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Elaine Solar Farm

Landscape and Visual Impact and Visual Assessment Report

10th November 2023

THIS REPORT HAS BEEN PREPARED FOR URBIS PTY LTD ON BEHALF OF ELGIN ENERGY

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Quality Assurance

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1 INTRODUCTION

Elgin Energy (the applicant) plans to submit a Planning Application for the development of a solar installation on the Midland Highway, Elaine. The Project is located approximately 12 kilometres (km) northeast of Meredith and approximately 80 km west of Melbourne (refer to ***Figure 1***).

The Elaine Solar Farm (the Project) involves the erection of approximately 256,866 individual solar panels on two sites of a total of approximately 246 hectares (ha), as well as the installation of inverters, transformers and the construction of a battery energy system.

The site will encompass the following properties:

- The western block (Windy property) – 171.04 ha
- The eastern block (Peter's property) – 74.84 ha

The development will be situated to the east and west of the Midland Highway and north of the existing HV transmission lines and Lal Lal Wind Farm.

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

Photo simulations, theoretical zone of visual influence (TZVI) mapping and glint and glare analysis included in this report have been prepared by Urbis.

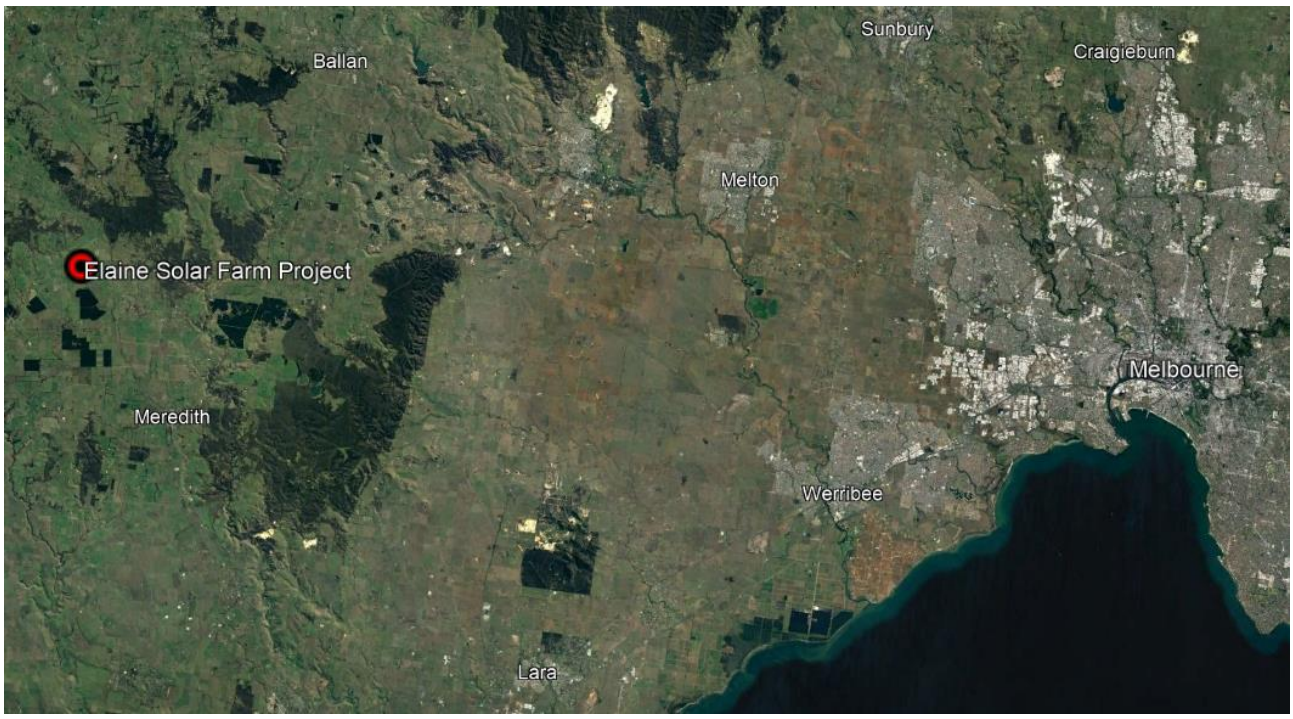


Figure 1 - Site location (Source: Google Earth).

2 METHODOLOGY

2.1 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).
- Guidance Note for Landscape and Visual Assessment, Australian Institute of Landscape Architects (AILA) (2018).

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.

2.2 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 (refer to ***Table 1***).

Level of Visual Impact N/A = Not Apparent, VL = Very Low, L = Low, M = Moderate, H = High		Visual/Viewer Sensitivity		
		H	M	L
Level of Visual Modification to the Setting	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 determination matrix.

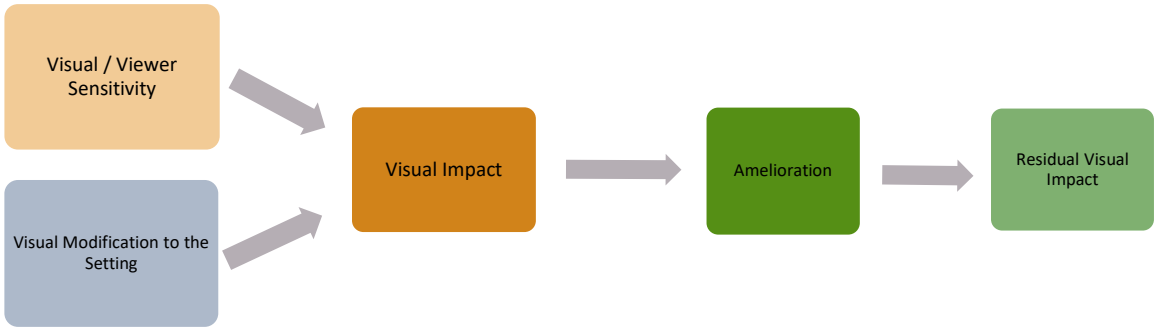


Diagram 1 – Visual impact assessment process.

2.2.1 Visual sensitivity

In this report, the approach to the visual sensitivity is consistent with the USDAFS visual management system[1].

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.

[1] Landscape Aesthetics – A Handbook for Scenery Management, Agricultural Handbook No. 701. United States Department of Agriculture Forest Service (1995).

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 – 4 km); and
- background (> 4 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 km	2 – 4 km	> 4 km
Residences/Townships	H	H	H	M	L
Tourism	H	H	H	M	L
Highways	H	M	M	L	L
Passenger Rail	M	M	L	L	L
Secondary Roads	M	L	L	L	VL
Local Roads	L	L	L	VL	VL
Agricultural Areas	L	L	L	VL	VL
Forestry	VL	VL	VL	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.

2.2.2 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.

2.2.3 Residual impacts

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.

2.3 Lighting impacts

AS-NZS-4282-2019 Control of the obtrusive effects of outdoor lighting provides standards for the assessment and limitation of lighting impacts. The standard 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 A1), whereas a city centre with high levels of night-time activity would be categorised as a high district brightness area (Category A4).

The standard is aimed at the minimisation of light spill. Regardless of the existing brightness of a particular setting, it is a widely accepted principle that light spill, particularly upward light spill, be minimised wherever possible.

2.3.1 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.

2.4 Glint and glare 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 by Urbis 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.

2.5 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.

3 PROJECT CONTEXT AND SETTING APPRAISAL

3.1 Project context

The Project is comprised of two main parcels of land located to the east and west of the Midland Highway, between Woolshed Road to the north and Murphys Road to the south. The Melbourne Ballarat Railway Line is located approximately 1km to the east. The western parcel immediately abuts approximately 1.7km of the Midland Highway, while the eastern parcel is offset approximately 850 metres (m) to the east of the highway (refer to ***Figure 2***).

The township of Meredith and the settlement of Elaine are located approximately 12km and 4.3km, respectively, to the south of the Project.

The Elaine section of the Lal Lal wind farm abuts the Project immediately to the south and west and interconnector and high voltage transmission lines are located throughout the broader landscape setting.

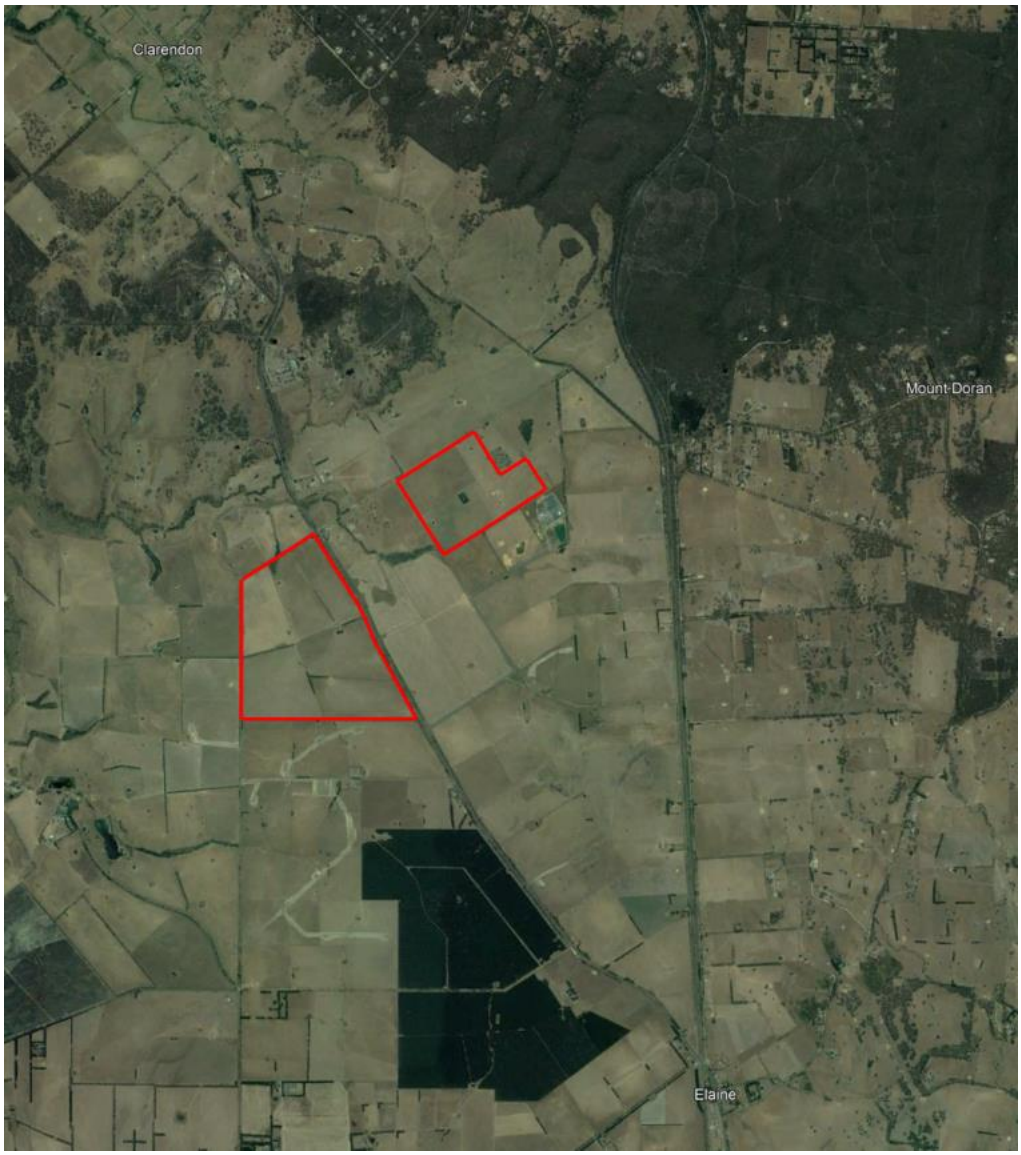


Figure 2 – Project context (Source: Google Earth).

3.2 Land use and zoning

3.2.1 Land use

The land use of the Project and surrounding area is comprised predominately of grazing and cropping with a number of blocks of pine plantation located to the south of the Project, to west of the Midland Highway.

The Elaine section of the Lal Lal wind farm, comprised of 22 wind turbines to 161m in height, abuts the project immediately to the south and west. Interconnector powerlines are located along Murphys Road, to the south of the eastern part of the project, and along the western side of the Midland Highway. An electrical substation is located immediately adjacent to the project in the northeast (refer to ***Figure 3***, ***Figure 4*** and ***Figure 5***).

High voltage transmission lines are located throughout the broader landscape setting to the east and north of the project.

A higher concentration of rural residences is located on slightly elevated land at Mr Doran, to the west of the railway line and to the northwest of the Project. Adjoining immediately to the north is a densely wooded area of Mt Doran State Forest.

The most significant road within the viewshed of the Project is the Midland Highway, an "A" grade road.

Figure 3 - The Elaine section of the Lal Lal Wind Farm is located immediately to the south of the western and eastern parts of the Project. The wind farm substation is located adjacent to the southeast corner of the eastern block

Figure 4 - Wind turbines of the Lal Lal Wind Farm to the south of Murphys Lane.

Figure 5 - Interconnector powerlines for the Lal Lal Wind Farm traverse the landscape along Murphys Lane to the south of the Project.

3.2.2 Zoning

The Project is located within the Moorabool Shire Council. The entirety of the Project site is zoned Farming Zone (FZ) within the Moorabool Planning Scheme (refer to ***Figure 6***).

The surrounding land use of the area is also zoned predominantly FZ.

None of the objectives of the planning scheme for FZ land relate to the protection of landscape or visual values. However, a responsible authority must consider the visual impacts of a proposed development on surrounding areas.

The Mt Doran State Forest Public Conservation and Resource Zone (PCRZ) is located approximately 1.8km to the northeast of the Project.

Under Strategic Directions, Clause 2.03-2 Environmental and landscape values of the planning scheme, Council seeks to:

- Maintain and enhance the natural environment and the Shire's rural identity and character.
- Facilitate land use and development that is compatible with the Shire's natural environment, native vegetation and places of environmental significance.
- Protect the landscape and scenic qualities of forested hill slopes, rural landscapes and bushland settings of the Shire.
- Ensure that the riparian area along watercourses is retained, protected and revegetated.

The Project is subject to a Design and Development Overlay (DDO2) which relates to visual amenity and building design. Relevant considerations are:

- Location in context to adjacent land.
- Form of development.
- Colour, type and finish of external cladding materials.
- Landscaping.
- Landscape and visual amenity impacts – buildings and works, materials, setbacks and landscaping.

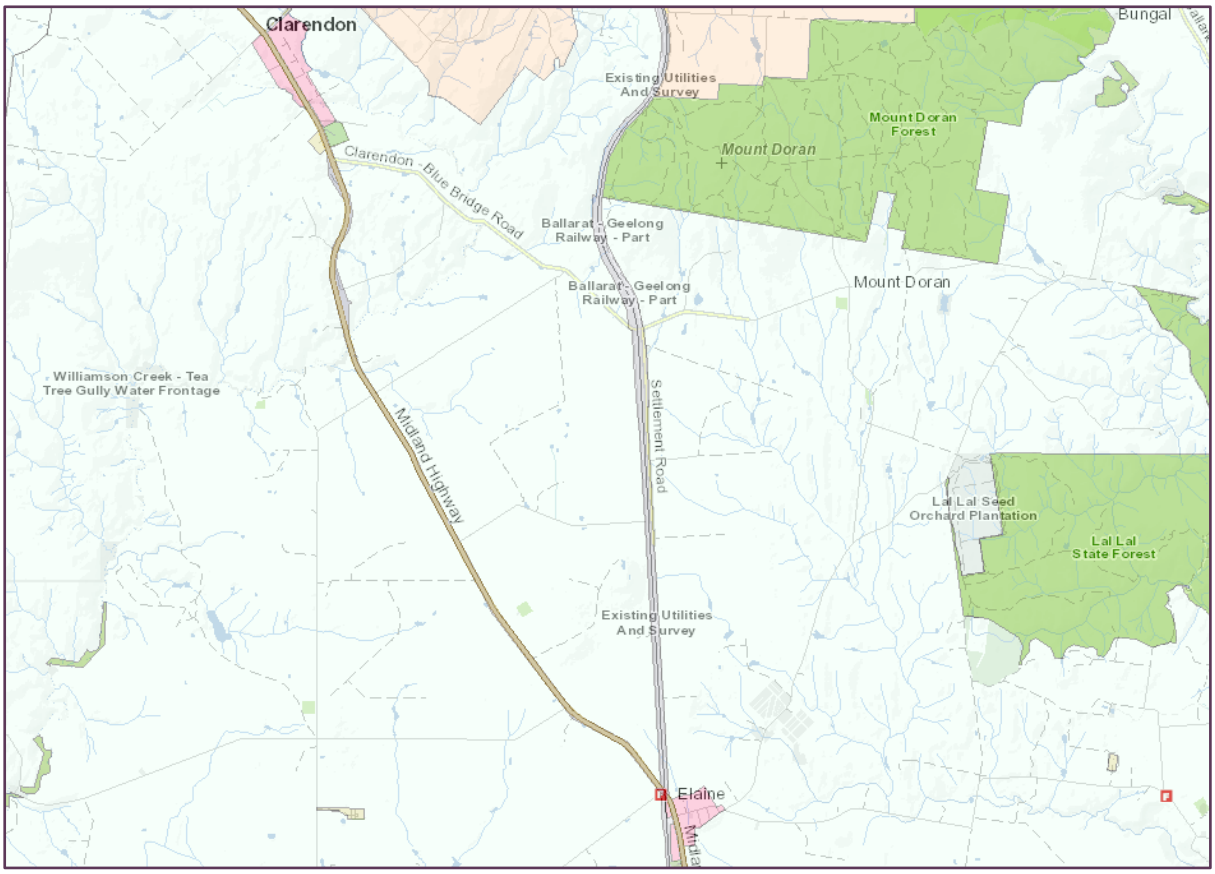


Figure 6 – Land use zoning.

3.3 Vegetation and landscape form

The Project is located within a flat to slightly undulating landscape comprised of open pasture or cropping land visually compartmentalised by rows of dense trees and tall shrubs along roadways and paddock boundaries (refer to ***Figure 7***, ***Figure 8*** and ***Figure 9***).

The topography falls gently to the north from an east to west aligned high point in the topography, located approximately 1km south of Murphys Lane (refer to ***Figure 10***).

To the north of the Project, the topography rises from the generally cleared valley the Midland Highway traverses, to heavily wooded hills between Mt Doran and Lal Lal to the northeast, and Durham Lead Nature Conservation Reserve to the northwest.

Mount Buninyong is visible in the distance, approximately 10km to the north-northeast.

The lack of highly elevated topography that may allow for overlooking, combined with the banded vegetation, results in a visually compartmentalised landscape, with views to the Project area mostly screened from the north and west.

The HV line which bisects the landscape immediately to the south of the Project area results in a significant modification to the landscape of the setting.

The elevated form of the Melbourne to Ballarat railway line provides screening of proximate viewpoints to its east.

Figure 7 - Dense vegetation compartmentalises views in the flat to gently undulating landscape, particularly from roads such as the Midland Highway.

Figure 8 - Character of the Project's eastern block, with Mt Doran State Forest in the background.

Figure 9 - Character of the Project's western block.

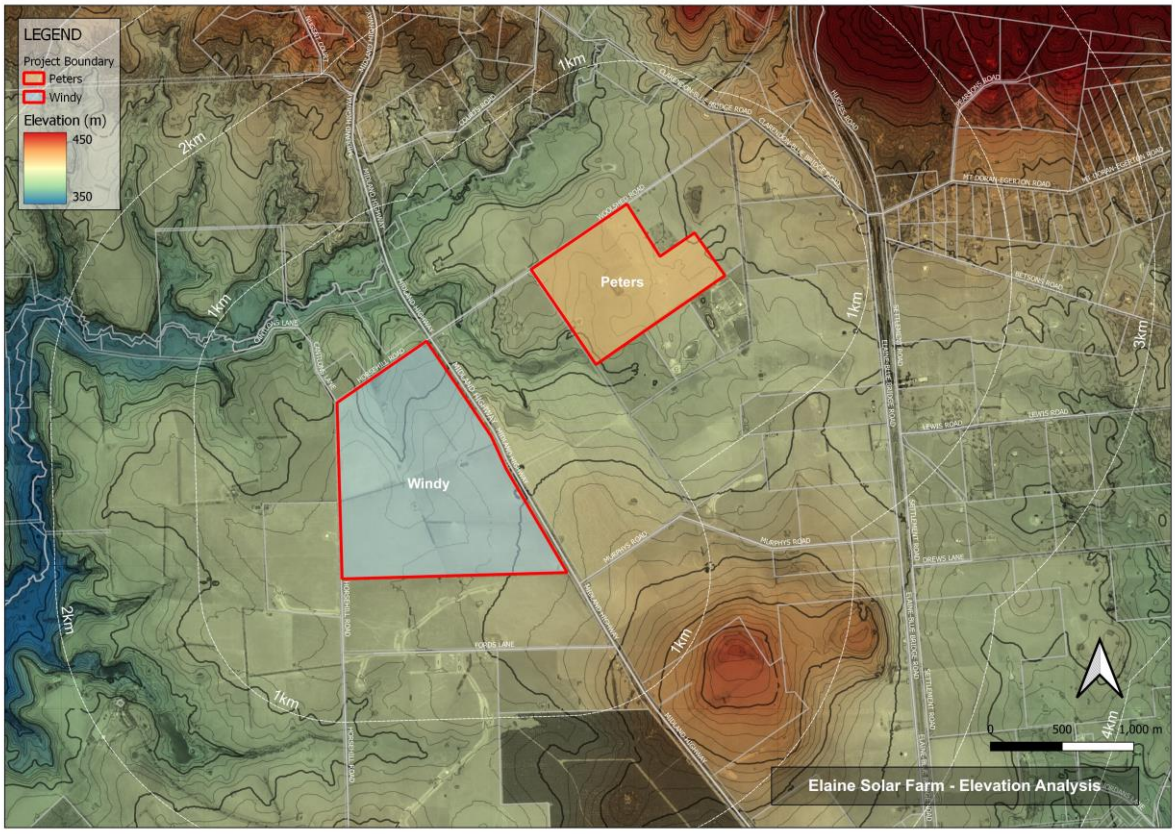


Figure 10 – Elevation of Project area and surrounds.

3.4 Landscape character type

Within the regional setting of the Project, the landscape character types have been identified using the assessment undertaken in the South West Victoria Landscape Assessment (2013)[2]. The Project is located to the east of the assessment study area and sits within:

- Area 1.5 – Western Volcanic Plain – Volcanic Agricultural.

The landscape character type immediately to the north of the Project is:

- Area 2.5 – Uplands – Plateaus and Gorges

Refer to ***Figure 11*** for the location of the Project in relation to identified landscape units.

3.4.1 Area 1.3 – Western Volcanic Plain – Volcanic Agricultural

Key Landscape Features

- Open pastoral landscape with long distance views.
- Exotic shelterbelts.
- Stands of remnant vegetation.

Relevant Landscape Values and Significance

There are limited landscapes of significance within the unit part from areas subject to SLO's along waterways. Typically, the openness of the landscape affords distant views to elevated landforms in the adjacent Uplands unit, particularly to Mt Buninyong.

3.4.2 Area 2.5 – Uplands – Plateaus and Gorges

Key Landscape Features

- The dramatic topography of deep gorges and flat plateaus.
- River valleys.
- Areas of State Forest.
- Undeveloped character.

Landscape Values and Significance

Most proximate to the Project is Lal Lal gorge and falls, located approximately 8km to the northeast, which is identified as being of State significance.

[2] Planisphere, (2013). South West Victoria Landscape Assessment – Landscape Character Types & Areas and Landscape Values and Significance.

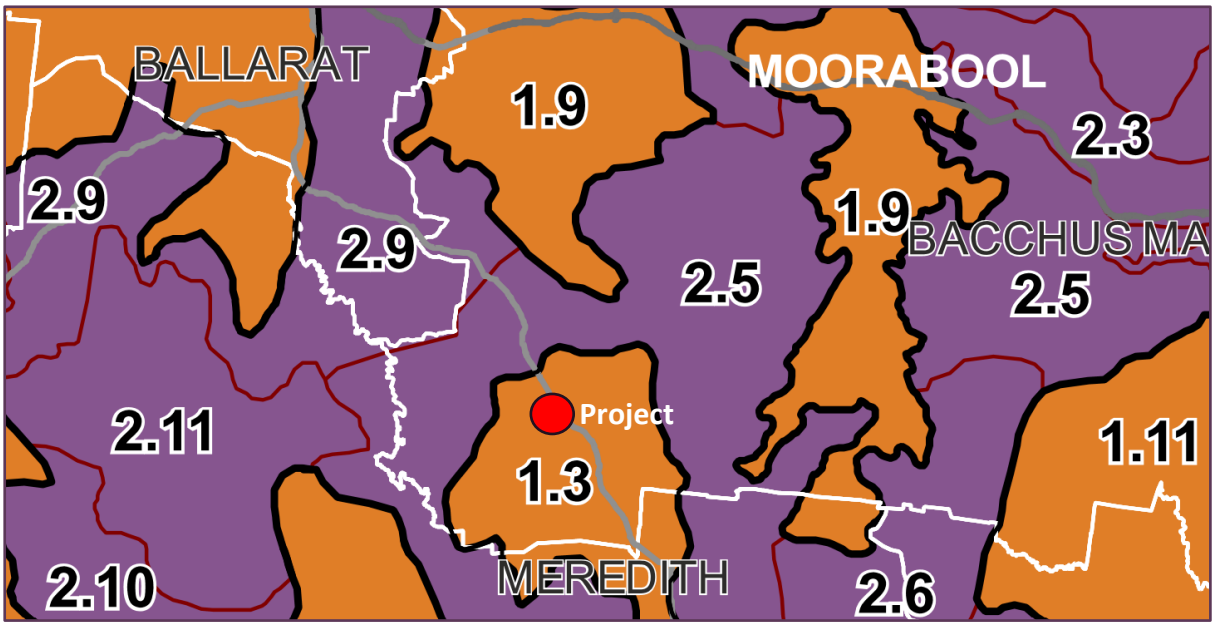


Figure 11 - Landscape Units (Source: South West Victoria Landscape Assessment).

3.5 Scenic Quality

The landscape character type of the Project area and its surrounds is described by Leonard and Hammond)[3] as the West Central Hills.

They describe the scenic quality of West Central Hills landscape character type, as found on the Project area and its immediate surrounds, as outlined below in ***Table 3***.

Description	Moderate Scenic Quality	Low Scenic Quality
Landforms	Rounded hills, ridges and peaks which are not visually dominant. Broad shallow valleys.	Large expanses of indistinctly dissected landform that provide few landmarks which to orient.
Vegetation	Predominately open forest or woodland combined with some natural openings that offer some visual relief. Vegetative stands that exhibit a range of size, texture and colour.	Extensive areas of similar vegetation and very limited variation in texture and colour.
Waterforms	Waterforms absent.	Waterforms absent.

Table 3 – Scenic Quality of the Project area and surrounds (Source: Leonard and Hammond).

3.6 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.

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

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 and immediate surrounds (up to 2km distant) 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 such as Williamson Creek. 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.

Topography – High capability due to mostly flat topography, with minimal potential for overlooking within a 2km radius. However, overlooking may be possible from elevated residential locations at Lal Lal, approximately 3km to the north, depending on the presence of vegetation.

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

4 COMPONENTS OF THE PROJECT

4.1 Key features

As illustrated in ***Figure 8***, the Project involves the development of a solar energy facility on approximately 77.5 ha of the combined eastern and western blocks of the Project, which together total approximately 246 ha.

The eastern block, of a total 74.84ha, approximately 65ha will be occupied by Project components, including 60,636 solar panels.

The western block, of a total 171.4ha, approximately 158ha will be occupied by Project components, including 196,230 solar panels.

The works and components associated with the Project over both blocks include:

- Approximately 256,866 tracking solar panels arranged in a generally regular, rectilinear pattern comprised of modules of multiple panels;
- A 150 MW battery energy storage system (BESS) covering approximately 2.4 ha;
- 35 solar inverters;
- 37 BESS inverters;
- A substation;
- All Installation of an all-weather access road (minimum width of 5 metres) around the site to provide access to panels, inverters and transformers;
- 2.3 m high perimeter security fencing;
- Visual amelioration screen planting; and
- Overhead powerlines with 14 m pole heights, connecting from the switch room on the western block to the main solar substation on the eastern block.

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

4.2 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: 1303mm x 2,400mm. Once mounted on the frames and fully tilted the panels will be capable of reaching an overall height of no more than approximately 3.2 metres above ground level.

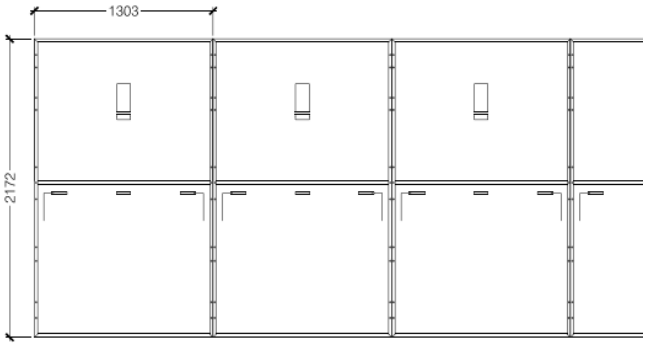
The glass surfaced panels are coated to maximise daylight absorption, and thus minimise glare potential. Other materials are an encapsulant, a rear layer and a frame around the outer edge There will be approximately 256,866 modules.

Mounted single axis bifacial tilting panels.

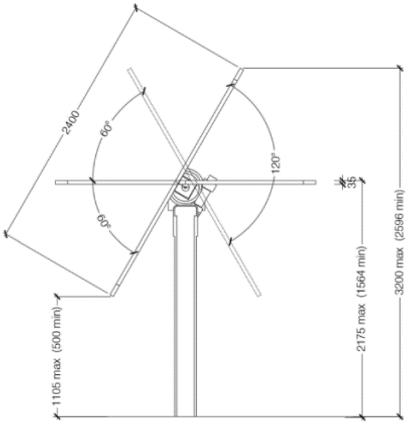
Mounting Frames

The panels will be attached in a single 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.

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.



Solar panel module row - Plan



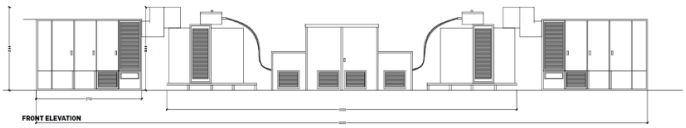
Self-powered tracker – Side elevation

Transformer and Inverter

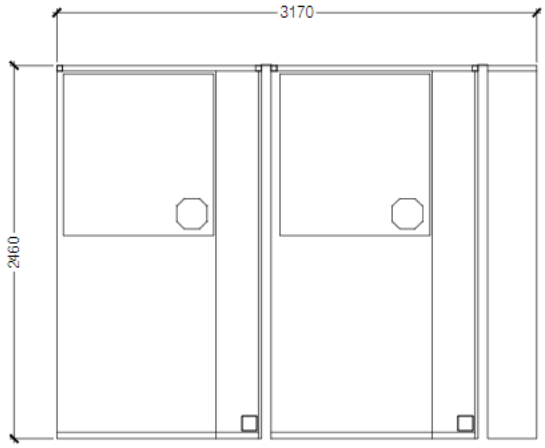
The panels generate Direct Current (DC) electricity which must be converted into Alternating Current (AC) before being fed into the local electricity grid network.

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.



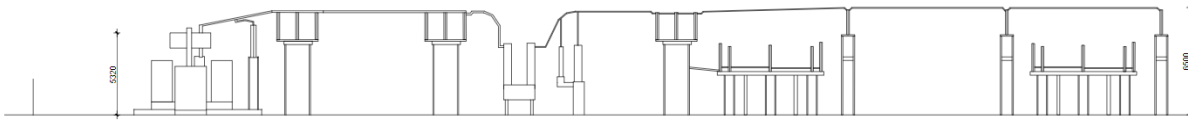
Transformer – Side elevation



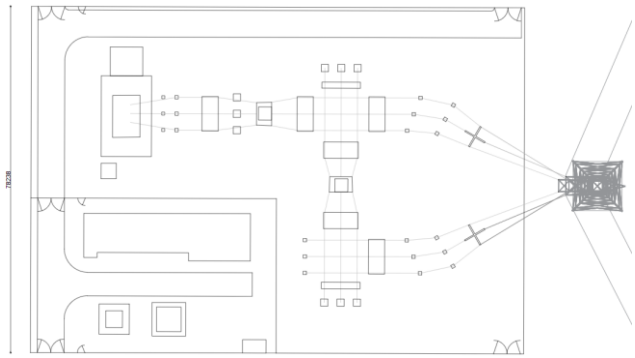
Inverter – side elevation

Substation

The substation with a footprint of approximately 74m x 70m and a maximum height of 18.5m.



Substation – typical front elevation



Substation – typical plan

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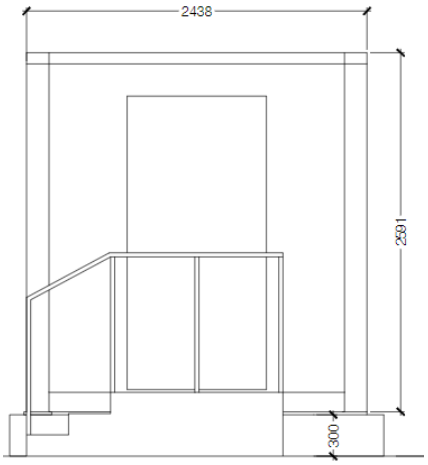
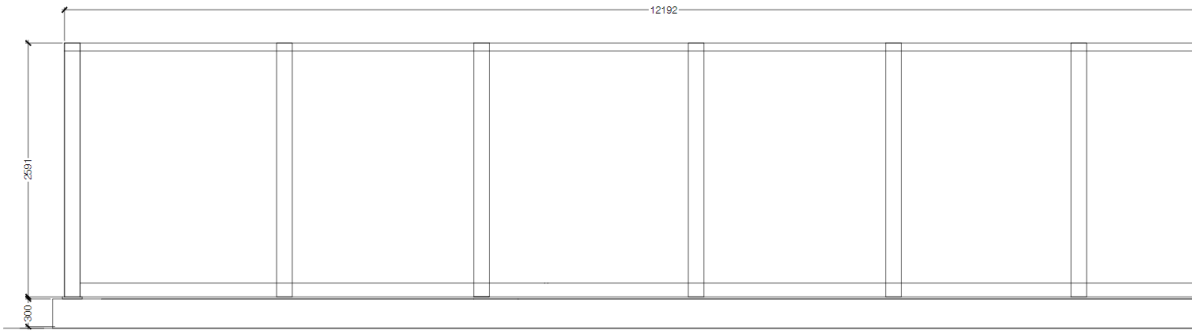
Battery Energy Storage System (BESS)

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



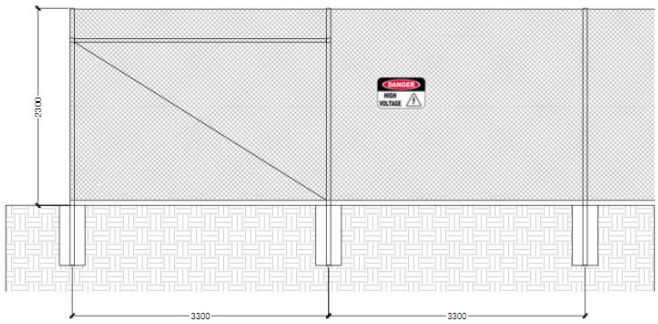
BESS – side elevation



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.

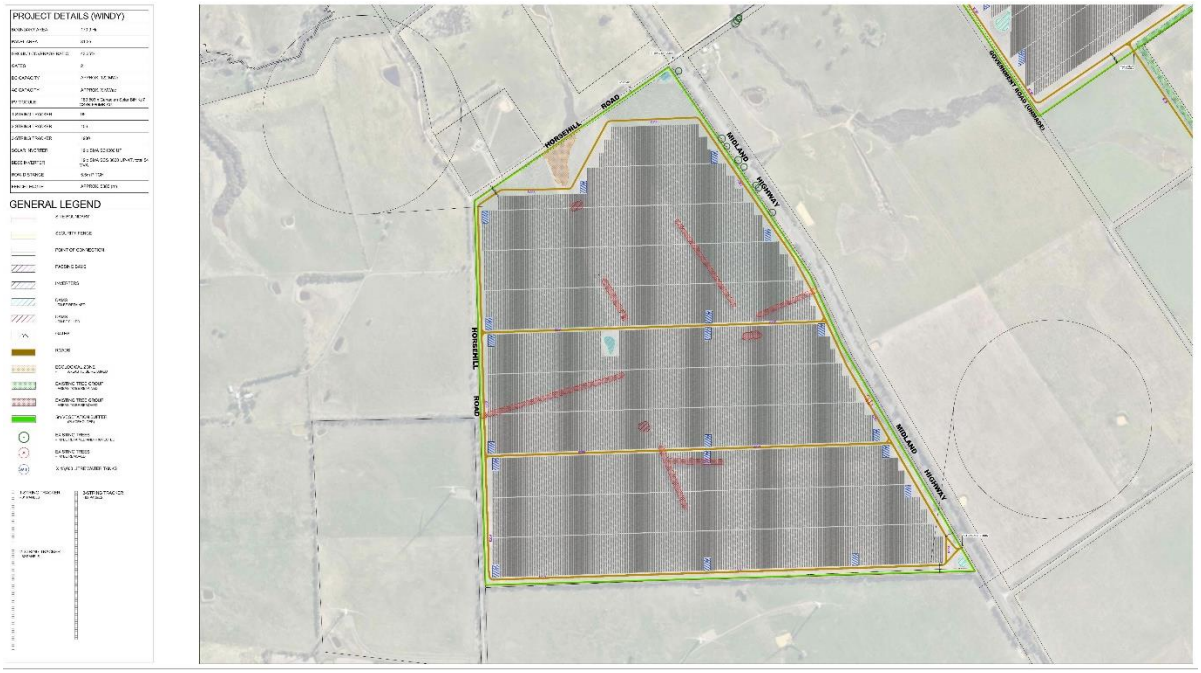


Drawing of proposed perimeter fencing.

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.



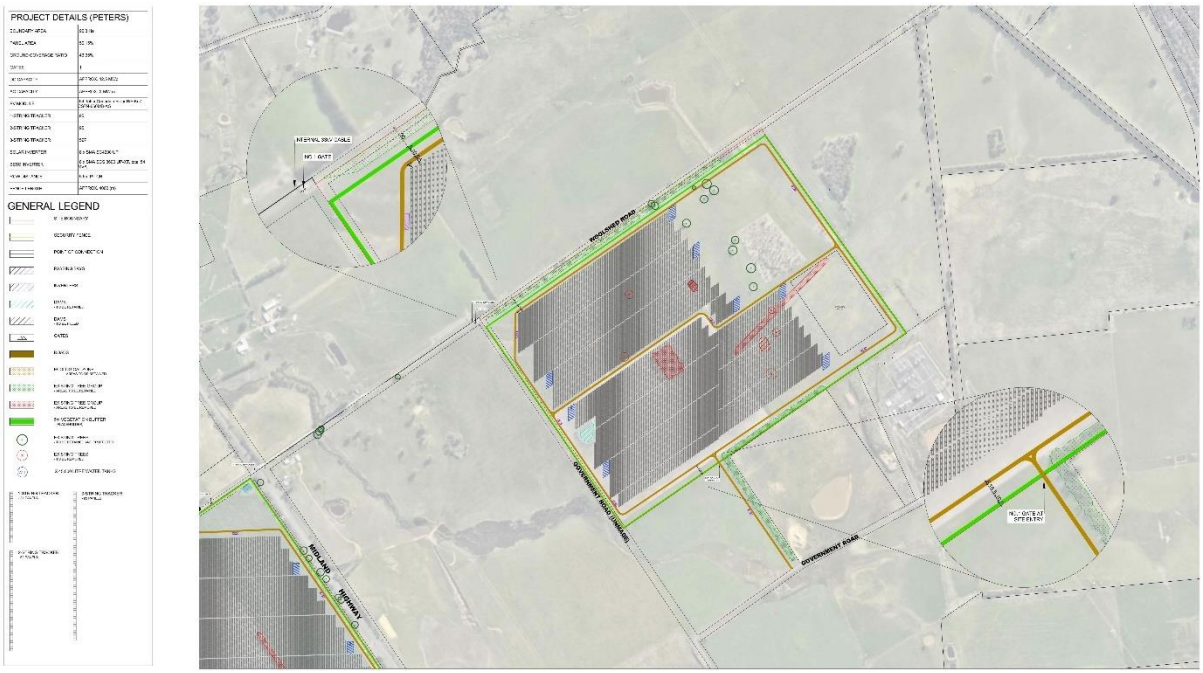


Figure 12 – Proposed development layout.

5 VISUAL IMPACT ASSESSMENT

5.1 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 13 indicates the theoretical viewshed of the Project, or theoretical zone of visual influence (TZVI). It should be noted that the TZVI is based on topography only and does not take into account the screening effects of vegetation. As a result, it is essentially demonstrating a theoretical or 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.

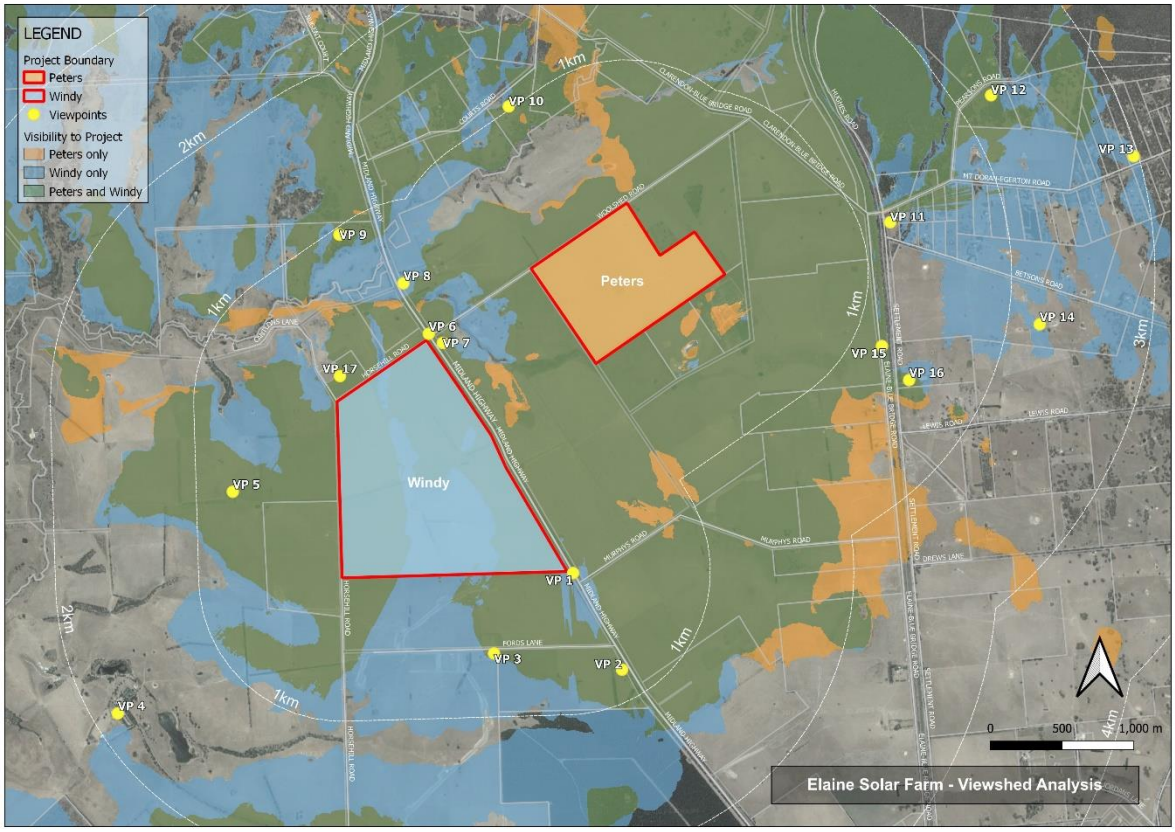


Figure 13 - TZVI of the Project and assessed sensitive viewpoint (VP) locations.

5.2 Sensitive viewpoints

The viewpoint (VP) locations that are included in this assessment are from uses considered to be of higher sensitivity, such as residences and declared roads (refer to ***Table 2*** and ***Figure 13***). Due to the typically low-profile form of the Project, the detailed assessment of viewpoints is confined to sensitive locations within 2 km of the Project with a view, the area within which the Project will be most visible. Viewpoints which the TZVI analysis showed as not being visible were not assessed. Additionally, the residences 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. Photo simulations have been prepared for the potentially highest impact viewpoints.

The photo simulations demonstrate the Project at the completion of construction without any landscaping and at 5 years following the establishment of landscape (refer to ***Appendix A***).

5.3 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.

5.3.1 The effect of residential vegetation on visual screening

In order to provide protection from the influences of the environment, particularly sun and wind, Australian rural residential gardens have traditionally developed a dense band of vegetation to surround an intimate and protected home yard. The effect of this in many instances has been to effectively contain the viewshed from the house and surrounding yard itself, screening views to the distance. The presence of foreground vegetation has a direct impact on the visibility of the Project and the context in which it will be viewed.

Vegetation within the landscape distant from the residence that may provide additional screening of views is not considered at this time. However, it is considered as part of the detailed viewpoint t assessment.

5.3.1.1 Residential viewpoint landscape setting typologies

Throughout the visual catchment, the majority of residences sit within a landscape that is comprised of medium to tall vegetation, with varying levels of density depending on either the extent of clearing or extent of planting.

The height and density of vegetation has a direct relationship to the visual exposure of the residence to the proposed development.

The following three setting typologies have been developed to assist the understanding of the influence of vegetation on the screening of views from residences.

The assessment has considered the overall screening effect of vegetation as it relates to the direction of views towards the solar farm. For example, if the vegetation at the perimeter of the residence is sparse on the side away from the direction of views to the solar farm and dense on the side where there may be potential views, the effect of screening vegetation reflects the side with views. The same applies for the converse situation.

5.3.1.1.1 Typology 1 - Rural Residential – Open or scattered tall vegetation

Views to external areas are minimally to partially filtered by scattered tall trees.

Influence on visibility and potential impact

Partial to open views of the proposed development will be possible over open pasture or below and between tall, scattered trees. The potential exists for visual impact (refer to ***Figure 14***).

Figure 14 - Typology 1 – Typical plan and elevation.

5.3.1.1.2 Typology 2 - Rural Residential – Semi open tall vegetation

Views to external areas are partially to heavily screened by semi open, tall vegetation.

Influence on visibility and potential impact
Partial to fully screened views of the proposed development will only be possible where limited breaks in vegetation occur. The potential for visual impact is significantly reduced (refer to ***Figure 15***).

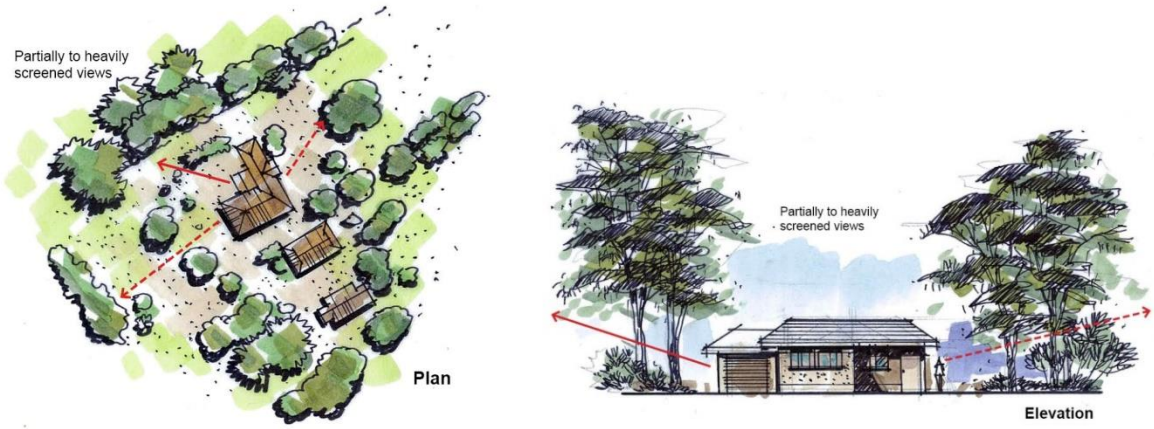


Figure 15 - Typology 2 – Typical plan and elevation.

5.3.1.1.3 Typology 3 - Rural Residential – Dense Tall Vegetation

Views to external areas heavily to fully screened by dense, tall vegetation.

Influence on visibility and potential impact
Views of the proposed development will not be possible and therefore any impacts are highly unlikely (refer to ***Figure 16***).

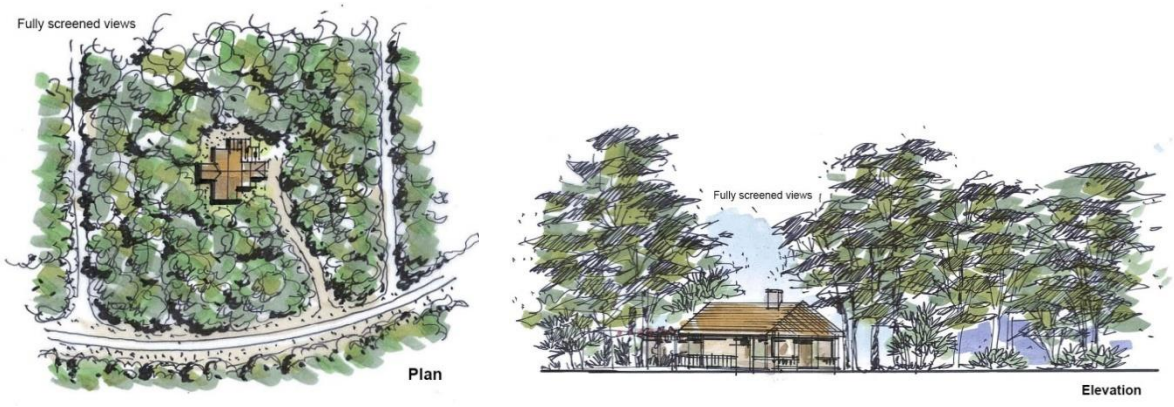


Figure 16 - Typology 3 – Typical plan and elevation.

5.3.1.2 Overview Assessment of Views from Residences

A desktop assessment was undertaken based on aerial photography and field surveys, of the potential degree of visibility from residences surrounding the Project, considering the following factors (refer to ***Figure 17***):

- Proximity to the Project:
  - 0-2 km from Project boundary.
- Whether views are theoretically possible due to topography. Where topography provides screening, no assessment has been undertaken.
- Degree of vegetation present around the residence
  - Highly screened.
  - Partially screened.
  - Minimally screening.

Figure 17 - Relative level of vegetation screening surrounding residences where views theoretically possible (excludes intervening vegetation) (Source: Google Earth).

5.3.2 Detailed assessment of representative sensitive viewpoints

VIEWPOINT 1 – MIDLAND HIGHWAY - SOUTH	
Photo Location	The southeast corner of the western block on the highway (refer to ***Figure 13***).
Viewing Distance	10 m to the Project's western block (solar panels) and 1.5km to the eastern block from the photo location.
Duration of View and Frequency of View	Duration: Moving at 100kmh. Frequency: Medium.
Visual Use Area	Rural Highway – "A" category road (refer to ***Figure 18*** and ***Figure 19***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the highway status and tourist use.
Visual Modification	**LOW - MODERATE** – From this viewpoint, the closer western block of the Project will be mostly screened by existing roadside vegetation (***Figure 20***). The more distant eastern Block will be visually recessive and partially screened by roadside vegetation (refer to ***Figure 22***).
Visual Impact	**MODERATE TO HIGH**– Although the Project is mostly screened from view, the high level of visual sensitivity results in a moderate to high level of visual impact.
Proposed Amelioration	Additional perimeter amelioration planting will infill breaks in roadside vegetation.
Residual Impact	**VERY LOW –** As amelioration planting establishes, the residual visual impact level will progressively reduce to very low (***Figure 21***).

Figure 18 – VP1 - Location and landscape of the setting (Source: Google Earth)

Figure 19 – VP1 - View of the landscape setting of the Midland Highway.

Figure 20 – VP1 – Photo simulation of view to the Project's western block from the western (northbound) lane of the Midland Highway.

Figure 21 – VP1 - Photo simulation of the Project's western block with establishing screening landscape, as viewed from the western (northbound) lane of the Midland Highway.

Figure 22 – VP1 – View to the Project's eastern block from the western verge of the Midland Highway.

VIEWPOINT 2 – RESIDENCE AT 5261 MIDLAND HIGHWAY	
Photo Location	The highway verge adjacent to the residence (refer to ***Figure 13***).
Viewing Distance	770m to the Project's western block (solar panels) and 2.1km to the eastern block from the photo location.
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential – Partially screened setting (refer to ***Figure 23*** and ***Figure 24***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW - LOW** – From this viewpoint, the closer western block of the Project will be mostly screened by existing vegetation, fences, and outbuildings around the residence as well as a band of vegetation along the Project's southern boundary (***Figure 25***). The distant eastern Block will be visually recessive and screened by vegetation along the eastern verge of the highway (refer to ***Figure 26***).
Visual Impact	**LOW** – Given the Project is heavily screened from view, resulting in a very low to low visual modification level, when combined with high level of visual sensitivity, a low level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Given the already low level of visibility, amelioration planting will only have a minimal effect on the level of residual visual impact.

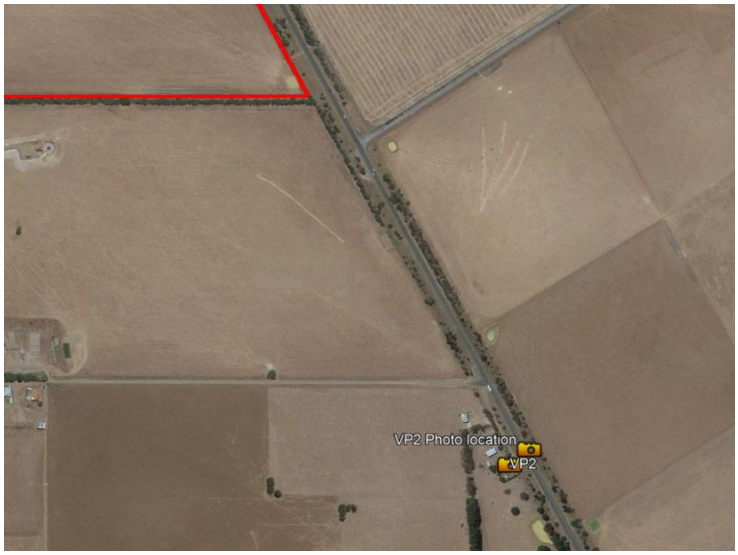


Figure 23 – VP2 - Location and landscape of the setting (Source: Google Earth)

Figure 24 – VP2 - View of the landscape setting of the residence from the Midland Highway

Figure 25 – VP2 – View to the Project's western block from the western verge of the Midland Highway adjacent to the residence.

Figure 26 – VP2 – View to the Project's eastern block from the western verge of the Midland Highway adjacent to the residence.

VIEWPOINT 3 – RESIDENCE AT 87 FORDS LANE	
Photo Location	The road verge adjacent to the residence (refer to ***Figure 13***).
Viewing Distance	570 m to the Project's western block (solar panels) and 2.1km to the eastern block from the photo location.
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential – Partially screened setting (refer to **Figure 27** and ***Figure 28***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW - LOW** – From this viewpoint, the closer western block of the Project will be mostly screened by existing vegetation to the north of the residence (***Figure 29***) as well as a band of vegetation along the Project's southern boundary (***Figure 30***). The distant eastern Block will be visually recessive and screened by vegetation along the western and eastern verge of the highway (refer to ***Figure 31***).
Visual Impact	**LOW** – Given the Project is heavily screened from view, resulting in a very low to low visual modification level, when combined with high level of visual sensitivity, a low level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Given the already low level of visibility, amelioration planting will only have a minimal effect on the level of residual visual impact.

Figure 27 – VP3 - Location and landscape of the setting (Source: Google Earth)

Figure 28 – VP3 - View of the landscape setting of the residence from Fords Lane.

Figure 29 – VP3 - View of establishing screen planting to the north of the residence.

Figure 30 – VP3 – View to the Project's western block from Fords Lane to the east of the residence.

Figure 31 – VP3 – View to the Project's eastern block from block from Fords Lane to the east of the residence.

VIEWPOINT 4 – "NARMBOOL"	
Photo Location	Horsehill Road verge, 1.4km to the east of the building complex on the property (refer to ***Figure 13***).
Viewing Distance	260m from the photo location, and 1.8 km from the viewpoint to the Project's western block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Moderate.
Visual Use Area	Tourism (refer to ***Figure 32*** and ***Figure 33***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the tourism use.
Visual Modification	**NOT APPARENT** – From this viewpoint, the Project will not be visible due to the effects of topography. Additionally, vegetation along Horsehill Road and the southern boundary of the eastern block screens views (***Figure 34***).
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 32 – VP4 - Location and landscape of the setting (Source: Google Earth)

Figure 33 – VP4 - View west to the landscape setting of "Narmbool" from Horsehill Road.

Figure 34 – VP4 – View northeast to the Project's western block from Horsehill Road, 1.4km to the east of the main building complex.

VIEWPOINT 5 – 100 HORSEHILL ROAD	
Photo Location	Horsehill Road verge, 730m to the east of the residence (refer to ***Figure 13***).
Viewing Distance	10m from the photo location, and 740m from the viewpoint to the Project's western block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Partially screened setting (refer to ***Figure 35*** and ***Figure 36***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**LOW** – From this viewpoint, the closer western block of the Project will be mostly screened by scattered existing vegetation to the east of the residence as well as a band of establishing vegetation along the Project's western boundary (***Figure 37*** and ***Figure 38***). The eastern block, 2.5km to the east, will be hidden from view.
Visual Impact	**MODERATE** – Given the Project is mostly screened from view, resulting in a low visual modification level, when combined with high level of visual sensitivity, a moderate level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Given the already low level of visibility, amelioration planting will only have a minimal effect on the level of residual visual impact.

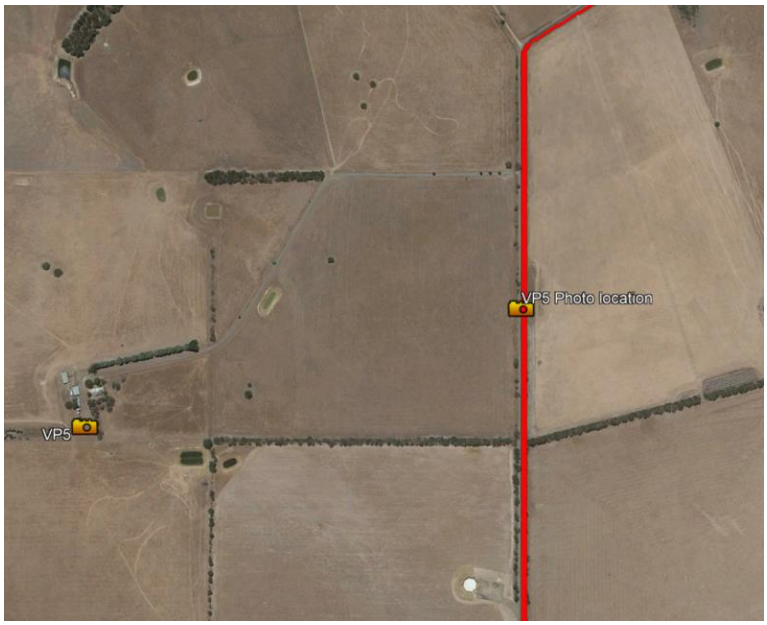


Figure 35 – VP5 - Location and landscape of the setting (Source: Google Earth)

Figure 36 – VP5 - View west to the landscape setting of the residence from Horsehill Road.

Figure 37 – VP5 – View north along Horsehill Road of vegetation establishing along the western boundary of the western block of the Project.

Figure 38 – VP5 – View east through a break in vegetation to the Project's western block from Horsehill Road, 730m from the residence.

VIEWPOINT 6 – MIDLAND HIGHWAY - NORTH	
Photo Location	The northeast corner of the western block on the highway (refer to ***Figure 13***).
Viewing Distance	50 m to the Project's western block (solar panels) and 860m to the eastern block from the photo location.
Duration of View and Frequency of View	Duration: Moving at 100kmh. Frequency: Medium.
Visual Use Area	Rural Highway – "A" category road (refer to ***Figure 39*** and ***Figure 40***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the highway status and tourist use.
Visual Modification	**LOW** – From this viewpoint, the closer western block of the Project will be mostly screened by existing roadside vegetation (***Figure 41***). The more distant eastern Block will be visually recessive and mostly screened by rising topography and roadside vegetation.
Visual Impact	**MODERATE** – Given the Project is mostly screened from view, the high level of visual sensitivity combined with a low visual modification level results in a moderate level of visual impact.
Proposed Amelioration	Additional perimeter amelioration planting will infill breaks in roadside vegetation.
Residual Impact	**VERY LOW –** As amelioration planting establishes, the residual visual impact level will progressively reduce to very low (refer to ***Figure 42***).

Figure 39 – VP6 - Location and landscape of the setting (Source: Google Earth)

Figure 40 – VP6 - View south showing the landscape setting of the Midland Highway.

Figure 41 – VP6 – Photo simulation view to the northern boundary of Project's western block from the Midland Highway.

Figure 42 – VP6 - Photo simulation of the Project's western block with establishing screening landscape, as viewed from the eastern (southbound) lane of the Midland Highway.

VIEWPOINT 7 – RESIDENCE AT 5876 MIDLAND HIGHWAY	
Photo Location	The highway verge adjacent to the residence (refer to ***Figure 13***).
Viewing Distance	50m to the Project's western block (solar panels) and 830m to the eastern block from the photo location.
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential – Partially screened setting (refer to ***Figure 43*** and ***Figure 44***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**LOW** – From this viewpoint, the western block of the Project will be mostly screened by existing vegetation around the residence as well as a band of vegetation along the western block's eastern boundary to the Midland Highway (***Figure 45***) The eastern block will be partially screened by vegetation and buildings to the east of the residence as well as rising topography and scattered intervening vegetation within the landscape.
Visual Impact	**MODERATE** – Given the Project is partially screened from view, resulting in a low visual modification level, when combined with high level of visual sensitivity, a moderate level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Given the relatively low level of visibility, amelioration planting will have some effect on reducing the level of residual visual impact.

Figure 43 – VP7 - Location and landscape of the setting (Source: Google Earth)

Figure 44 – VP7 - View of the landscape setting of the residence from the Midland Highway. The eastern block of the Project is located in the background.

Figure 45 – VP7 – View to the Project's western block from the eastern verge of the Midland Highway adjacent to the residence.

VIEWPOINT 8 – RESIDENCE AT 5930 MIDLAND HIGHWAY	
Photo Location	The eastern highway verge adjacent to the residence (refer to ***Figure 13***).
Viewing Distance	360m to the Project's western block (solar panels) and 920m to the eastern block from the viewpoint.
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential – Partially screened setting (refer to ***Figure 46*** and ***Figure 47***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**LOW** – From this viewpoint, the western block of the Project will be partly screened by existing vegetation around the residence as well as vegetation along the Midland Highway (***Figure 48***) The eastern block will be fully screened from view by rising topography.
Visual Impact	**MODERATE** – Given the Project is partially screened from view, resulting in a low visual modification level, when combined with high level of visual sensitivity, a moderate level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Amelioration planting will be highly effective at reducing the level of residual visual impact (refer to ***Figure 49***).

Figure 46 – VP8 - Location and landscape of the setting (Source: Google Earth)

Figure 47 – VP8 - View of the landscape setting of the residence from the Midland Highway.

Figure 48 – VP8 – Photo simulation view to the Project's western block from the eastern verge of the Midland Highway adjacent to the residence.

Figure 49 – VP8 - Photo simulation of the Project's western block with establishing screening landscape, as viewed from the from the eastern verge of the Midland Highway adjacent to the residence.

VIEWPOINT 9 – RESIDENCE AT 5975 MIDLAND HIGHWAY	
Photo Location	The western highway verge 250m to the east of the residence (refer to ***Figure 13***).
Viewing Distance	900m to the Project's western block (solar panels) and 1.1m to the eastern block from the viewpoint.
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential – Heavily screened setting (refer to ***Figure 50*** and ***Figure 51***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**MODERATE** – From this slightly elevated viewpoint, the western block of the Project will be mostly screened by existing vegetation around the residence. However, views to the eastern and western blocks may still be possible between or under vegetation (Refer to ***Figure 52***).
Visual Impact	**HIGH** – Given the Project is partially screened from view, resulting in a moderate visual modification level, when combined with high level of visual sensitivity, a moderate level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**LOW** – Amelioration planting will be effective in reducing the level of residual visual impact.

Figure 50 – VP9 - Location and landscape of the setting (Source: Google Earth)

Figure 51 – VP9 - View of the landscape setting of the residence from the Midland Highway.

Figure 52 – VP9 – View north of the landscape setting of the residence from Horsehill Road showing dense planting along the southern frontage to the Project.

VIEWPOINT 10 – 108 COURTS ROAD	
Photo Location	Courts Road verge, 250m to the southeast of the residence (refer to ***Figure 13***).
Viewing Distance	1 km from the viewpoint to the Project's eastern block (solar panels) and 1.7km from the viewpoint to the Project's western block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Partially screened setting (refer to ***Figure 53*** and ***Figure 54***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**VERY LOW** – From this viewpoint, the closer eastern block of the Project will be mostly screened by vegetation to the south of the residence and vegetation along roadsides and paddock boundaries. Where visible, it will appear as a very thin, distant line (refer to ***Figure 55***). The western block, 1.7km to the southwest will be hidden from view by rising topography.
Visual Impact	**LOW** – Given the Project is mostly screened from view, resulting in a very low visual modification level, when combined with high level of visual sensitivity, a low level of visual impact will result.
Proposed Amelioration	Additional perimeter amelioration planting will infill any breaks in existing vegetation that may allow glimpses of the Project.
Residual Impact	**VERY LOW** – Amelioration planting will be effective at reducing the level of residual visual impact (refer to ***Figure 56***).

Figure 53 – VP10 - Location and landscape of the setting (Source: Google Earth)

Figure 54 – VP10 – Landscape setting of the residence (Source: Google Earth).

Figure 55 – VP10 – Photo simulation view west south to the Project from the residence.

Figure 56 – VP10 – Photo simulation view west to the Project from the residence showing landscape amelioration at 5 years maturity.

VIEWPOINT 11 – 16 MT DORAN - EGERTON ROAD	
Photo Location	Mt Doran - Egerton Road verge, 70m to the north of the residence (refer to ***Figure 13***).
Viewing Distance	1.3km from the viewpoint and photo location to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Highly screened setting (refer to ***Figure 57*** and ***Figure 58***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**NOT APPARENT** – From this viewpoint, the eastern and western blocks of the Project will be fully screened by scattered existing vegetation between the residence and the Melbourne – Ballarat railway line (***Figure 59***).
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 57 – VP11 - Location and landscape of the setting (Source: Google Earth)

Figure 58 – VP11 – View south to the landscape setting of the residence from Mt Doran – Egerton Road.

Figure 59 – VP11 – View west along Mt Doran – Egerton Road towards the eastern block of the Project (Source: Google Streetview).

VIEWPOINT 12 – 79 PEARSONS ROAD	
Photo Location	Pearsons Road verge, 160m to the west of the residence (refer to ***Figure 13***).
Viewing Distance	2.1km from the photo location, and 2.3km from the viewpoint to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Highly screened setting (refer to ***Figure 60*** and ***Figure 61***).
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the residential use more than 2km distance from the Project.
Visual Modification	**NOT APPARENT** – From this viewpoint, the eastern and western blocks of the Project will be fully screened by dense existing vegetation between the residence and the Melbourne – Ballarat railway line (***Figure 62***).
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 60 – VP12 - Location and landscape of the setting (Source: Google Earth)

Figure 61 – VP12 – View east to the landscape setting of the residence from Pearsons Road.

Figure 62 – VP12 – View west from Pearsons Road towards the eastern block of the Project.

VIEWPOINT 13 – 183 MT DORAN - EGERTON ROAD	
Photo Location	Mt Doran - Egerton Road verge, 110m to the southwest of the residence (refer to ***Figure 13***).
Viewing Distance	2.9km from the photo location, and 3km from the viewpoint to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Highly screened setting (refer to ***Figure 63*** and ***Figure 64***).
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the residential use more than 2km distant from the Project.
Visual Modification	**NOT APPARENT** – From this viewpoint, the eastern and western blocks of the Project will be fully screened by dense existing vegetation to the west of the residence and along Mt Doran – Egerton Road (***Figure 65***).
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 63 – VP13 - Location and landscape of the setting (Source: Google Earth)

Figure 64 – VP13 – View east to the landscape setting of the residence from Mt Doran - Egerton Road.

Figure 65 – VP13 – View west southwest from Mt Doran - Egerton Road towards the eastern block of the Project.

VIEWPOINT 14 – 125 BETSONS ROAD	
Photo Location	Betsons Road verge, 320m to the north of the residence (refer to ***Figure 13***).
Viewing Distance	2.1km from the photo location, and 2.2km from the viewpoint to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Minimally screened setting (refer to ***Figure 66*** and ***Figure 67***).
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the residential use is more than 2km distant from the Project.
Visual Modification	**NOT APPARENT** – From this viewpoint, the closer eastern block of the Project will be screened from view by the relatively dense vegetation along the Melbourne – Ballarat railway line that currently screens views to the existing substation (***Figure 68***). The western block, 3.8km to the west, will also be hidden from view.
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 66 – VP14 - Location and landscape of the setting (Source: Google Earth)

Figure 67 – VP14 – View south to the landscape setting of the residence from Betsons Road.

Figure 68 – VP14 – View west from Betsons Road towards the eastern block of the Project.

VIEWPOINT 15 – MELBOURNE – BALLARAT RAILWAY LINE	
Photo Location	Elaine – Blue Bridge Road verge, 50m to the west of the rail line (refer to ***Figure 13***).
Viewing Distance	1.2km from the photo location to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Moving at 100kmh. Frequency: Moderate.
Visual Use Area	Transport – Passenger rail (refer to ***Figure 69*** and ***Figure 70***).
Visual Sensitivity	**LOW** - Sensitivity of users is low based on the passenger rail use more than 1km distant from the Project.
Visual Modification	**LOW** – From this viewpoint, the closer eastern block of the Project will be fully screened by existing vegetation along the western side of the railway line and vegetation located closer to the Project (***Figure 71*** and ***Figure 72***). However, limited views to the Project may be possible from the railway line further to the north. The western block, 2.7km to the west, will be mostly hidden from view by vegetation along the Midland Highway.
Visual Impact	**LOW** – Given the Project is mostly screened from view, resulting in a low visual to moderate visual modification level, when combined with low level of visual sensitivity, a low level of visual impact will result.
Proposed Amelioration	Perimeter amelioration planting will provide for screening where views to the Project from the rail line are possible through breaks in existing vegetation.
Residual Impact	**VERY LOW** – Amelioration planting will be effective at reducing the level of residual visual impact.

Figure 69 – VP15 - Location and landscape of the setting (Source: Google Earth)

Figure 70 – VP15 – View south to the landscape setting of the railway line from Elaine – Blue Bridge Road.

Figure 71 – VP15 – View south along Elaine – Blue Bridge Road showing typical planting along the edge of the railway line.

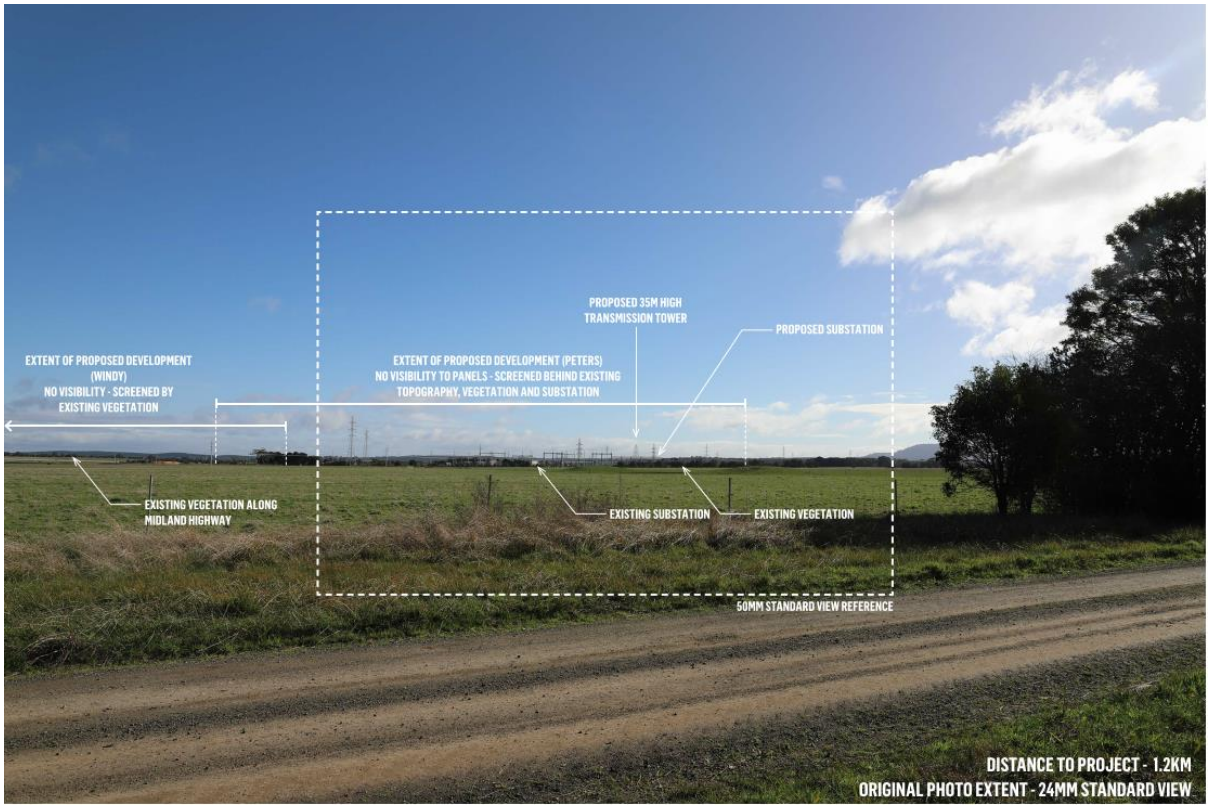


Figure 72 – VP15 – Photo simulation of view west from Elaine – Blue Bridge Road adjacent to the railway line towards the existing substation and the area of the eastern block of the Project.

VIEWPOINT 16 – 430 SETTLEMENT ROAD	
Photo Location	Settlement Road verge, 125m to the west of the residence (refer to ***Figure 13***).
Viewing Distance	1.4km from the photo location, and 1.5km from the viewpoint to the Project's eastern block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural residential – Heavily screened setting (refer to ***Figure 73***and ***Figure 74***).
Visual Sensitivity	**MODERATE** - Sensitivity of users is moderate based on the residential use more than 2km distant from the Project.
Visual Modification	**NOT APPARENT** – From this viewpoint, the Project will not be visible due to the screening provided by the elevated rail formation (***Figure 75***).
Visual Impact	**NOT APPARENT** – The Project is not visible for this viewpoint. As a result, there is no visual impact.
Proposed Amelioration	**NONE** - Visual amelioration is not required for this viewpoint.
Residual Impact	**NOT APPARENT** – As there is no visual impact, amelioration will not have any influence on the level of residual impact.

Figure 73 – VP16 - Location and landscape of the setting (Source: Google Earth).

Figure 74 – VP16 – View east to the landscape setting of the residence from Settlement Road.

Figure 75 – VP16 – View west from Settlement Road towards the eastern block of the Project.

VIEWPOINT 17 – RESIDENCE AT 68 HORSEHILL ROAD	
Photo Location	The site of a future residence, immediately adjacent to a temporary residence (refer to ***Figure 13***).
Viewing Distance	100m to the Project's western block (solar panels).
Duration of View and Frequency of View	Duration: Static. Frequency: Low.
Visual Use Area	Rural Residential (refer to ***Figure 76*** and ***Figure 77***).
Visual Sensitivity	**HIGH** - Sensitivity of users is high based on the residential use.
Visual Modification	**HIGH** – From this viewpoint, which has uninterrupted views of the wind turbines at the Lal Lal wind farm, the western block of the Project will be highly visible from the site of the future residence (refer to ***Figure 78***). However, the Project will not interrupt views to Mt Buninyong from the future residence. The eastern block will be screened by rising topography and scattered intervening vegetation within the landscape.
Visual Impact	**HIGH** – Given the high visual modification level, when combined with high level of visual sensitivity, a high level of visual impact will result.
Proposed Amelioration	Dense perimeter amelioration planting along the northern boundary of the western block.
Residual Impact	**LOW** – Amelioration planting be highly effective at reducing the level of residual visual impact (refer to ***Figure 79***).

Figure 76 - VP17 - Location and landscape of the setting (Source: Google Earth [2019] and Nearmap [2023]).

Figure 77 - VP17 – View north to the landscape setting of the future residence from Horsehill Road.

Figure 78 - VP17 – Photo simulation view south from the site of the future residence towards the western block of the Project.

Figure 79 - VP17 – Photo simulation view south from the site of the future residence towards the western block of the Project showing landscape amelioration at 5 years maturity.

5.4 Lighting impacts

The applicable environmental lighting zone for the Project area based on AS-NZS-4282-2019 is Category A2, which is a low district lighting area, which applies to rural residential areas and areas with secondary and local roads.

Within the Category A2 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.

5.5 Glint and glare impacts

A glint and glare assessment has been prepared by Urbis for relevant receptors within 1km of the Project (refer to ***Figure 80***), the results of which are summarised in this section. Refer to ***Appendix C*** for the full glint and glare assessment report.

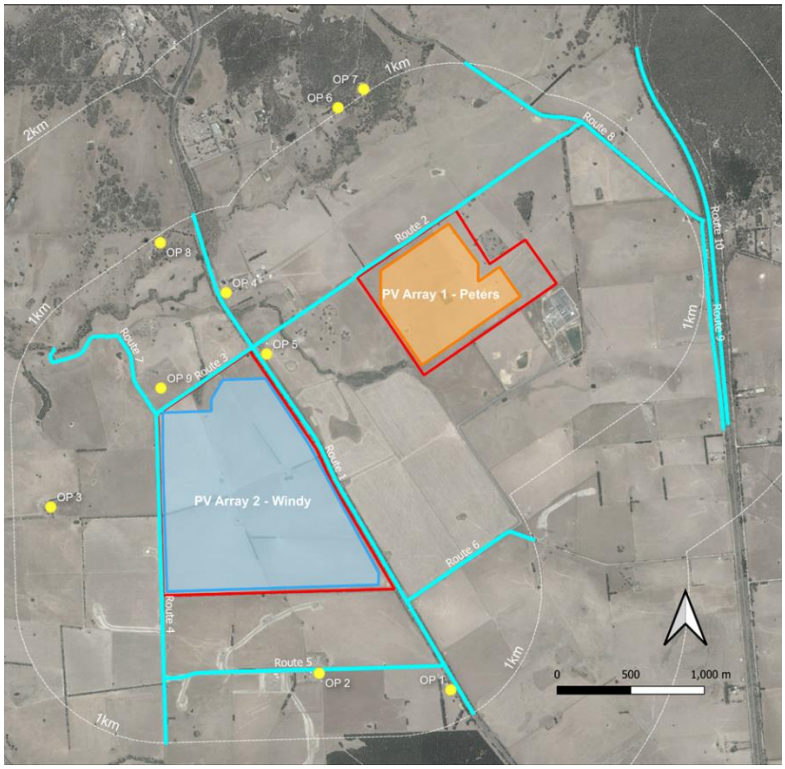


Figure 80 – Project receptors and routes (airport receptors out of range not shown).

5.5.1 Summary of Results

A total of seven scenarios based on resting angle were simulated covering the full range of motion from 0° to +/-60° to understand the effect of altering the resting angle parameter on predicted glare. For scenarios with resting angle configured at 0°-3° some green and yellow glare is predicted from PV Array 1 – Peters and/or PV Array 2 – Windy. The amount of glare predicted decreases as the resting angle is increased, with the modelling showing that scenarios ranging from a resting angle of 5°-60° resulted in no predicted glare to any receptors from both project sites. (refer to ***Table 4***).

	PV Array 1 - Peters		PV Array 2 - Windy	
	Green Glare (min/year)	Yellow Glare (min/year)	Green Glare (min/year)	Yellow Glare (min/year)
Resting Angle	**Total (all receptors)**	**Total (all receptors)**	**Total (all receptors)**	**Total (all receptors)**
0 degrees	2,144	485	1,607	658
3 degrees	613	14	0	0
5 degrees	0	0	0	0
15 degrees	0	0	0	0
30 degrees	0	0	0	0
45 degrees	0	0	0	0
60 degrees	0	0	0	0

Table 4 - Summary results: Total predicted glare based on resting angle.

Under all scenarios where the Project is configured with a resting angle from 5°-60° there is no glare predicted towards all identified receptors (refer to ***Table 5***).

For more detailed results, the report outputs from the GlareGauge software are provided in **Appendix C.**

			Green Glare (min/year)	Yellow Glare (min/year)	Green Glare (min/year)	Yellow Glare (min/year)
Receptor ID	**Receptor Type**	**Receptor details**	**PV Array 1 Peters**		**PV Array 2 Windy**	
OP 1	dwelling	5621 Midland Highway	0	0	0	0
OP 2	dwelling	87 Fords Lane	0	0	0	0
OP 3	dwelling	100 Horsehill Road W	0	0	0	0
OP 4	dwelling	5930 Midland Highway	0	0	0	0
OP 5	dwelling	5876 Midland Highway	0	0	0	0
OP 6	dwelling	108 Courts Road	0	0	0	0
OP 7	dwelling	146 Courts Road	0	0	0	0
OP 8	dwelling	5975 Midland Highway	0	0	0	0
OP 9	dwelling	68 Horsehill Road	0	0	0	0
Route 1	road	Midland Highway	0	0	0	0
Route 2	road	Woolshed Road	0	0	0	0
Route 3	road	Horsehill Road	0	0	0	0
Route 4	road	Horsehill Road W	0	0	0	0
Route 5	road	Fords Lane	0	0	0	0
Route 6	road	Murphys Road	0	0	0	0
Route 7	road	Cantlons Lane	0	0	0	0
Route 8	road	Clarendon-Blue Bridge Road	0	0	0	0
Route 9	road	Elaine-Blue Bridge Road	0	0	0	0
Route 10	road	Geelong-Ballarat Railway	0	0	0	0

Table 5 - Summary of results: Total predicted glare (resting angles 5°-60°).

It is recommended that the Resting Angle for the Project is configured to between 5° and 60° to eliminate all potential glare towards assessed receptors. This range falls within the typical resting angle range for solar farms of around 45-60 degrees.

Based on the proposed layout there are no glare impacts expected for the Project for all assessed receptors within 1km of the Project, which includes assessed roads and dwellings. As a result, there would also be no interference expected for viewpoints located at greater distances from the project site.

As there is no glare predicted when the proposed solar panels for the Project are configured within the recommended and typical resting angle ranges, additional glare mitigation measures are not required.

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.

For air traffic, risk is considered minimal, principally because of the distance to the nearest aviation facility at Lethbridge Airport, which is located 22 km to the south.

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) may be consulted.

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 FAA concluded:

'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.' [4]

[4] Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports (2021).

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6 AMELIORATION STRATEGIES

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

6.1 On-Site Actions

On-site actions relate to initiatives which can be undertaken within the boundaries of the Project area (refer to the ***Appendix B*** and ***Figure 81***).

6.1.1 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 where vegetation is lacking. The western block of the Project has an exposed boundary to the north, which should be planted with dense screening species to ameliorate views from VP9. The southern and eastern boundaries are mostly well screened by existing vegetation. However, infill planting of these boundaries will mitigate impacts to VP1 and VP6.

The eastern block is typically distant from most sensitive viewpoints, with views filtered by vegetation throughout the landscape. However, low density tall shrub planting should be located around all perimeters.

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

The low-profile form of the majority of the Project, primarily the solar array, which is approximately 2.4 m in height at full tilt, will ensure that planting will be able to provide screening within a relatively short period of time.

6.1.2 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.

6.2 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.

Figure 81 – Landscape Strategy

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7 CONCLUSION

7.1 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 sections of the Midland Highway and one residence on partly elevated topography to the north. 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 to slightly undulating topography does not allow for significant overlooking from fore or middle ground locations and the scattered, and occasionally dense bands of vegetation surrounding the Project's western block provides visual screening, with the extent of screening increasing with distance from the Project.

Additionally, the Project is located within an "envelope" of energy infrastructure components, ensuring collocation or clustering of landscape modifying elements.

7.2 Visual impacts

7.2.1 Views and visibility

Residential viewpoints to the east and west are typically at a similar elevation to the Project and, therefore, overlooking will not be possible.

The highpoint in the topography to the south of the Project results in views from the south from residences, as well as the settlement of Elaine, being blocked.

From residences in slightly elevated areas to the north, in the vicinity of Mt Doran and Durham Lead, dense vegetation surrounding the viewpoints will screen most views to the Project.

Residences on more elevated land between Mt Doran and Lal Lal may have overlooking views of the Project where breaks in the mostly dense vegetation permit.

Distant views may be possible from the Alexander Bell Memorial Tower lookout platform at Mount Buninyong.

Views from the Midland Highway to Mount Buninyong will not be interrupted by the Project, as the highest components of the project would sit well below the tops of vegetation lining the road corridor.

The powerlines will be of a similar height to other powerlines along roads throughout the setting of the project. Consequently, their visual impact is assessed as being low.

Where views of the Project may be possible from residences, the Midland Highway and Mount Buninyong, the components of the Project will be viewed in the context of 22 existing wind turbines, a substation and interconnector powerlines.

7.2.2 Visual impact on sensitive receptors

Prior to amelioration, only a limited number of sensitive uses proximate to the Project will result in a high or medium high initial level of impact. These are:

- VP1 – from the Midland Highway travelling from the south, a moderate to high visual impact is predicted prior to amelioration.
- VP6 - from the Midland Highway travelling from the north, a moderate visual impact is predicted prior to amelioration.
- VP9 – from the residence at 5975 Midland Highway, located on slightly elevated topography, a high visual impact is predicted prior to amelioration.
- VP17 - from the residence at 68 Horsehill Road, located on slightly elevated topography, a high visual impact is predicted prior to amelioration.

Apart from the above, overall, the Project is assessed as having either a low level of visual impact, or not being visible from surrounding sensitive viewpoints, primarily due to the limited number of proximate sensitive viewpoints and the relative lack of visibility resulting from existing vegetation throughout the landscape and the screening effects of rising topography. The residual visual impact will typically reduce to very low after the establishment of amelioration measures.

Viewpoint (VP)#	Distance from Project	Sensitivity	Modification level	Initial Impact	Residual Impact
VP 1 – Midland Hwy (South)	10m	H	L - M	M - H	VL
VP 2 – 5261 Midland Hwy	770m	H	VL - L	L	VL
VP 3 – 87 Fords Rd	540m	H	VL - L	L	VL
VP 4 – "Nambool"	1.7km	H	NA	NA	NA
VP 5 – 100 Horsehill Rd	740m	H	L	M	VL
VP 6 – Midland Hwy (North)	50m	H	L	M	VL
VP 7 – 5876 Midland Hwy	50m	H	L	M	VL
VP 8 – 5930 Midland Hwy	360m	H	L	M	VL
VP 9 – 5975 Midland Hwy	250m	H	M	H	L
VP 10 – 108 Courts Rd	1km	H	VL	L	VL
VP 11 – 16 Mt Doran Rd	1.3km	H	NA	NA	NA
VP12 – 79 Pearsons Rd	2.3km	M	NA	NA	NA
VP13 – 183 Mt Doran Rd	3km	M	NA	NA	NA
VP14 – 125 Betsons Rd	2.2km	M	NA	NA	NA
VP15 – Melb – Ballarat Rail	1.2km	L	L	L	VL
VP16 – 430 Settlement Rd	1.5km	M	NA	NA	NA
VP17 – 68 Horsehill Rd	150m	H	H	H	L

Table 6 – Summary of Visual Impacts – representative viewpoints

7.3 Lighting impacts

Within the Category A2 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.

7.4 Glint and glare impacts

Given the tilting solar panels, and the minimal opportunities for overlooking of the Project, the potential for impact resulting from reflection or glare is considered low.

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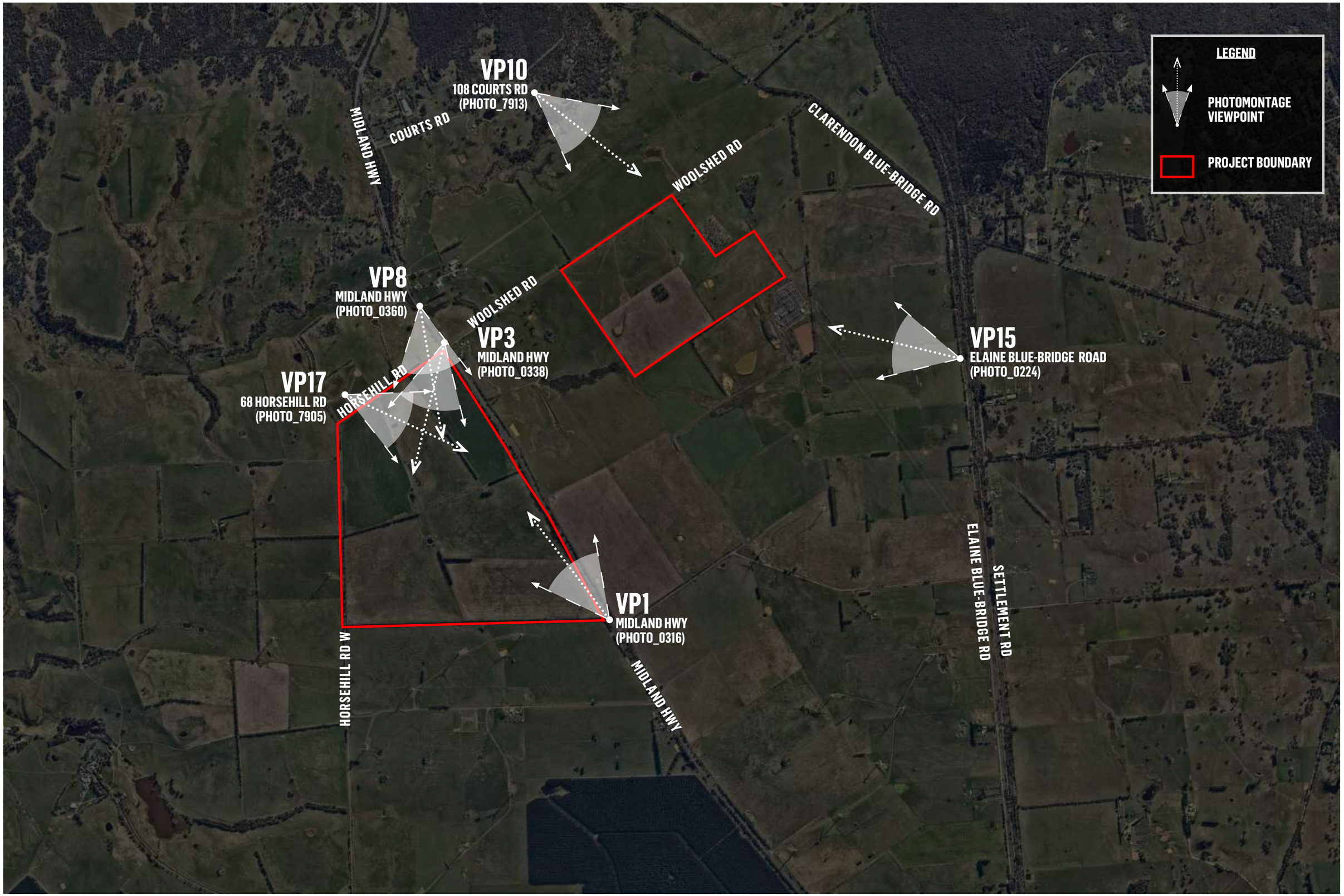
APPENDIX A – PHOTO SIMULATIONS

URBIS

ELAINE SOLAR FARM

VISUAL ASSESSMENT | PHOTOMONTAGES

PREPARED FOR
ELGIN ENERGY
NOVEMBER 2023



URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

PHOTOMONTAGES - VIEW LOCATION MAP

ADVERTISED PLAN

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_MAP
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP1 (PHOTO 0316) : LOOKING NW ALONG MIDLAND HWY | EXISTING CONDITIONS 2023-07-07 11:55 AEST

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_1A
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP1 (PHOTO 0316) : LOOKING NW ALONG MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_1B
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP1 (PHOTO 0316) : LOOKING NW ALONG MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT WITH LANDSCAPING AT 5 YRS

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_1C
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP3 (PHOTO 0338) : LOOKING SSW FROM MIDLAND HIGHWAY | EXISTING CONDITIONS 2023-07-07 12:25 AEST

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_3A
REV: -

DISTANCE TO PROJECT - <50M
ORIGINAL PHOTO EXTENT - 35MM STANDARD VIEW

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP3 (PHOTO 0338) : LOOKING SSW FROM MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_3B
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP3 (PHOTO 0338) : LOOKING SSW FROM MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT WITH LANDSCAPING AT 5 YRS

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_3C
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP8 (PHOTO 0360) : LOOKING SOUTH ACROSS MIDLAND HWY | EXISTING CONDITIONS 2023-07-07 12:33 AEST

ADVERTISED PLAN

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_8A
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP8 (PHOTO 0360) : LOOKING SOUTH ACROSS MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_8B
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP8 (PHOTO 0360) : LOOKING SOUTH ACROSS MIDLAND HWY | PHOTOMONTAGE - PROPOSED DEVELOPMENT WITH LANDSCAPING AT 5 YRS

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_8C
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP10 (PHOTO 7913) : LOOKING SE FROM 108 COURTS RD | EXISTING CONDITIONS 2023-08-24 12:00 AEST

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_10A
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP10 (PHOTO 7913) : LOOKING SE FROM 108 COURTS RD | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_10B
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP10 (PHOTO 7913) : LOOKING SE FROM 108 COURTS RD | PHOTOMONTAGE - PROPOSED DEVELOPMENT WITH LANDSCAPING AT 5 YRS

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_10C
REV: -

50MM STANDARD VIEW REFERENCE

ORIGINAL PHOTO EXTENT - 24MM STANDARD VIEW

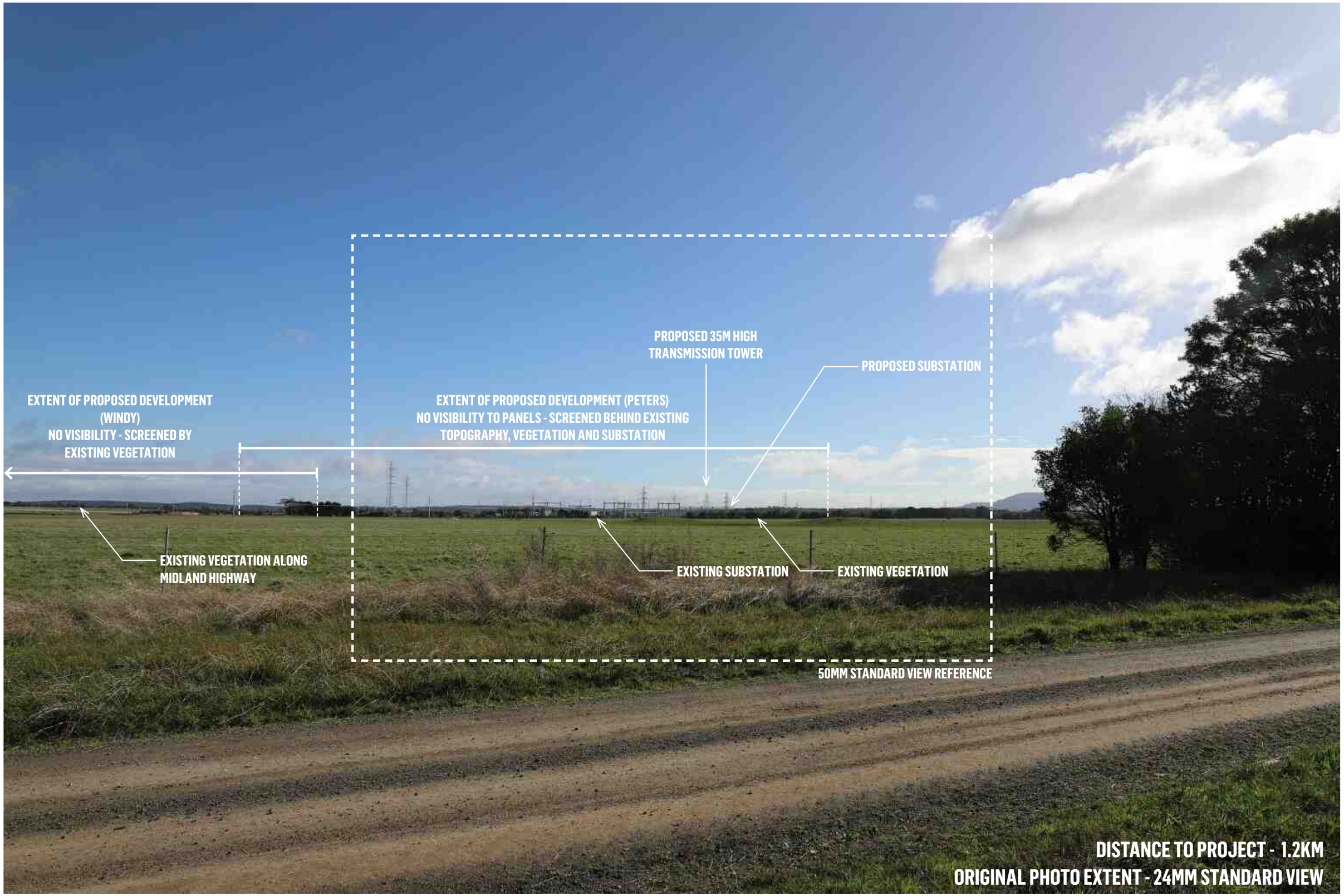
URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP15 (PHOTO 0465) : LOOKING WNW FROM ELAINE BLUE-BRIDGE RD | EXISTING CONDITIONS 2023-07-07 13:12 AEST

ADVERTISED PLAN

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_15A
REV: -



URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP15 (PHOTO 0465) : LOOKING WNW FROM ELAINE BLUE-BRIDGE RD | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_15B
REV: -

ORIGINAL PHOTO EXTENT - 50MM STANDARD VIEW

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP17 (PHOTO 7905) : LOOKING ESE FROM 68 HORSEHILL RD | EXISTING CONDITIONS 2023-08-24 11:08 AEST

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_17A
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP17 (PHOTO 7905) : LOOKING ESE FROM 68 HORSEHILL RD | PHOTOMONTAGE - PROPOSED DEVELOPMENT

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_17B
REV: -

URBIS

ELAINE SOLAR FARM - VISUAL ASSESSMENT

VP17 (PHOTO 7905) : LOOKING ESE FROM 68 HORSEHILL RD | PHOTOMONTAGE - PROPOSED DEVELOPMENT WITH LANDSCAPING AT 5 YRS

DATE: 2023-11-09
JOB NO: P0042161
DWG NO: VP_17C
REV: -

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APPENDIX B – LANDSCAPE AMELIORATION STRATEGY

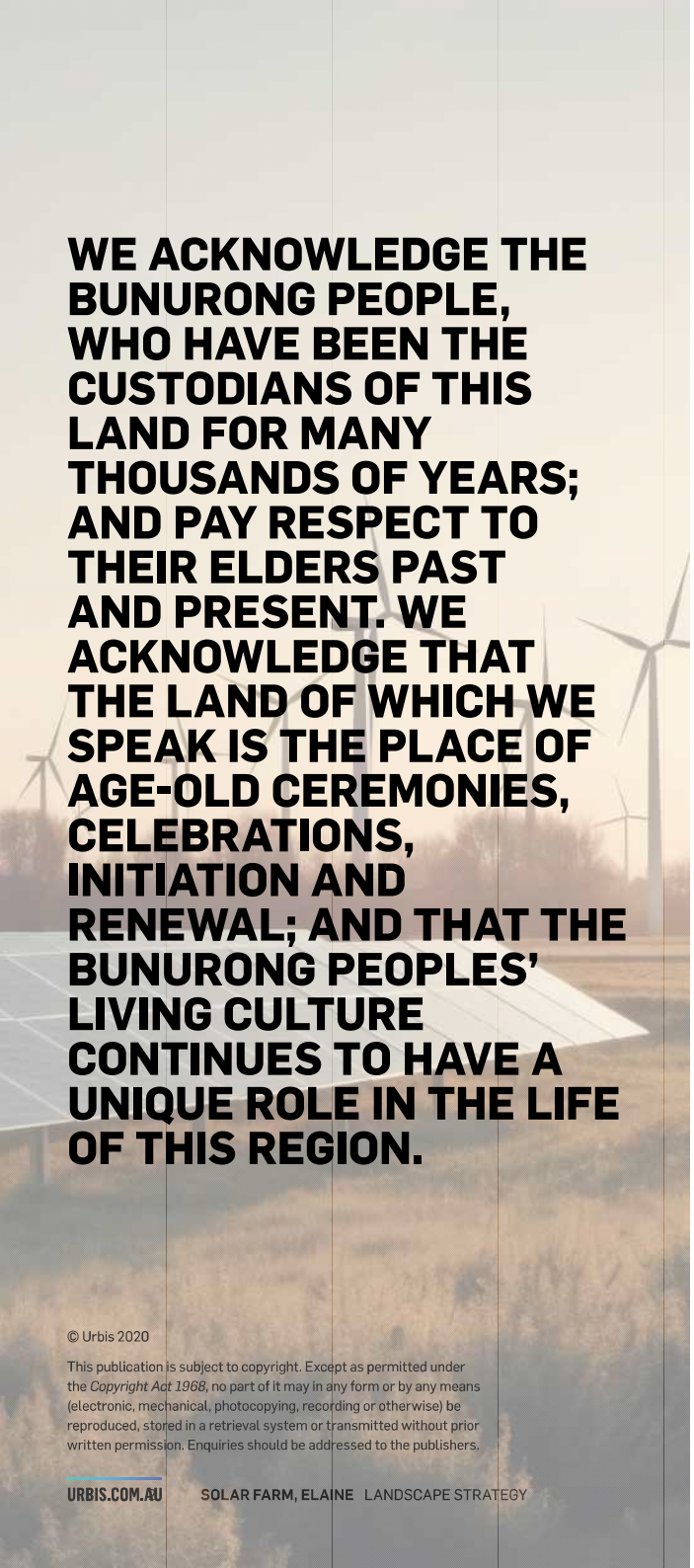
LANDSCAPE STRATEGY

ADVERTISED PLAN

ELAINE SOLAR FARM

DATE: 28.08.2023

URBIS



WE ACKNOWLEDGE THE BUNURONG PEOPLE, WHO HAVE BEEN THE CUSTODIANS OF THIS LAND FOR MANY THOUSANDS OF YEARS; AND PAY RESPECT TO THEIR ELDERS PAST AND PRESENT. WE ACKNOWLEDGE THAT THE LAND OF WHICH WE SPEAK IS THE PLACE OF AGE-OLD CEREMONIES, CELEBRATIONS, INITIATION AND RENEWAL; AND THAT THE BUNURONG PEOPLES' LIVING CULTURE CONTINUES TO HAVE A UNIQUE ROLE IN THE LIFE OF THIS REGION.

CONTENTS

INTRODUCTION

Elgin Energy plan to submit a Planning Application for the development of the Elaine Solar Project (the Project) along the Midland Highway, Elaine. The Project is located approximately 12 kilometres (km) northeast of Meredith and approximately 80 km west of Melbourne.

This design report has been prepared by Urbis Pty Ltd (Urbis) to support the amelioration recommendations of a preliminary Landscape Visual Impact Assessment (LVIA) and for inclusion in the Planning Application.

SITE CONTEXT

The Project is located along the both the eastern and western boundaries of Midland Highway, between Clarendon (north) and Elaine (south).

The Project is comprised of two proposed sites (east and west). Both sites are situated adjacent to the Elaine Wind Farm.

The land use of the Project site and surrounding area is mostly agricultural farming.

DEVELOPMENT PROPOSAL

The Project involves the erection of approximately 246,884 individual solar panels across the two proposed sites, totaling approximately 267 hectares. This will include in the installation of inverters, transformers and the construction of a substation and battery energy storate system (BESS).

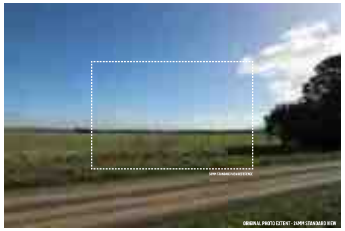
An agricultural type stockproof fence will be installed around the boundary of the site, with a 2.3 m high security fence set 5 metres to the inside of it. The 5 m space between the fences will enable the establishment of a buffer planting zone to screen the Project from surrounding sensitive viewpoints.

View 1: NW down Midland Highway

View 3: SSW from Midland Highway

View 8: South across Midland Highway

View 15: WNW from Blue-Bridge Rd.



DESIGN RESPONSE

METHODOLOGY

Screen Planting

The Landscape and Visual Impact Assessment report (LVIA) has identified viewpoints surrounding the Project subject to highest visual impacts. The most effective way to ameliorate views is to establish screen planting around the perimeter of the Project.

The western block of the Project has an exposed boundary to the north, which should be planted with dense screening species to ameliorate views from VP9. The southern and eastern boundaries are mostly well screened by existing vegetation. However, infill planting of these boundaries will mitigate impacts to VP1 and VP6.

The eastern block is typically distant from most sensitive viewpoints, with views filtered by vegetation throughout the landscape. However, low density tall shrub planting should be located around all perimeters.

The low-profile form of the majority of the Project, primarily the solar array, which is approximately 2.4 m in height at full tilt, will ensure that planting will be able to provide screening within a relatively short period of time.

PLANT ESTABLISHMENT MAINTENANCE

Maintenance Notes:

General

- Maintain a minimum 3 metre height of screening shrubs.
- Maintain 100mm maximum height of grassland within property boundary.
- Planting maintenance period: the planting maintenance period will be 52 weeks and will commence from the date of practical completion of each phase of planting works (hereby specified to be a separable part of the works). It is anticipated that planting works will be undertaken in one phase.
- Planting maintenance program: 2 weeks prior to practical completion, furnish a proposed planting establishment program, and amend it as required. Such proposal should contain details of the types and frequency of maintenance activities involved with the establishment of plants and grassed areas. Comply with the approved program.
- Planting maintenance log book: keep a log book recording when and what maintenance work has been done and what materials, including approved toxic materials, have been used. Log book must be signed off by the client's representative after each maintenance visit. Maintain log book in location nominated by superintendent. All entries are to be initialled by person nominated by superintendent. Log book to contain a copy of the approved planting establishment program.
- Product warranty: submit the supplier's written statement certifying that plants are true to the required species and type, and are free from diseases, pests and weeds.
- Insurance: the contractor is to ensure suitable insurance cover and / or bank guarantee is in place for the theft and / or damage of all works executed under this contract for the plant maintenance period.

Solar Panels

Urbis understand the following:

- Solar panels will be surrounded by existing pasture grass for easy. maintenance. Grass to be maintained to maximum 100mm height through grazing or slashing.
- Existing pasture grass to continue underneath solar panels extent.
- Gravel maintenance paths provided for vehicular maintenance circulation.

Watering

If the watering regime is intended to be amended the contractor must seek written approval from the superintendent immediately prior to the deferment of watering.

Watering permits: the contractor is responsible for obtaining the necessary watering permits required to carry out the watering as specified.

Watering Strategy

- Low water demand planting is proposed.
- Passive irrigation is proposed on site.
- Water truck watering to be utilised during establishment/maintenance period.

Planting Maintenance

Protection of works: provide any fencing or barriers necessary to protect the planting from damage throughout the planting establishment period.

Recurrent works: throughout the planting maintenance period, continue to carry out recurrent works of a maintenance nature all to the extent required to ensure that the plants are in the best possible condition at the end of the planting maintenance period. These activities are including but not limited to:

- weeding,
- rubbish removal,
- fertilizing,
- pest and disease control,
- adjusting / replacing stakes and ties
- topping up locally sourced mulch,
- cultivating,
- pruning,
- keeping the site neat and tidy.

Replacements: the contractor is responsible for the replacement of failed, damaged or stolen trees, shrubs and groundcovers throughout the planting establishment period.

Weeding

Generally: regularly remove, by hand, rubbish and weed growth that may occur or recur throughout turfed, planted and mulched areas. Continue eradication throughout the course of the works and during the planting establishment periods.

Weed eradication: the contractor must make allowance for a higher level of maintenance during establishment to ensure that weeds are controlled.

Herbicide use: re-application of herbicide such as Ronstar or equivalent if required.

Compliance

Requirement: plant maintenance shall be deemed complete subject to the following compliance with the criteria:

- repairs to planting media completed,
- ground surfaces are covered with the specified treatment to the specified depths,
- pests, disease, or nutrient deficiencies or toxicities are not evident.

- organic and rock mulched surfaces have been maintained in a weed free and tidy condition and to the specified depth
- vegetation is established and well formed
- plants have healthy root systems that have penetrated into the surrounding, undisturbed ground and not able to be lifted out of its planting hole
- vegetation is not restricting essential sight lines and signage
- collection and removal of litter
- all non-conformance reports and defects notifications have been closed out.
- plant maintenance compliance schedule.

Pruning

- Generally: tree plantings shall be left to grow in a form consistent with the growth habit of the species.
- Pruning: cut back tree canopies and groundcovers to road verges, and light poles and signs as required achieving clear sight lines when viewed along roadway.

Requirement: pruning to be undertaken by a qualified tree surgeon / arborist

Completion

- Cleaning: remove temporary protective fences and tree stakes at the end of the planting maintenance period.

Safety and Security

An integrated approach to safety will improve actual and perceived personal security in pedestrian public domain areas. Signage will be provided across the precinct to assist with wayfinding and navigation through the site.

VEGETATION RETENTION STRATEGY

- Refer to Ecological Consultants 'Biodiversity Assessment' for detailed fauna and flora reports and species
- Existing vegetation will be retained where possible.
- Dead trees with habitat value will be relocated. Refer to Ecological Consultants report for more information.

PROPOSED SCREENING TYPOLOGIES

Type 1 - High Density Tree & Shrub Planting

Comprised of:

- Large Trees – Centrally located along 5m buffer in random groups at 10m centres
- Small Trees – Centrally located along 5m buffer in random small groups between the canopy trees. Can be located as close as 3m apart.
- Large Shrubs – roughly located in a meandering line centrally along the 5m buffer at 2m centres.
- Medium Shrubs - roughly located in a meandering line either side of the line of trees and large shrubs at 1.2m centres.

Type 2 - High Density Shrub Planting

Comprised of:

- Large Shrubs – roughly located in a meandering line centrally along the 5m buffer at 2m centres.
- Medium Shrubs - roughly located in a meandering line either side of the large shrubs at 1.2m centres.

Type 3 - Low Density Tree & Shrub Planting

Comprised of:

- Large Trees – Centrally located along 5m buffer in random groups at 10m centres
- Large Shrubs – roughly located in a meandering line centrally along the 5m buffer at 3m centres.
- -Medium Shrubs - roughly located in a meandering line either side of the line of trees and large shrubs at 2m centres.

Type 4 - Low Density Shrub Planting

Comprised of:

- Large Shrubs – roughly located in a meandering line centrally along the 5m buffer at 3m centres.
- Medium Shrubs - roughly located in a meandering line either side of the line of trees and large shrubs at 2m centres.

PROPOSED PLANT SPECIES

- Given the location of the Project between the foothills of the You Yangs and the Little River, the plant species have been drawn from a number of EVC's and Council plant lists:
- EVC 55- Victorian Volcanic Plains – Plains woodlands or forests
- EVC 132 – Victorian Volcanic Plain – Plains grassland and chenopod shrublands
- EVC 22 – Central Victorian Uplands – Grassy Dry Forests
- EVC 128 – Central Victorian Uplands – Grassy Forest
- EVC 175 - Central Victorian Uplands – Grassy woodland

Plants of the Buninyong Region, N McCraken (2004)

LANDSCAPE STRATEGY

OVERALL PLANTING STRATEGY

LEGEND

- **Landscape Buffer Type 1:** High Density Tree & Shrub Planting
- **Landscape Buffer Type 2:** High Density Shrub Planting
- **Landscape Buffer Type 3:** Low Density Tree & Shrub Planting
- **Landscape Buffer Type 4:** Low Density Shrub Planting
- Vegetation Groups
  - to be removed. Refer to Urbis Elaine SF site plan for details
- Vegetation Groups
  - to be retained. Refer to Urbis Elaine SF site plan for details

Refer to Urbis Solar Farm Site Plan for detailed plan and specific location of retained and removed vegetation groups and trees.

PLANTING TYPOLOGIES

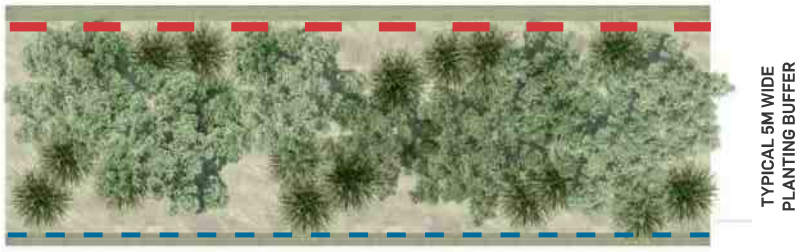
BUFFER PLANTING TYPE 1

HIGH DENSITY TREE & SHRUB PLANTING

LARGE TREES			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Red Stringybark	*Eucalyptus macrorhyncha*	10-35m x 10-20m	Tubestock
Bundy	*Eucalyptus goniocalyx s.l*	8-20m x 6-15m	Tubestock
Messmate Stringybark	*Eucalyptus obliqua*	20-90m x 10-35m	Tubestock
Yarra Gum	*Eucalyptus yarrensis*	10-20m x 5-10m	Tubestock
SMALL TREES			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Silver Wattle	*Acacia dealbata*	6-30m x 5-10m	Tubestock
Blackwood	*Acacia melanoxylon*	5-30m x 4-15m	Tubestock
Black Sheoak	*Allocasuarina littoralis*	5-12m x 2-6m	Tubestock
LARGE SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Hedge Wattle	*Acacia paradoxa*	2-4m x 2-5m	Tubestock
Golden Wattle	*Acacia pyncnantha*	3-10m 2-5m	Tubestock
Hop Wattle	*Acacia stricta*	2-5m x 2-4m	Tubestock
Drooping Sheoak	*Allacasuarina verticillata*	5-8m x 4-6m	Tubestock
Silver Banksia	*Banksia marginata*	1-3m x 0.5-2m	Tubestock
MEDIUM SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Prickly Moses	*Acacia verticillata*	2-5m x 3-5m	Tubestock
Sweet Bursaria	*Bursaria spinosa*	2-6m x 2-3m	Tubestock
Prickly Current Bush	*Coprosma quadrifida*	2-4m x 1-1.5m	Tubestock
Sticky Hop Bush	*Dodonaea viscosa*	2-4m x 2-4m	Tubestock
Tree Violet	*Melicytus dentatus*	2-4m x 1-2.5m	Tubestock
Prickly Tea Tree	*Leptospermum continentale*	1-4m x 1-2m	Tubestock
Silky Tea Tree	*Leptospermum lanigerum*	2-6m x 1-3m	Tubestock

BUFFER PLANTING TYPE 2

HIGH DENSITY SHRUB PLANTING



LARGE SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Hedge Wattle	*Acacia paradoxa*	2-4m x 2-5m	Tubestock
Golden Wattle	*Acacia pyncnantha*	3-10m 2-5m	Tubestock
Hop Wattle	*Acacia stricta*	2-5m x 2-4m	Tubestock
Drooping Sheoak	*Allacasuarina verticillata*	5-8m x 4-6m	Tubestock
Silver Banksia	*Banksia marginata*	1-3m x 0.5-2m	Tubestock
MEDIUM SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Prickly Moses	*Acacia verticillata*	2-5m x 3-5m	Tubestock
Sweet Bursaria	*Bursaria spinosa*	2-6m x 2-3m	Tubestock
Prickly Current Bush	*Coprosma quadrifida*	2-4m x 1-1.5m	Tubestock
Sticky Hop Bush	*Dodonaea viscosa*	2-4m x 2-4m	Tubestock
Tree Violet	*Melicytus dentatus*	2-4m x 1-2.5m	Tubestock
Prickly Tea Tree	*Leptospermum continentale*	1-4m x 1-2m	Tubestock
Silky Tea Tree	*Leptospermum lanigerum*	2-6m x 1-3m	Tubestock

LEGEND

Trees*

Shrub \ Screen Planting*

Tufting Planting*

Existing Grass

Security Mesh Fence

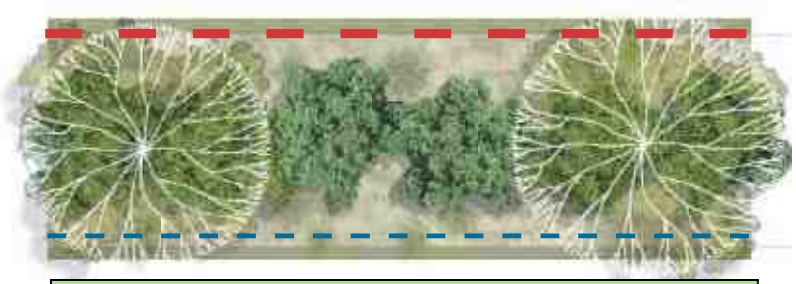
Property Boundary Line

*Plants to be selected from Proposed Planting List

PLANTING TYPOLOGIES

BUFFER PLANTING TYPE 3

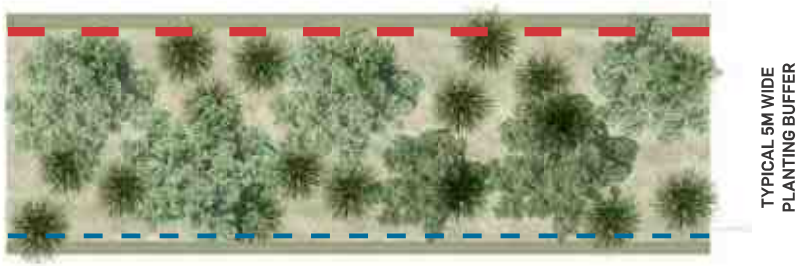
LOW DENSITY TREE & SHRUB PLANTING



LARGE TREES			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Red Stringybark	*Eucalyptus macrorhyncha*	10-35m x 10-20m	Tubestock
Bundy	*Eucalyptus goniocalyx s.l*	8-20m x 6-15m	Tubestock
Messmate Stringybark	*Eucalyptus obliqua*	20-90m x 10-35m	Tubestock
Yarra Gum	*Eucalyptus yarrensis*	10-20m x 5-10m	Tubestock
LARGE SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Hedge Wattle	*Acacia paradoxa*	2-4m x 2-5m	Tubestock
Golden Wattle	*Acacia pyncnantha*	3-10m 2-5m	Tubestock
Hop Wattle	*Acacia stricta*	2-5m x 2-4m	Tubestock
Drooping Sheoak	*Allacasuarina verticillata*	5-8m x 4-6m	Tubestock
Silver Banksia	*Banksia marginata*	1-3m x 0.5-2m	Tubestock
MEDIUM SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Prickly Moses	*Acacia verticillata*	2-5m x 3-5m	Tubestock
Sweet Bursaria	*Bursaria spinosa*	2-6m x 2-3m	Tubestock
Prickly Current Bush	*Coprosma quadrifida*	2-4m x 1-1.5m	Tubestock
Sticky Hop Bush	*Dodonaea viscosa*	2-4m x 2-4m	Tubestock
Tree Violet	*Melicytus dentatus*	2-4m x 1-2.5m	Tubestock
Prickly Tea Tree	*Leptospermum continentale*	1-4m x 1-2m	Tubestock
Silky Tea Tree	*Leptospermum lanigerum*	2-6m x 1-3m	Tubestock

BUFFER PLANTING TYPE 4

LOW DENSITY SHRUB PLANTING



LARGE SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Hedge Wattle	*Acacia paradoxa*	2-4m x 2-5m	Tubestock
Golden Wattle	*Acacia pyncnantha*	3-10m 2-5m	Tubestock
Hop Wattle	*Acacia stricta*	2-5m x 2-4m	Tubestock
Drooping Sheoak	*Allacasuarina verticillata*	5-8m x 4-6m	Tubestock
Silver Banksia	*Banksia marginata*	1-3m x 0.5-2m	Tubestock
MEDIUM SHRUBS			
COMMON NAME	**SCIENTIFIC NAME**	**MATURE SIZE (H X W)**	**POT SIZE**
Prickly Moses	*Acacia verticillata*	2-5m x 3-5m	Tubestock
Sweet Bursaria	*Bursaria spinosa*	2-6m x 2-3m	Tubestock
Prickly Current Bush	*Coprosma quadrifida*	2-4m x 1-1.5m	Tubestock
Sticky Hop Bush	*Dodonaea viscosa*	2-4m x 2-4m	Tubestock
Tree Violet	*Melicytus dentatus*	2-4m x 1-2.5m	Tubestock
Prickly Tea Tree	*Leptospermum continentale*	1-4m x 1-2m	Tubestock
Silky Tea Tree	*Leptospermum lanigerum*	2-6m x 1-3m	Tubestock

LEGEND

- Trees*
- Shrub \ Screen Planting*
- Tufting Planting*
- Existing Grass
- Security Mesh Fence
- Property Boundary Line

*Plants to be selected from Proposed Planting List

PLANTING PALETTE

TALL SHRUBS


Acacia stricta


Acacia pycnantha


Acacia paradoxa


Drooping sheoak


Banksia marginata

MEDIUM SHRUBS


Leptospermum continentale


Acacia verticillata


Hymenanthera dentata


Bursari spinosa


Dodonaea viscosa

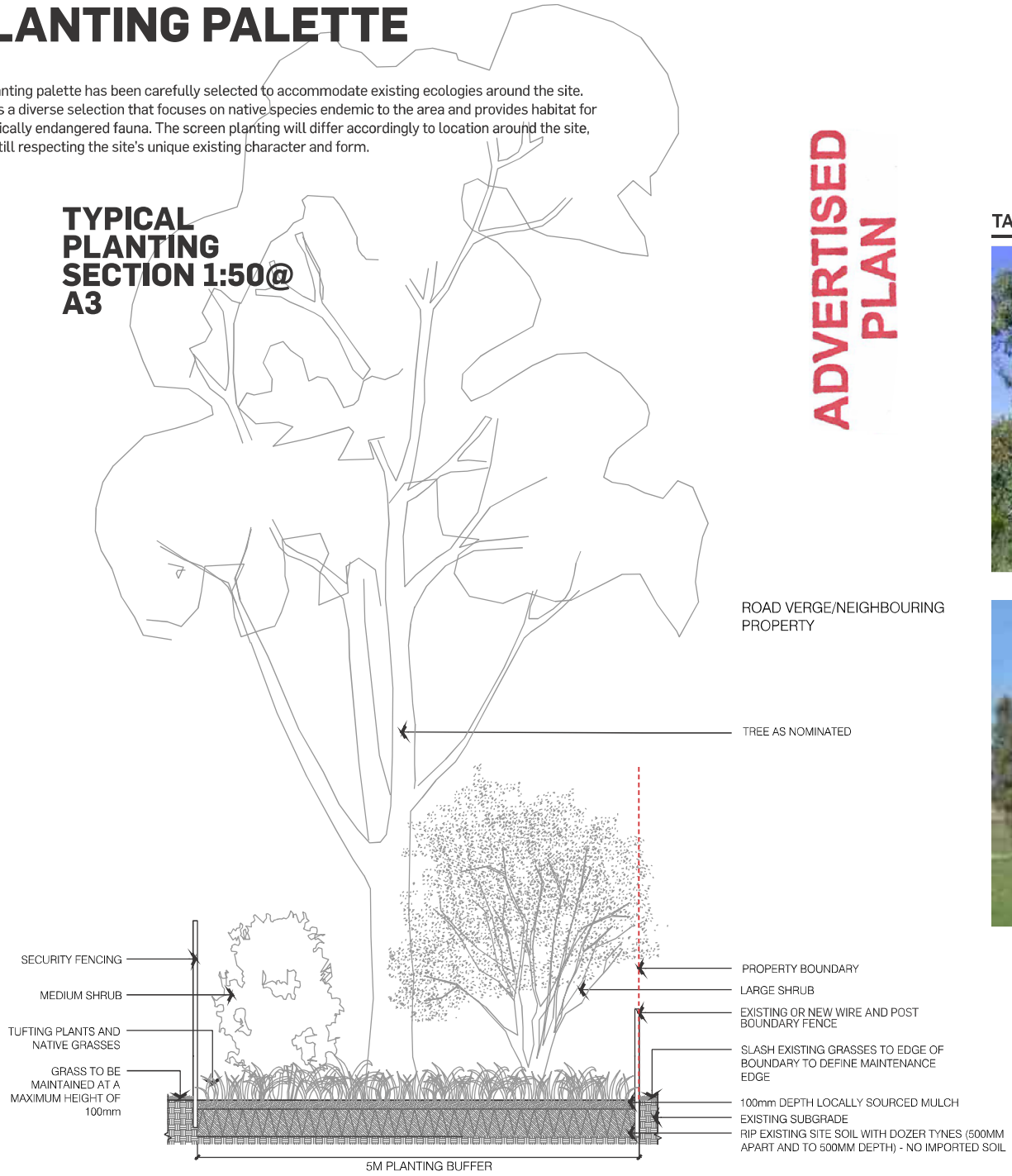

Coprosma quadrifida


Leptospermum lanigerum

PLANTING PALETTE

The planting palette has been carefully selected to accommodate existing ecologies around the site. There is a diverse selection that focuses on native species endemic to the area and provides habitat for the critically endangered fauna. The screen planting will differ accordingly to location around the site, while still respecting the site's unique existing character and form.

TYPICAL PLANTING SECTION 1:50@ A3



TALL & SMALL TREES


Eucalyptus goniocalyx


Acacia dealbata


Eucalyptus yaraensis


Allocasuarina verticillata


Eucalyptus obliqua


Eucalyptus macrorhyncha

PETER HAACK
CONSULTING

APPENDIX C – GLINT AND GLARE ANALYSIS

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)

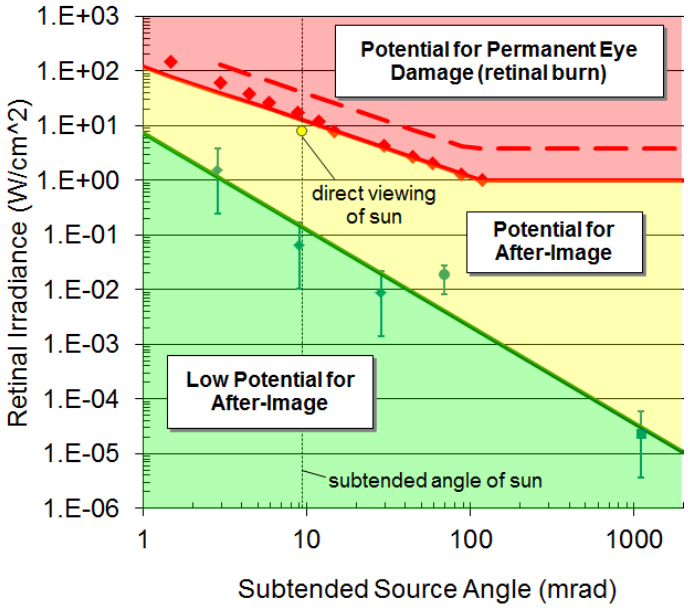


Figure 1 – Glare hazard plot defining ocular impact (Ho et al, 2011)

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 1***. 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 1***) 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, with an additional solar farm located about 700m from the north-south runway proposed to be operational by end of 2024.

PV Array Areas

The Project consists of two proposed PV array areas, representing the area proposed to contain solar panels based on the proposed layout. Coordinates for these have been derived from the supplied CAD plans which contain geo-coordinates. Refer to **Table 2** and ***Figure 2***.

Table 1 – Project PV Areas

PV Array ID	PV Array area details
PV Array 1	Proposed - Peters
PV Array 2	Proposed - Windy

Receptors

As recommended in DELWP's Solar Energy Facilities: Design and Development Guideline (October 2022), roads and dwellings within 1km of the proposed facility boundaries will be assessed. Additionally, dwellings and routes sitting just outside of this 1km zone will also be assessed. These additional receptors are identified by Receptor IDs OP6, OP7, Route 9 and Route 10. Refer to **Table 2 and *Figure 2* .**

The Project will also be assessed for potential glare towards the nearest aviation facility, which have been identified as follows:

- Lethbridge Airport is approximately 21 kilometres to the SSE of the project and consists of one runway running approximately east-west.

A total of 21 receptors have been identified and will be assessed. Refer to **Table 2** and ***Figure 2***

Table 2 – Project receptors and routes

Receptor ID	Receptor Type	Receptor details	Distance to Project
FP 1	airport	Lethbridge Airport (10)	21.0km
FP 2	airport	Lethbridge Airport (28)	21.8km
OP 1	dwelling	5621 Midland Highway	780m
OP 2	dwelling	87 Fords Lane	550m
OP 3	dwelling	100 Horsehill Road W	740m
OP 4	dwelling	5930 Midland Highway	420m
OP 5	dwelling	5876 Midland Highway	70m
OP 6	dwelling	108 Courts Road	1.01km
OP 7	dwelling	146 Courts Road	1.01km
OP 8	dwelling	5975 Midland Highway	940m
OP 9	dwelling	68 Horsehill Road	125m
Route 1	road	Midland Highway	25m
Route 2	road	Woolshed Road	<10m
Route 3	road	Horsehill Road	<10m
Route 4	road	Horsehill Road W	<10m
Route 5	road	Fords Lane	520m
Route 6	road	Murphys Road	120m
Route 7	road	Cantlons Lane	<10m
Route 8	road	Clarendon-Blue Bridge Road	850m
Route 9	road	Elaine-Blue Bridge Road	1.02km
Route 10	road	Geelong-Ballarat Railway	1.07km

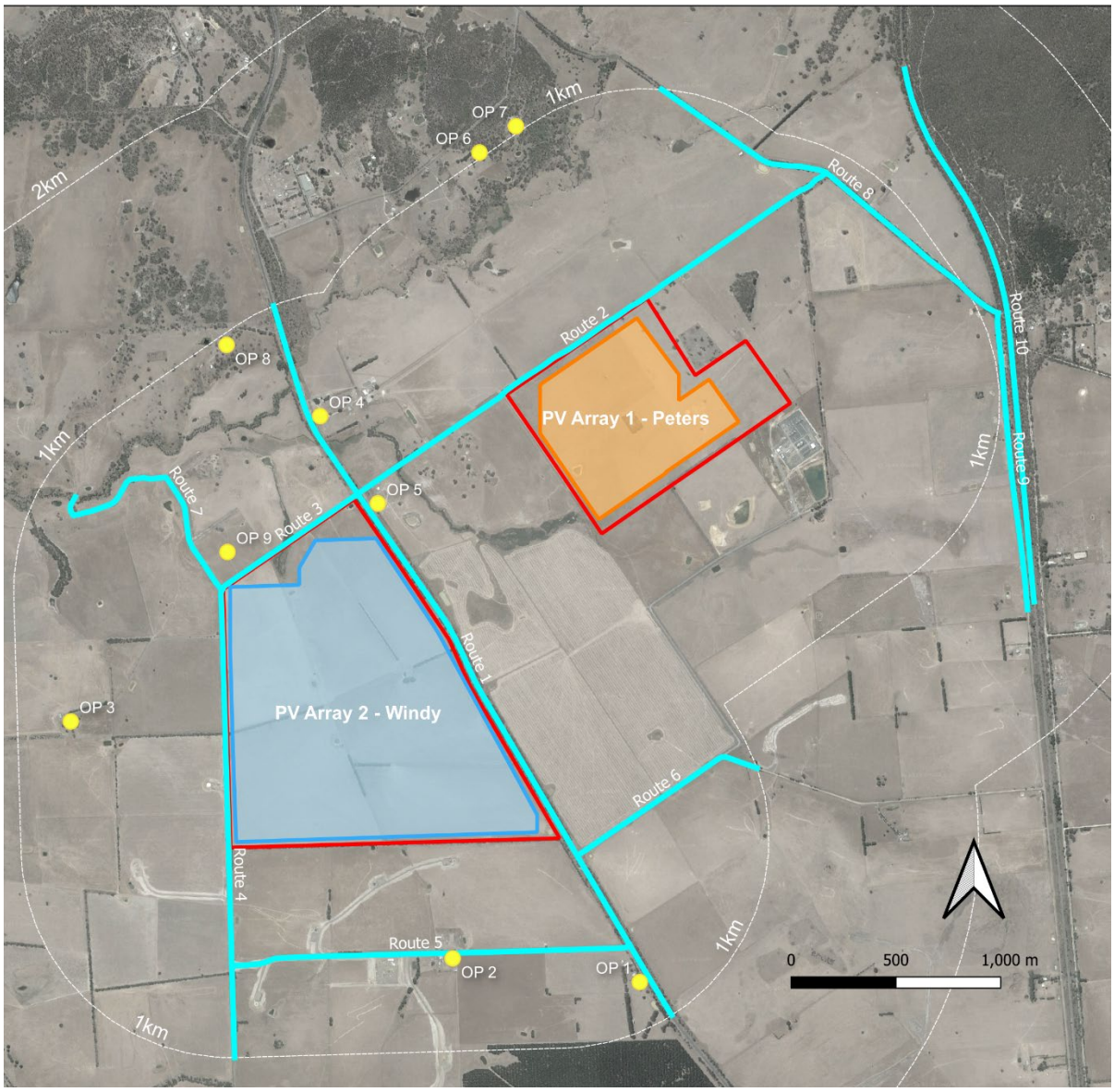


Figure 2 – Project receptors and routes (airports out of range – not shown)

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 3**.

Table 3 – 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°,3°,5°,15°,30°,45°,60°)
Ground Coverage Ratio (GCR)	0.436	-	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 as specified in supplied manufacturers specification sheet. (Canadian Solar - CS7N-660MB-AG)
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			
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 minimum ground clearance of 500mm.
Standing height at Observation Points (OPs)	1.6	m	Height of person standing above natural ground level at observation points (OPs)
Driver height (road)	1.3	m	Average height of driver above road
Driver height (railway)	2.42	m	Average height of driver above ground
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 Arrays 1 and 2 have been extracted from geo-referenced digital CAD files and imported into the model. 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.

Resting Angles

In order to better understand and reduce the amount of any predicted glare from the Project towards all identified receptors, a number of scenarios across the solar panel tilt range will be analysed. We have found that for projects where glare has been predicted that a key factor affecting the level of predicted Project glare could often be contributed to the configured resting angle of the proposed 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. If by analysing the project over a number of resting angle scenarios find that there is a significant change in magnitude of predicted glare that it often 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. The resting angle for solar panels is configurable, typically set to around 45-60 degrees.

Results

A total of seven scenarios based on resting angle were simulated covering the full range of motion from 0° to +/-60° to understand the effect of altering the resting angle parameter on predicted glare. For scenarios with resting angle configured at 0°-3° some green and yellow glare is predicted from PV Array 1 – Peters and/or PV Array 2 – Windy. The amount of glare predicted decreases as the resting angle is increased, with the modelling showing that scenarios ranging from a resting angle of 5°-60° resulted in no predicted glare to any receptors from both project sites. See **Table 4**.

Table 4 – Summary results: Total predicted glare based on resting angle.

	PV Array 1 - Peters		PV Array 2 - Windy	
	Green Glare (min/year)	Yellow Glare (min/year)	Green Glare (min/year)	Yellow Glare (min/year)
Resting Angle	**Total (all receptors)**	**Total (all receptors)**	**Total (all receptors)**	**Total (all receptors)**
0 degrees	2,144	485	1607	658
3 degrees	613	14	0	0
5 degrees	0	0	0	0
15 degrees	0	0	0	0
30 degrees	0	0	0	0
45 degrees	0	0	0	0
60 degrees	0	0	0	0

Under all scenarios where the Project is configured with a resting angle from 5°-60° there is no glare predicted towards all identified receptors. See **Table 5**.

For detailed results, the report outputs from the ForgeSolar's GlareGauge software is provided as **Appendix C.**

Table 5 – Summary of results: Total predicted glare (resting angles 5°-60°)

			Green Glare (min/year)	Yellow Glare (min/year)	Green Glare (min/year)	Yellow Glare (min/year)
Receptor ID	**Receptor Type**	**Receptor details**	**PV Array 1 Peters**		**PV Array 2 Windy**	
FP 1	airport	Lethbridge Airport (10)	0	0	0	0
FP 2	airport	Lethbridge Airport (28)	0	0	0	0
OP 1	dwelling	5621 Midland Highway	0	0	0	0
OP 2	dwelling	87 Fords Lane	0	0	0	0
OP 3	dwelling	100 Horsehill Road W	0	0	0	0
OP 4	dwelling	5930 Midland Highway	0	0	0	0
OP 5	dwelling	5876 Midland Highway	0	0	0	0
OP 6	dwelling	108 Courts Road	0	0	0	0
OP 7	dwelling	146 Courts Road	0	0	0	0
OP 8	dwelling	5975 Midland Highway	0	0	0	0
OP 9	dwelling	68 Horsehill Road	0	0	0	0
Route 1	road	Midland Highway	0	0	0	0
Route 2	road	Woolshed Road	0	0	0	0
Route 3	road	Horsehill Road	0	0	0	0
Route 4	road	Horsehill Road W	0	0	0	0
Route 5	road	Fords Lane	0	0	0	0
Route 6	road	Murphys Road	0	0	0	0
Route 7	road	Cantlons Lane	0	0	0	0
Route 8	road	Clarendon-Blue Bridge Road	0	0	0	0
Route 9	road	Elaine-Blue Bridge Road	0	0	0	0
Route 10	road	Geelong-Ballarat Railway	0	0	0	0

We therefore recommend that the Resting Angle for the Project is configured to between 5° and 60° to eliminate all potential glare towards assessed receptors. This range falls within the typical resting angle range for solar farms of around 45-60 degrees.

Based on the proposed layout there are no glare impacts expected for the Project for all assessed receptors within 1km of the Project, which includes assessed roads and dwellings. As a result, there would also be no interference expected for viewpoints located at greater distances from the project site.

As there is no glare predicted when the proposed solar panels for the Project are configured within the recommended and typical resting angle ranges, additional glare mitigation measures are not required.

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.

FORGESOLAR'S GLAREGAUGE:
GLARE ANALYSIS RESULTS
5° RESTING ANGLE SCENARIO

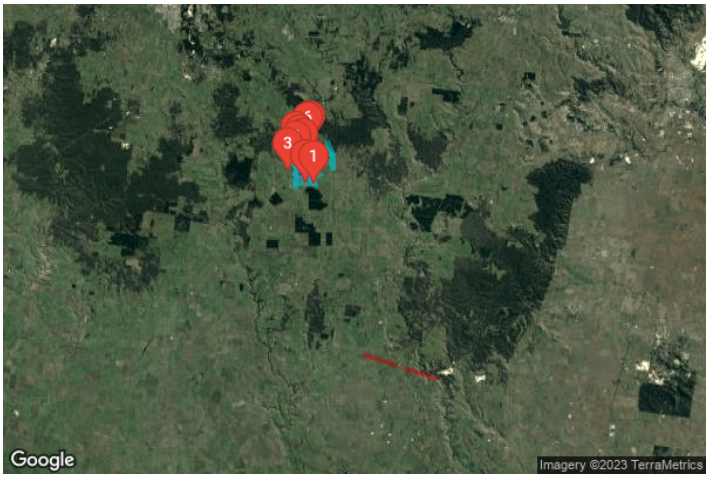
FORGESOLAR GLARE ANALYSIS

Project: **P0042161 Elaine Solar Farm**
Site configuration: **ElaineSF_202308A_05deg**

Client: Elgin

Created 26 Oct, 2023
Updated 26 Oct, 2023
Time-step 1 minute
Timezone offset UTC10
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 104020.16634

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2



Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1 - Peters	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 2 - Windy	SA tracking	SA tracking	0	0.0	0	0.0	-

Total 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 01 - Midland Highway	0	0.0	0	0.0
Route 02 - Woolshed Road	0	0.0	0	0.0
Route 03 - Horsehill Road	0	0.0	0	0.0
Route 04 - Horsehill Road W	0	0.0	0	0.0
Route 05 - Fords Lane	0	0.0	0	0.0
Route 06 - Murphys Road	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 07 - Cantlons Lane	0	0.0	0	0.0
Route 08 - Clarendon-Blue Bridge Road	0	0.0	0	0.0
Route 09 - Elaine-Blue Bridge Road	0	0.0	0	0.0
Route 10 - Geelong-Ballarat Railway	0	0.0	0	0.0
FP 1 - Lethbridge Airport 10	0	0.0	0	0.0
FP 2 - Lethbridge Airport 28	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

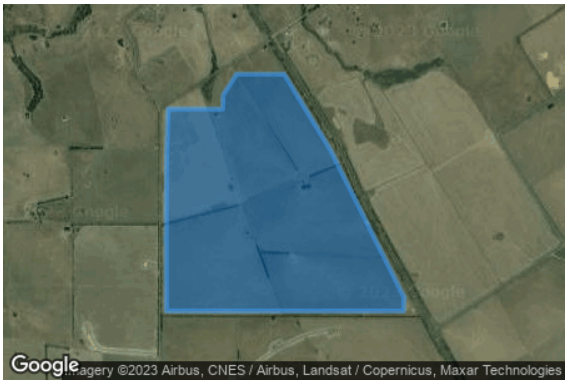
Component Data

PV Arrays

Name: PV array 1 - Peters
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.436
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	-37.733929	144.001022	389.45	2.17	391.62
2	-37.732067	144.004679	394.27	2.17	396.45
3	-37.731991	144.004744	394.33	2.17	396.51
4	-37.729941	144.008770	397.33	2.17	399.51
5	-37.728082	144.007233	398.62	2.17	400.79
6	-37.728934	144.005561	395.73	2.17	397.91
7	-37.727827	144.005605	397.20	2.17	399.38
8	-37.725348	144.003430	397.15	2.17	399.32
9	-37.728071	143.998081	396.10	2.17	398.27
10	-37.730162	143.997997	395.95	2.17	398.12

Name: PV array 2 - Windy
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.436
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	-37.747266	143.980841	395.46	2.17	397.64
2	-37.747264	143.997140	401.43	2.17	403.60
3	-37.746513	143.997171	401.50	2.17	403.68
4	-37.738506	143.992087	399.13	2.17	401.30
5	-37.734440	143.988937	389.38	2.17	391.55
6	-37.734441	143.985652	387.34	2.17	389.52
7	-37.735590	143.984732	385.89	2.17	388.06
8	-37.736324	143.984702	386.61	2.17	388.78
9	-37.736325	143.980958	391.10	2.17	393.28
10	-37.739004	143.980849	393.55	2.17	395.72
11	-37.743343	143.980824	395.51	2.17	397.69

Route Receptors

Name: Route 01 - Midland Highway
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.724324	143.983799	387.10	1.30	388.40
2	-37.726194	143.984414	379.80	1.30	381.10
3	-37.727705	143.984938	376.40	1.30	377.70
4	-37.728818	143.985345	376.60	1.30	377.90
5	-37.729430	143.985635	376.90	1.30	378.20
6	-37.729953	143.985967	377.00	1.30	378.30
7	-37.731785	143.987436	382.10	1.30	383.40
8	-37.733147	143.988544	387.50	1.30	388.80
9	-37.735701	143.990618	393.50	1.30	394.80
10	-37.737588	143.992153	399.90	1.30	401.20
11	-37.738238	143.992661	399.90	1.30	401.20
12	-37.738878	143.993070	399.70	1.30	401.00
13	-37.739687	143.993504	399.80	1.30	401.10
14	-37.740687	143.994030	400.00	1.30	401.30
15	-37.741234	143.994383	400.00	1.30	401.30
16	-37.744669	143.996756	402.00	1.30	403.30
17	-37.748708	143.999532	403.80	1.30	405.10
18	-37.749951	144.000387	404.80	1.30	406.10
19	-37.751907	144.001737	408.90	1.30	410.20
20	-37.752940	144.002448	411.60	1.30	412.90
21	-37.754893	144.003818	416.80	1.30	418.10
22	-37.755292	144.004110	417.70	1.30	419.00

Name: Route 02 - Woolshed Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.732504	143.988021	385.13	1.30	386.43
2	-37.731271	143.990436	379.71	1.30	381.01
3	-37.730381	143.992216	386.86	1.30	388.16
4	-37.729679	143.993613	390.85	1.30	392.15
5	-37.728567	143.995852	395.82	1.30	397.12
6	-37.728273	143.996249	395.94	1.30	397.24
7	-37.727821	143.997114	396.36	1.30	397.66
8	-37.727243	143.998315	395.99	1.30	397.29
9	-37.726933	143.998881	395.45	1.30	396.75
10	-37.726615	143.999667	394.46	1.30	395.76
11	-37.726044	144.000799	394.89	1.30	396.19
12	-37.725604	144.001622	395.44	1.30	396.74
13	-37.725498	144.001832	395.73	1.30	397.03
14	-37.725228	144.002402	396.58	1.30	397.88
15	-37.724848	144.003113	397.28	1.30	398.58
16	-37.724647	144.003602	397.07	1.30	398.37
17	-37.724187	144.004482	396.26	1.30	397.56
18	-37.723944	144.004900	396.09	1.30	397.39
19	-37.723199	144.006403	397.05	1.30	398.35
20	-37.721877	144.008985	403.07	1.30	404.37
21	-37.721126	144.010437	405.79	1.30	407.09
22	-37.720317	144.012019	408.40	1.30	409.70
23	-37.720107	144.012474	409.79	1.30	411.09
24	-37.720003	144.012812	410.80	1.30	412.10
25	-37.719902	144.013043	411.61	1.30	412.91
26	-37.719658	144.013353	412.45	1.30	413.75
27	-37.719535	144.013670	412.87	1.30	414.17
28	-37.719402	144.013856	413.56	1.30	414.86
29	-37.719354	144.013880	413.80	1.30	415.10

Name: Route 03 - Horsehill Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.732504	143.988021	385.13	1.30	386.43
2	-37.733269	143.986540	386.52	1.30	387.82
3	-37.733895	143.985308	385.37	1.30	386.67
4	-37.734685	143.983767	383.33	1.30	384.63
5	-37.735442	143.982274	389.28	1.30	390.58
6	-37.736192	143.980802	391.10	1.30	392.40
7	-37.736281	143.980643	390.80	1.30	392.10
8	-37.736371	143.980551	390.60	1.30	391.90
9	-37.736425	143.980505	390.56	1.30	391.86

Name: Route 04 - Horsehill Road W
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.736425	143.980505	390.56	1.30	391.86
2	-37.736498	143.980473	390.58	1.30	391.88
3	-37.736603	143.980450	390.60	1.30	391.90
4	-37.736931	143.980449	390.72	1.30	392.02
5	-37.738078	143.980457	392.25	1.30	393.55
6	-37.738425	143.980460	392.52	1.30	393.82
7	-37.739933	143.980448	394.39	1.30	395.69
8	-37.742002	143.980442	395.15	1.30	396.45
9	-37.742775	143.980435	395.53	1.30	396.83
10	-37.743337	143.980433	395.61	1.30	396.91
11	-37.743945	143.980429	395.66	1.30	396.96
12	-37.744809	143.980428	395.78	1.30	397.08
13	-37.746119	143.980427	395.90	1.30	397.20
14	-37.748895	143.980411	395.37	1.30	396.67
15	-37.750011	143.980400	395.13	1.30	396.43
16	-37.751431	143.980394	394.98	1.30	396.28
17	-37.753370	143.980382	394.46	1.30	395.76
18	-37.755338	143.980381	390.20	1.30	391.50
19	-37.756510	143.980373	388.68	1.30	389.98

Name: Route 05 - Fords Lane
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.752257	144.001978	409.75	1.30	411.05
2	-37.752306	144.001871	409.38	1.30	410.69
3	-37.752337	144.001725	408.98	1.30	410.28
4	-37.752349	144.001302	407.74	1.30	409.04
5	-37.752347	143.998489	404.35	1.30	405.65
6	-37.752343	143.994981	402.01	1.30	403.31
7	-37.752333	143.992596	400.83	1.30	402.13
8	-37.752308	143.990093	397.36	1.30	398.66
9	-37.752302	143.987434	395.91	1.30	397.21
10	-37.752290	143.985046	394.84	1.30	396.14
11	-37.752304	143.982917	394.76	1.30	396.06
12	-37.752334	143.982649	394.76	1.30	396.06
13	-37.752427	143.982348	394.79	1.30	396.09
14	-37.752522	143.981952	394.84	1.30	396.14
15	-37.752576	143.980924	395.32	1.30	396.62
16	-37.752562	143.980387	395.06	1.30	396.36

Name: Route 06 - Murphys Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.748311	143.999303	403.44	1.30	404.74
2	-37.748057	143.999832	404.08	1.30	405.38
3	-37.747156	144.001600	405.96	1.30	407.26
4	-37.746764	144.002383	406.85	1.30	408.15
5	-37.746430	144.003039	407.17	1.30	408.47
6	-37.745748	144.004382	406.95	1.30	408.25
7	-37.745027	144.005801	405.19	1.30	406.49
8	-37.744387	144.007037	404.17	1.30	405.47
9	-37.744311	144.007219	404.30	1.30	405.60
10	-37.744287	144.007345	404.42	1.30	405.72
11	-37.744300	144.007481	404.60	1.30	405.90
12	-37.744351	144.007676	404.87	1.30	406.17
13	-37.744509	144.008164	405.07	1.30	406.37
14	-37.744816	144.009157	405.00	1.30	406.30

Name: Route 07 - Cantlons Lane
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.736425	143.980505	390.56	1.30	391.86
2	-37.736316	143.980382	390.14	1.30	391.44
3	-37.736088	143.980167	389.91	1.30	391.21
4	-37.735421	143.979660	389.38	1.30	390.68
5	-37.734993	143.979319	387.00	1.30	388.30
6	-37.734597	143.978996	385.83	1.30	387.13
7	-37.734443	143.978908	385.45	1.30	386.75
8	-37.734223	143.978809	384.58	1.30	385.88
9	-37.733653	143.978732	382.94	1.30	384.24
10	-37.732870	143.978639	382.03	1.30	383.33
11	-37.732686	143.978563	381.56	1.30	382.86
12	-37.732311	143.978299	380.29	1.30	381.59
13	-37.731758	143.977867	376.95	1.30	378.25
14	-37.731526	143.977669	375.56	1.30	376.86
15	-37.731574	143.976793	374.91	1.30	376.21
16	-37.731519	143.976486	374.57	1.30	375.87
17	-37.731564	143.975742	374.96	1.30	376.26
18	-37.731672	143.975549	374.59	1.30	375.89
19	-37.732289	143.975080	371.66	1.30	372.96
20	-37.732503	143.974854	371.31	1.30	372.61
21	-37.732622	143.974594	371.11	1.30	372.41
22	-37.732869	143.973623	369.74	1.30	371.04
23	-37.733042	143.972588	369.76	1.30	371.06
24	-37.732881	143.972491	368.33	1.30	369.63
25	-37.732764	143.972440	367.74	1.30	369.04
26	-37.732646	143.972445	367.32	1.30	368.62
27	-37.732493	143.972535	366.48	1.30	367.78
28	-37.732333	143.972667	366.88	1.30	368.18
29	-37.732244	143.972727	367.54	1.30	368.84

Name: Route 08 - Clarendon-Blue Bridge Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.715572	144.005166	399.33	1.30	400.63
2	-37.717431	144.008290	399.73	1.30	401.03
3	-37.718394	144.009892	409.06	1.30	410.36
4	-37.718734	144.010476	409.10	1.30	410.40
5	-37.718865	144.010772	409.17	1.30	410.47
6	-37.718937	144.011098	409.04	1.30	410.34
7	-37.719031	144.011925	409.95	1.30	411.25
8	-37.719057	144.012414	411.40	1.30	412.70
9	-37.719076	144.012599	411.85	1.30	413.15
10	-37.719167	144.013103	413.03	1.30	414.33
11	-37.719230	144.013466	413.51	1.30	414.81
12	-37.719295	144.013733	413.73	1.30	415.03
13	-37.719354	144.013880	413.80	1.30	415.10
14	-37.719494	144.014118	413.65	1.30	414.95
15	-37.719844	144.014606	413.28	1.30	414.58
16	-37.720933	144.016128	410.96	1.30	412.26
17	-37.722292	144.018051	409.75	1.30	411.05
18	-37.723235	144.019320	409.99	1.30	411.29
19	-37.724187	144.020766	409.09	1.30	410.39
20	-37.724367	144.021015	409.55	1.30	410.85
21	-37.724644	144.021334	410.94	1.30	412.24
22	-37.724985	144.021784	411.24	1.30	412.54
23	-37.725346	144.022353	410.62	1.30	411.92
24	-37.725552	144.022765	410.00	1.30	411.30
25	-37.725629	144.022986	410.02	1.30	411.32

Name: Route 09 - Elaine-Blue Bridge Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.725629	144.022986	410.02	1.30	411.32
2	-37.725947	144.022936	409.50	1.30	410.80
3	-37.726743	144.022986	410.32	1.30	411.62
4	-37.727618	144.023074	408.69	1.30	409.99
5	-37.729369	144.023189	405.99	1.30	407.29
6	-37.731392	144.023345	402.49	1.30	403.79
7	-37.732540	144.023436	400.82	1.30	402.12
8	-37.733285	144.023522	400.27	1.30	401.57
9	-37.734784	144.023719	399.70	1.30	401.00
10	-37.736062	144.023874	399.97	1.30	401.27
11	-37.736968	144.023968	398.71	1.30	400.01
12	-37.738387	144.024072	397.53	1.30	398.83

Name: Route 10 - Geelong-Ballarat Railway
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.715040	144.018353	434.63	2.42	437.05
2	-37.715724	144.018510	433.50	2.42	435.92
3	-37.716341	144.018694	432.34	2.42	434.76
4	-37.717095	144.019017	431.16	2.42	433.58
5	-37.718033	144.019503	429.65	2.42	432.07
6	-37.718575	144.019865	428.75	2.42	431.17
7	-37.720534	144.021359	425.54	2.42	427.96
8	-37.721085	144.021731	424.68	2.42	427.10
9	-37.721776	144.022128	423.53	2.42	425.95
10	-37.722297	144.022406	422.60	2.42	425.02
11	-37.722933	144.022702	421.55	2.42	423.97
12	-37.723829	144.023050	420.01	2.42	422.43
13	-37.724285	144.023189	419.21	2.42	421.63
14	-37.724975	144.023367	418.15	2.42	420.57
15	-37.725413	144.023453	417.49	2.42	419.91
16	-37.725953	144.023530	416.64	2.42	419.06
17	-37.726946	144.023617	415.26	2.42	417.68
18	-37.728413	144.023723	413.06	2.42	415.48
19	-37.730404	144.023876	410.02	2.42	412.44
20	-37.732231	144.024002	406.91	2.42	409.33
21	-37.734276	144.024153	403.66	2.42	406.08
22	-37.736413	144.024307	400.37	2.42	402.79
23	-37.738059	144.024435	398.37	2.42	400.79

Flight Path Receptors

Name: FP 1 - Lethbridge Airport 10
Description:
Threshold height: 15 m
Direction: 108.1°
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	-37.920347	144.097665	241.78	15.24	257.02
Two-mile	-37.911360	144.062789	257.09	168.61	425.70

Name: FP 2 - Lethbridge Airport 28
Description:
Threshold height: 15 m
Direction: 288.1°
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	-37.923466	144.109737	231.62	15.24	246.86
Two-mile	-37.932448	144.144617	106.08	309.47	415.55

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.753835	144.002438	412.21	1.60
OP 2	2	-37.752558	143.992354	400.31	1.60
OP 3	3	-37.741870	143.972098	391.95	1.60
OP 4	4	-37.729118	143.986126	380.60	1.60
OP 5	5	-37.732944	143.989095	387.65	1.60
OP 6	6	-37.718032	143.995201	406.22	1.60
OP 7	7	-37.716953	143.997223	412.70	1.60
OP 8	8	-37.725933	143.981188	399.36	1.60
OP 9	9	-37.734819	143.980874	391.71	1.60

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1 - Peters	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 2 - Windy	SA tracking	SA tracking	0	0.0	0	0.0	-

Total 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 01 - Midland Highway	0	0.0	0	0.0
Route 02 - Woolshed Road	0	0.0	0	0.0
Route 03 - Horsehill Road	0	0.0	0	0.0
Route 04 - Horsehill Road W	0	0.0	0	0.0
Route 05 - Fords Lane	0	0.0	0	0.0
Route 06 - Murphys Road	0	0.0	0	0.0
Route 07 - Cantlons Lane	0	0.0	0	0.0
Route 08 - Clarendon-Blue Bridge Road	0	0.0	0	0.0
Route 09 - Elaine-Blue Bridge Road	0	0.0	0	0.0
Route 10 - Geelong-Ballarat Railway	0	0.0	0	0.0
FP 1 - Lethbridge Airport 10	0	0.0	0	0.0
FP 2 - Lethbridge Airport 28	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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0

PV: PV array 1 - Peters no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 01 - Midland Highway	0	0.0	0	0.0
Route 02 - Woolshed Road	0	0.0	0	0.0
Route 03 - Horsehill Road	0	0.0	0	0.0
Route 04 - Horsehill Road W	0	0.0	0	0.0
Route 05 - Fords Lane	0	0.0	0	0.0
Route 06 - Murphys Road	0	0.0	0	0.0
Route 07 - Cantlons Lane	0	0.0	0	0.0
Route 08 - Clarendon-Blue Bridge Road	0	0.0	0	0.0
Route 09 - Elaine-Blue Bridge Road	0	0.0	0	0.0
Route 10 - Geelong-Ballarat Railway	0	0.0	0	0.0
FP 1 - Lethbridge Airport 10	0	0.0	0	0.0
FP 2 - Lethbridge Airport 28	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

PV array 1 - Peters and Route: Route 01 - Midland Highway

No glare found

PV array 1 - Peters and Route: Route 02 - Woolshed Road

No glare found

PV array 1 - Peters and Route: Route 03 - Horsehill Road

No glare found

PV array 1 - Peters and Route: Route 04 - Horsehill Road W

No glare found

PV array 1 - Peters and Route: Route 05 - Fords Lane

No glare found

PV array 1 - Peters and Route: Route 06 - Murphys Road

No glare found

PV array 1 - Peters and Route: Route 07 - Cantlons Lane

No glare found

PV array 1 - Peters and Route: Route 08 - Clarendon-Blue Bridge Road

No glare found

PV array 1 - Peters and Route: Route 09 - Elaine-Blue Bridge Road

No glare found

PV array 1 - Peters and Route: Route 10 - Geelong-Ballarat Railway

No glare found

PV array 1 - Peters and FP: FP 1 - Lethbridge Airport 10

No glare found

PV array 1 - Peters and FP: FP 2 - Lethbridge Airport 28

No glare found

PV array 1 - Peters and OP 1

No glare found

PV array 1 - Peters and OP 2

No glare found

PV array 1 - Peters and OP 3

No glare found

PV array 1 - Peters and OP 4

No glare found

PV array 1 - Peters and OP 5

No glare found

PV array 1 - Peters and OP 6

No glare found

PV array 1 - Peters and OP 7

No glare found

PV array 1 - Peters and OP 8

No glare found

PV array 1 - Peters and OP 9

No glare found

PV: PV array 2 - Windy no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 01 - Midland Highway	0	0.0	0	0.0
Route 02 - Woolshed Road	0	0.0	0	0.0
Route 03 - Horsehill Road	0	0.0	0	0.0
Route 04 - Horsehill Road W	0	0.0	0	0.0
Route 05 - Fords Lane	0	0.0	0	0.0
Route 06 - Murphys Road	0	0.0	0	0.0
Route 07 - Cantlons Lane	0	0.0	0	0.0
Route 08 - Clarendon-Blue Bridge Road	0	0.0	0	0.0
Route 09 - Elaine-Blue Bridge Road	0	0.0	0	0.0
Route 10 - Geelong-Ballarat Railway	0	0.0	0	0.0
FP 1 - Lethbridge Airport 10	0	0.0	0	0.0
FP 2 - Lethbridge Airport 28	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

PV array 2 - Windy and Route: Route 01 - Midland Highway

No glare found

PV array 2 - Windy and Route: Route 02 - Woolshed Road

No glare found

PV array 2 - Windy and Route: Route 03 - Horsehill Road

No glare found

PV array 2 - Windy and Route: Route 04 - Horsehill Road W

No glare found

PV array 2 - Windy and Route: Route 05 - Fords Lane

No glare found

PV array 2 - Windy and Route: Route 06 - Murphys Road

No glare found

PV array 2 - Windy and Route: Route 07 - Cantlons Lane

No glare found

PV array 2 - Windy and Route: Route 08 - Clarendon-Blue Bridge Road

No glare found

PV array 2 - Windy and Route: Route 09 - Elaine-Blue Bridge Road

No glare found

PV array 2 - Windy and Route: Route 10 - Geelong-Ballarat Railway

No glare found

PV array 2 - Windy and FP: FP 1 - Lethbridge Airport 10

No glare found

PV array 2 - Windy and FP: FP 2 - Lethbridge Airport 28

No glare found

PV array 2 - Windy and OP 1

No glare found

PV array 2 - Windy and OP 2

No glare found

PV array 2 - Windy and OP 3

No glare found

PV array 2 - Windy and OP 4

No glare found

PV array 2 - Windy and OP 5

No glare found

PV array 2 - Windy and OP 6

No glare found

PV array 2 - Windy and OP 7

No glare found

PV array 2 - Windy and OP 8

No glare found

PV array 2 - Windy and OP 9

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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