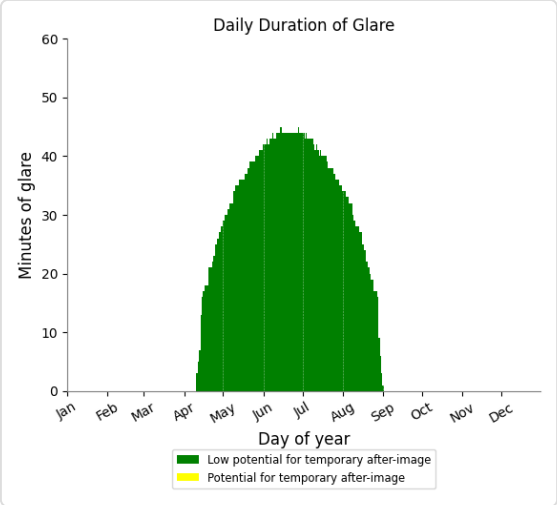
PV_AreaD and Route 1_MtRothwellRd

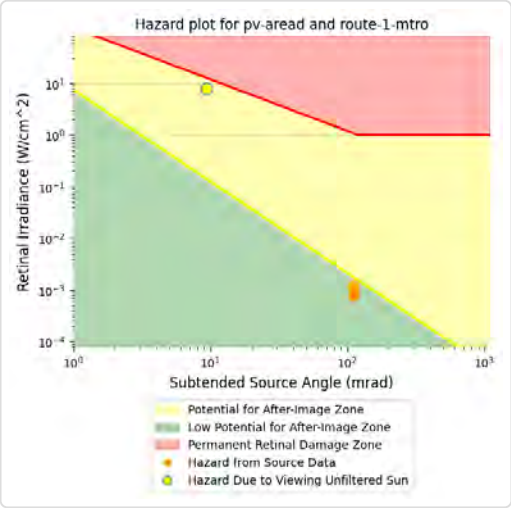
Receptor type: Route

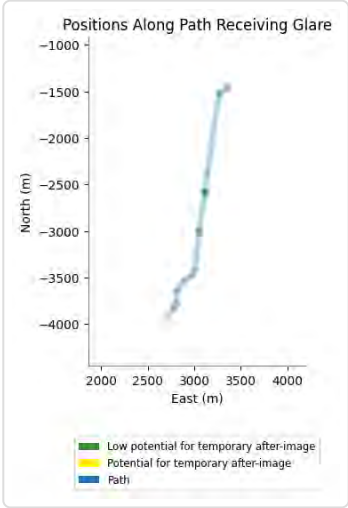
0 minutes of yellow glare

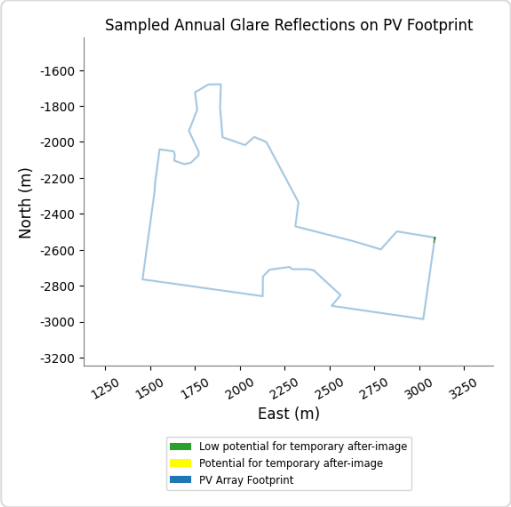
4,786 minutes of green glare









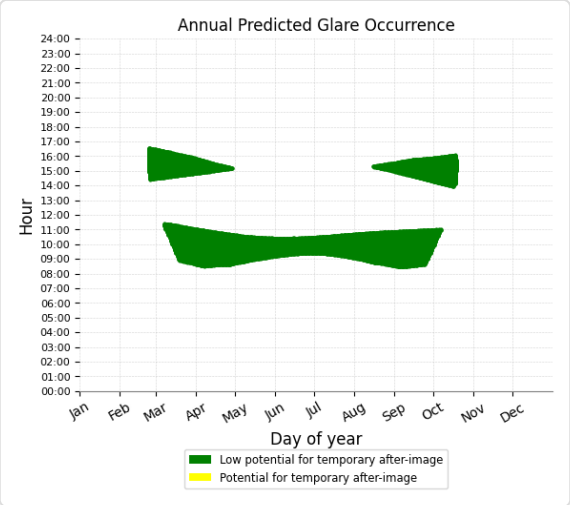


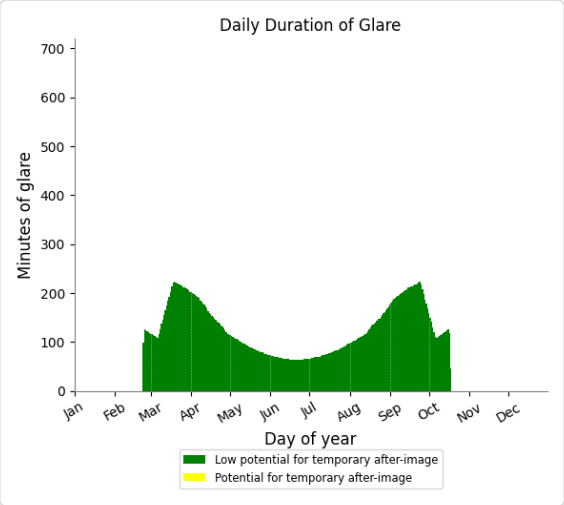
PV_AreaD and Route 3_TravellersWay

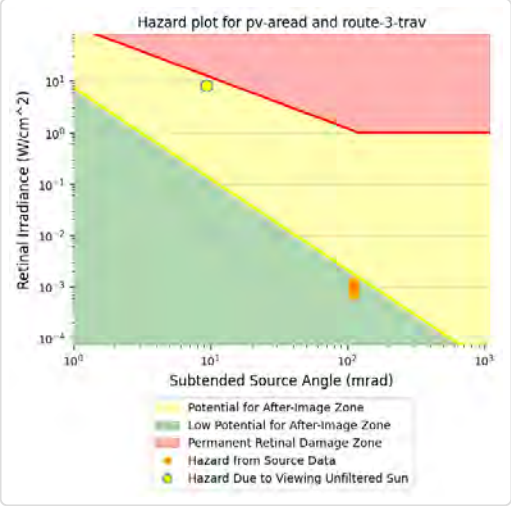
Receptor type: Route

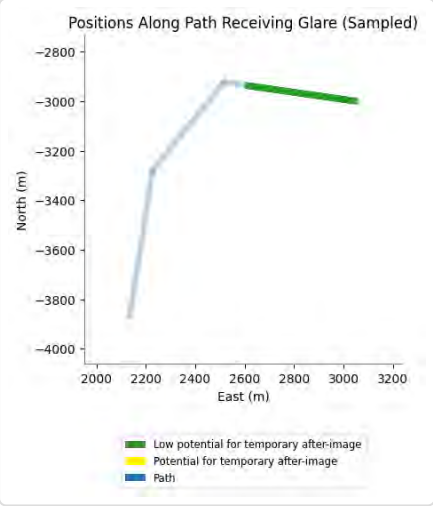
0 minutes of yellow glare

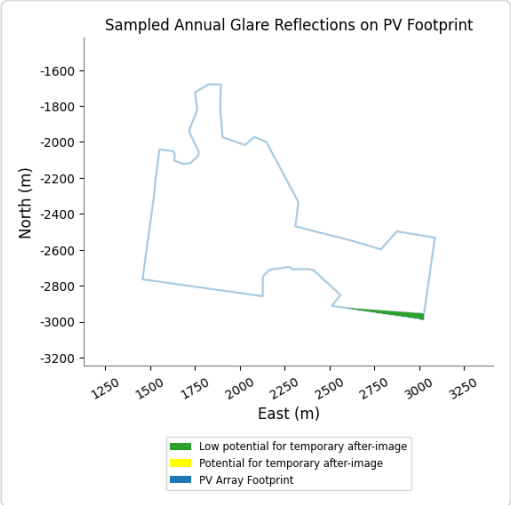
30,473 minutes of green glare











PV_AreaD and Route 2_LittleRiver-RipleyRoad

Receptor type: Route
No glare found

PV_AreaD and Route 4_SandyCreekRd

Receptor type: Route
No glare found

PV_AreaD and Route 5_BacchusMarshRd

Receptor type: Route
No glare found

PV_AreaD and Route 6_Moreton-MtRothwellRds

Receptor type: Route
No glare found

PV_AreaD and FP 1_BacchusMarsh01

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and FP 2_BacchusMarsh19

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and FP 3_BacchusMarsh09

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and FP 4_BacchusMarsh27

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and FP 5_Avalon18

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and FP 6_Avalon36

Receptor type: 2-mile Flight Path
No glare found

PV_AreaD and OP 1

Receptor type: Observation Point
No glare found

PV_AreaD and OP 2

Receptor type: Observation Point
No glare found

PV_AreaD and OP 3

Receptor type: Observation Point
No glare found

PV_AreaD and OP 4

Receptor type: Observation Point
No glare found

PV_AreaD and OP 5

Receptor type: Observation Point
No glare found

PV_AreaD and OP 6

Receptor type: Observation Point
No glare found

PV_AreaD and OP 7

Receptor type: Observation Point
No glare found

PV_AreaD and OP 8

Receptor type: Observation Point
No glare found

PV_AreaD and OP 9

Receptor type: Observation Point
No glare found

PV_AreaD and OP 10

Receptor type: Observation Point
No glare found

PV_AreaD and OP 11

Receptor type: Observation Point
No glare found

PV_AreaD and OP 12

Receptor type: Observation Point
No glare found

PV_AreaD and OP 13

Receptor type: Observation Point
No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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