Glint and Glare Assessment

Cosgrove Solar Farm

Bison Energy Company

February 2021

Contents

1. Introduction

1.1. Overview

Bison Energy proposes to construct and operate a 4.95MW Renewable Energy Facility (Solar Facility) 290 Cosgrove-Caniambo Road, Cosgrove at the corner of Cosgrove-Caniambo Road and Shepparton-Dookie College Road. This facility is to comprise of the installation of solar photovoltaic panels mounted in arrays on single axis trackers, cabling from the solar arrays to panel inverters and substation and connection into the local electricity network. The proposed solar array will be established within a 15.8-hectare portion of this land.

As part of the planning permit application a Glint and Glare assessment must be undertaken to determine the likely impact of glint and glare from the proposed development on nearby sensitive receptors and identify appropriate, feasible and reasonable mitigation strategies if required.

This Assessment has been prepared by Bison Energy engineering design technicians with input from planning and urban design consultants Habitat Planning. This report details the key inputs, methodology and the results of this glare assessment.

The objectives of this study are as follows:

- Carry out an analysis of glare from the proposed single axis tracking system;
- Identify observation points surrounding the proposed solar facility
- Identify and summarise potential glare impacts at various observation points;
- Recommend any mitigation to reduce glare issues

1.2. Glint and Glare

Glint refers to the momentary flash of bright light that can be caused by the reflectivity of solar panels and glare refers to the continuous source of light and is generally associated with stationary objects. Glint and glare from PV panels can have potential safety or amenity impacts to surrounding sensitive receivers, including potential to impair observers through inducing an after image.

The Solar Energy Facilities Design and Development Guideline require proponents to prepare a glint and glare assessment using an accepted methodology based on best practice.

1.3. PV Panels Reflectivity

As construction of PV panels primarily utilises glass and steel there is a perception of glint and glare from the reflectivity of solar panels. This leads to potential issues of distractions to motorists, aircraft and eye damage.

Generally, solar panels will not create significant glint or glare compared with other surfaces. PV panels are designed to collect sunlight to convert to energy and therefore absorb the majority of light received. The panels are designed using anti-reflective coatings during manufacture to reduce reflection and will typically absorb 80-90% of the light received.

PV panels are also generally less reflective than other naturally occurring elements such as soils and crops and have been found to be generally less reflective that general rural environments and far less reflective that open water[1].

The angle of incidence of the sunlight is also relevant in considering the reflection of solar development. A fixed axis solar facility will have panels that do not move throughout the day and therefore the angle incidence varies with the time of day. A tracking system, such as that proposed for this development, will follow the sun through the day and can have the angle of incidence reduced. It is also possible to 'back track' panels at certain periods of the day to reduce potential impacts.

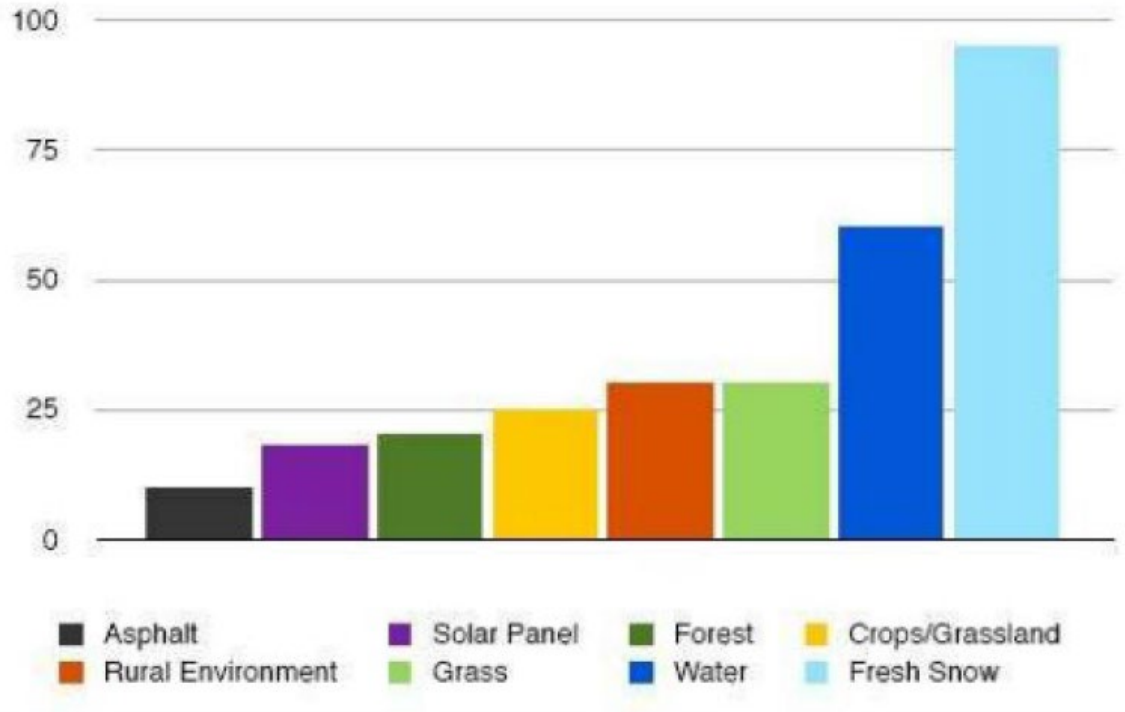


Figure 1 Comparative reflection analysis of PV panels to other surfaces (Spaven Consulting 2011, p.5)

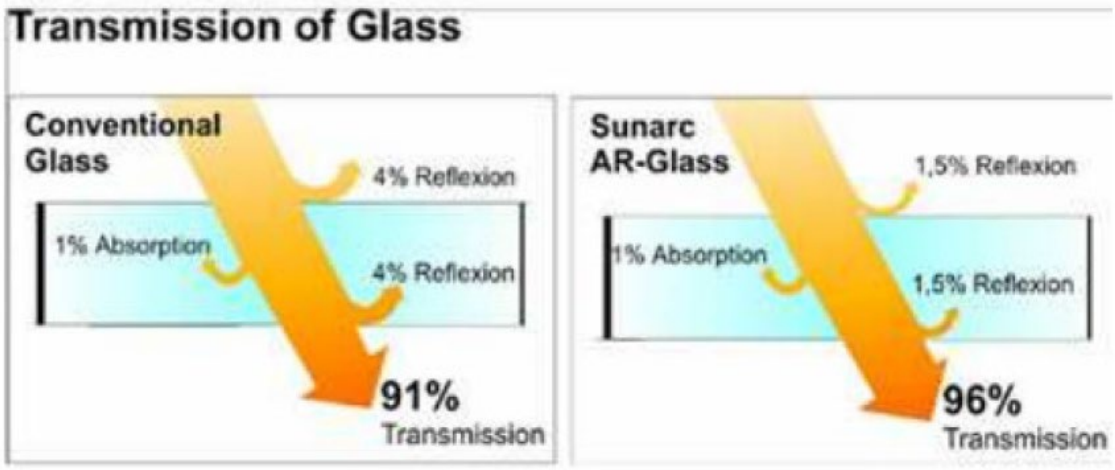


Figure 2 Reflective values of conventional glass and typical treated glass (Spaven Consulting 2011, p.5)

2. Subject Site

The subject site is located within the locality of Cosgrove, approximately 6.5 kilometres south-west of Dookie, at the corner of Cosgrove-Caniambo Road and Shepparton-Dookie Collage Road. The site is a rectangular parcel of land with dimension of 6.3.5 metres along its eastern boundary at Cosgrove-Caniambo Road, and has a depth of 270 metres. It is traversed by part of an electricity easement in the northeast corner.

The site is a rural property that is absent of development aside from basic rural infrastructure including water troughs throughout and a stockyard and water supply in the north-east corner.

The majority of the land, including the lease area is highly disturbed through cropping and other agricultural activities. There is also a farm dam at the north-west corner of the site. The topography of the land is generally flat, with little variation of elevation across its profile.

Vegetation throughout the site is limited, however there is a single remnant tree in the southern extent, and a patch of trees to the west of the dam, and inside the fenced area within the portion excluded from the solar development area.

At present, primary access is provided to the lot through a gate at the northeast corner from Cosgrove- Caniambo. The site is on a corner lot and future access maybe extended from other segments of the sites fronting roads.

The subject land is in a farming context and is immediately surrounded by similar farming properties in all directions. An existing dwelling occupies the land immediately to the south of the site,

3. Glint and Glare Assessment Methodology

The assessment methodology in this instance is based on guidance documents for Solar Facility design, studies in relation to glint and glare along with industry best practice modelling. The broad methodology followed for this study comprises:

- collate key data and model inputs for solar farm based on specifications and design
- identify primary receptors in the area surrounding the site;
- consider visibility of the panels from the receptor's location and whether or not panels are likely to be visible
- plot the location of all receptors in a Solar Glare Analyses Tool and input data for the proposed facility to model the expected impacts
- based on modelling, determine whether a reflection can occur to receptors and the extent/period of impact;
- determine whether a significant detrimental impact is expected.
- Recommend appropriate mitigation measures as required

3.1. Modelling Tool

This study has used the GlareGauge modelling tool by ForgeSolar. This is an industry standard technical modelling tool, which utilises the Solar Glare Hazard Analysis Tool (SGHAT) developed by Sandia National Laboratories, to assess the potential glare to receptors around solar arrays. This tool is required by a number of international authorities including the United States Federal Aviation Administration for glint and glare analyses near airports, and it recognised by the UK Civil Aviation Authority, and the Australian Government Civil Aviation Safety Authority.

The GlareGuage tool uses an interactive Google Maps interface to plot the arrangement of arrays and the location of sensitive receptors including static observation points, routes and flight paths. The elevation of the panels and receptors are automatically captured using ground elevation data of the respective locations. The modelling for consideration of this development utilises the specification and data of the proposed PV panels to be installed, the location of the panels relative to the receptors and the proposed angle of tilt for the panels.

If glare is found, the tool calculates the likelihood of the glare source to present a potential ocular hazard ranging from temporary after-image to retinal burn. The results are presented in a plot and graphs that specifies when glare will occur throughout the year and its duration, with colour codes indicating the potential ocular hazard. These hazard ratings are presented in the following section.

3.2. Glare Hazard Rating

The SGHAT defines three levels of ocular hazard as a result of glare. The hazards are defined as low, moderate or high, depending on the potential to impact vision through producing glare with a potential for afterimage. The following definitions are provided for the glare hazard levels referred to in this report.

No glare	No Glare - No glare predicted.
Green	**Low potential hazard** – Glare is present, however only a low potential for a temporary after-image. This hazard is shown green on the plots used by the GlareGuage tool, reproduced in **Figure 4** of this report.
Yellow	**Moderate potential hazard** -Glare present with the potential to leave temporary after-image of the glare. This hazard is shown green on the plots used by the GlareGuage tool, reproduced in **Figure 4** of this report.
High	**High potential hazard** – Glare is present with potential for permanent eye damage. This hazard is shown green on the plots used by the GlareGuage tool, reproduced in **Figure 4** of this report.

3.3. Model inputs

The proposed solar array associated with the Cosgrove solar facility will consist of panels fixed on single axis tracking. To accurately determine the potential glare impact of the array, the following array details were input into the GlareGuage tool.

Input	Unit	Value
Time zone	UTC	UTC +10
Peak DNI	kW/m^2	1000
PV Panel surface material	-	Smooth glass with anti-reflective coating
Tracking axis tilt	Degrees	0
Resting angle	Degrees	0
Orientation of tracking axis	Degrees	180
Offset angle of panel	Degrees	0
Maximum tracking angle	Degrees	60
Backtracking		None proposed
Height above ground	Metres	2

3.4. Identification of Receptors

In addition to the array inputs outlined above, the locations of the identified receptors were plotted into the GlareGuage tool on the same Google Maps interface. These receptors were input from within a capture area of a radius of approximately 2 kilometres around the location of the proposed facility.

A number of Observation Points (OP's) were identified within proximity to the site. These sites represent fixed locations where glint and glare could have an ongoing impact. These OP's consisted entirely of dwellings surrounding dwellings, including those in adjacent properties and were measured from a height of 1.5 metres above the ground for a typical viewing angle. There is also no technical limit to the distance at which reflections could occur. However, the significance of a reflection decreases with distance. This is because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes as the separation distance increases. Terrain and shielding by vegetation are also more likely to obstruct an observer's view at longer distances. In this case, a total of 40 OP's were recorded surrounding the sit at a radius of approximately 2 kilometres, as was deemed appropriate.

All surrounding routes were recorded for input into the GlareGuage tool similar to the OP's. These included Jancourt Road, Camperdown-Cobden Road, and any other roads or tracks within the surrounds. The height above ground was also input as 1.5 metres, considered a typical viewing height for individuals in vehicles travelling these routes.

There were no flight paths within proximity to the site.

Figure 3 below illustrates the location of the affected OP's and routes associated with the development.

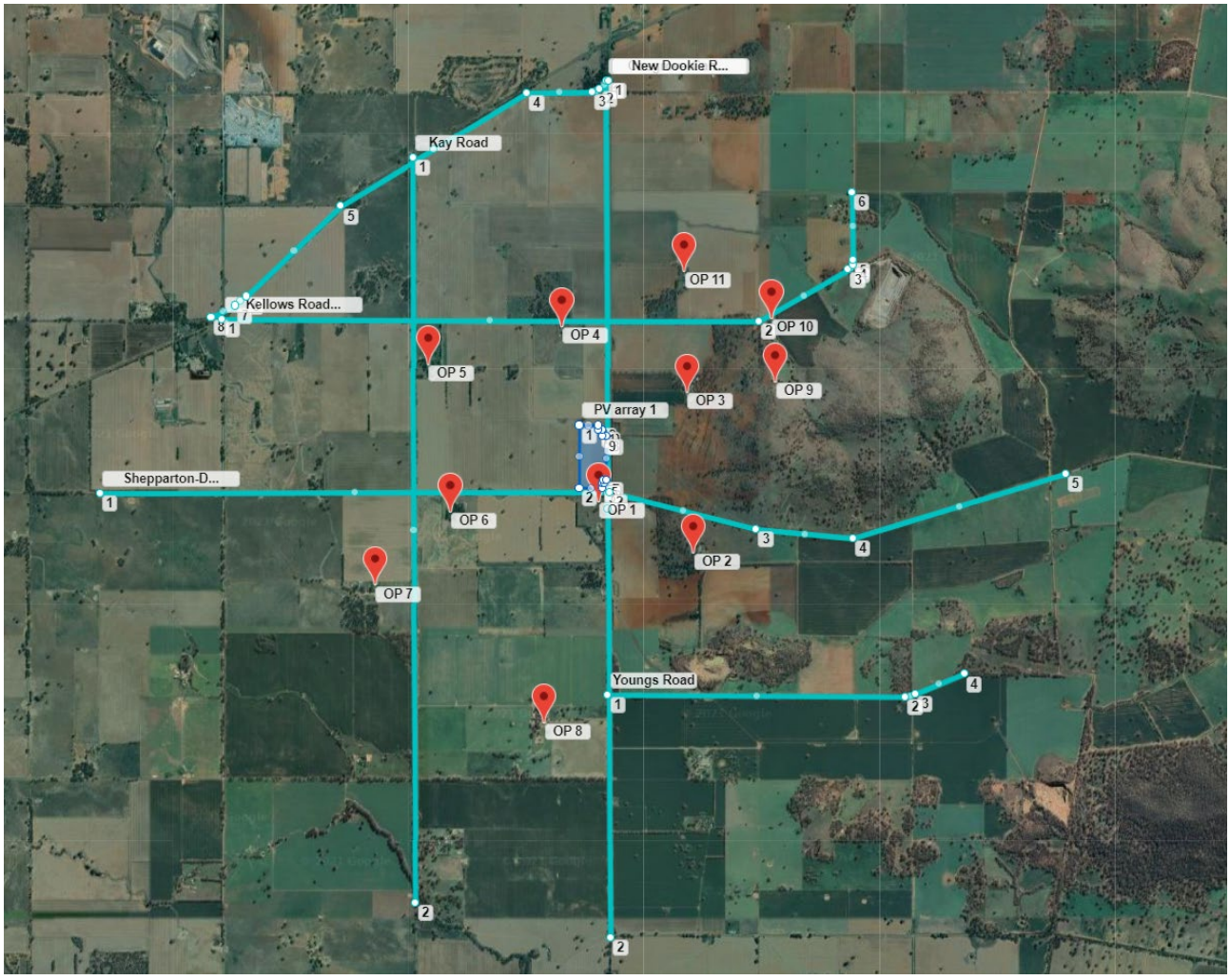
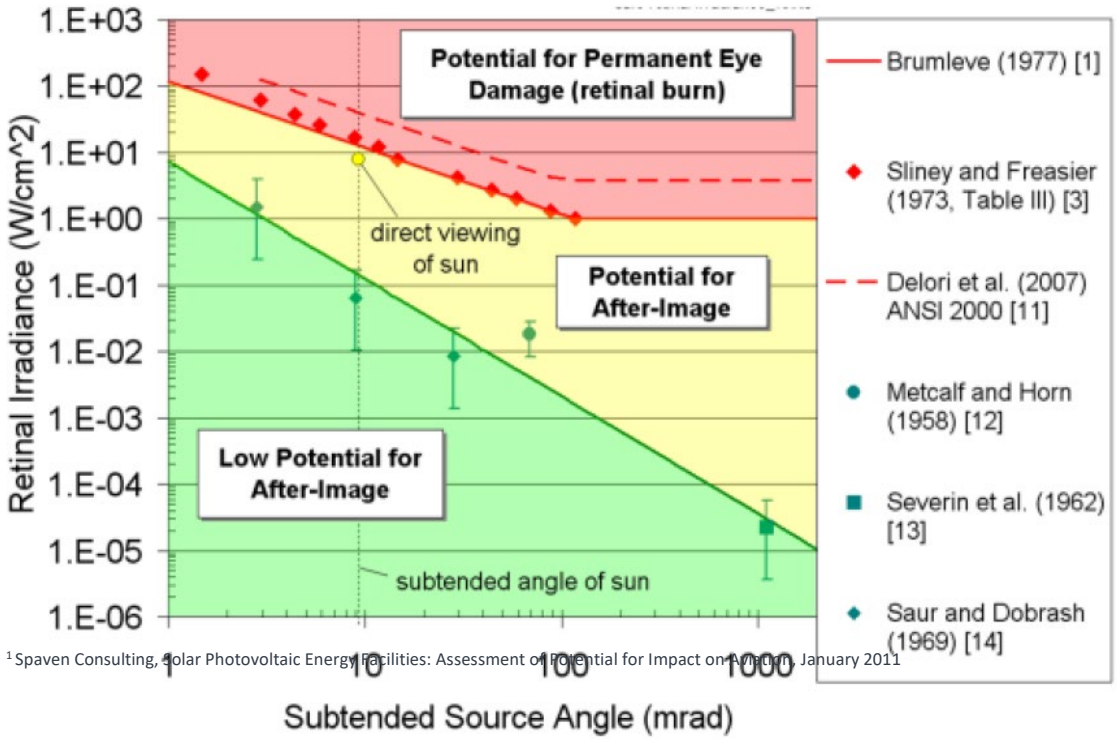


Figure 3 Receptors including observation points and routes assessed for glint and glare within the immediate context of the subject site

3.5. Assessment of Impacts

As discussed, an assessment of the potential impact of the proposal has been undertaken using the GlareGuage Tool. The tool enables the proposed solar facility to be mapped along with relevant data inputs and then uses the data to consider the potential for temporary after-image or more significant retinal burn. The chart presented at **Figure 4** represents the possible severity of glare at receptor locations.

In summary, the red glare refers to potential for permanent eye damage from the observation location, yellow glare indicates the potential for after image effects and green glare refers to low potential for after image impacts.



[1] Spaven Consulting, Solar Photovoltaic Energy Facilities: Assessment of Potential for Impact on Aviation, January 2011

Figure 4 Summary of potential glare impact with regard to total minutes of glare for receptor

The assessment relies on identifying the potential sensitive receptors surrounding the development and assessing the potential impacts on the receptors. The modelling for consideration of this development utilises the specification and data of the proposed PV panels to be installed, the location of the panels relative to the receptors and the proposed angle tilt for the panels.

4. Results

Of the 11 dwellings assessed, eight were calculated to receive “yellow glare”, for being subject to potential after image. The dwelling up the nearby hill to the east (OP 9) had the highest exposure, with 2293 minutes of yearly yellow glare, and three other dwellings also had >1000 minutes of yearly glare.

Of the surrounding roads, two were subject to yellow glare. Cosgrove-Caniambo Road anticipated 228 minutes of yearly glare and Shepparton-Dookie College Road was subject to 4317 minutes of glare.

A summary of the receptors which recorded glare, is provided in the following table. Note that receptors that did not record any glare are not included in the table below.

Table 1 Summary of results

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)
OP 2	0	1185	0
OP 3	0	1549	0
OP 5	210	748	0
OP 6	147	1543	0
OP 7	729	214	0
OP 9	111	2293	0
OP 10	4	6	0
Route: Cosgrove-Caniambo Road	0	228	0
Route: Shepparton-Dookie College Road	0	4317	0

5. Recommended Mitigation

The results indicate that a number of the OP's and some of the routes will experience glare, with many results indicating that they will be subject to glare with moderate potential afterimage. However, landscaping either existing on site, or will be provided in the form of perimeter plantings to further reduce the impacts of glare. Additionally, a temporary screening mesh fence will also be provided until this perimeter landscaping can be adequately established.

A summary of the recommended mitigation measures is provided in the following table.

Table 2 Summary of impact and mitigation

Receptor	Glare Rating	Extent	Existing mitigation	Recommended Mitigation
OP1				
OP 2	**Moderate** Yellow Glare with potential for after image	For up to 25 minutes between 4:00pm and 6:00pm between May and August	Existing established vegetation including established trees along road reserve.	New perimeter plantings on boundaries. Install mesh fencing around perimeter on southern interface
OP 3	**Moderate** Yellow Glare with potential for after image	For up to 20 minutes between 6:00pm and 8:00pm from October to March	Substantial vegetation associated with orchid/olive tree planting	New perimeter plantings on boundaries. Install mesh fencing around perimeter on southern interface
OP 5	**Moderate** Yellow Glare with potential for after image	For up to 15 minutes between 5:00am and 6:00am from November to March	Existing established vegetation	New perimeter plantings on boundaries. Install mesh fencing around perimeter on southern interface
OP 6	**Moderate** Yellow Glare with potential for after image	For up to 10 minutes between 6:00am and 8:00am from between April and October	Existing established vegetation	New perimeter plantings on boundaries. Install mesh fencing around perimeter on southern interface
OP 7	**Moderate** Yellow Glare with potential for after image	For up to 15 minutes between 7:00am to 8:00am from May to September	Existing established vegetation within site and along road reserve	Assess effectiveness of existing vegetation. Incorporate the proposed perimeter plantings at the boundary interface

OP 9	**Moderate** Yellow Glare with potential for after image	For up to 20 minutes between 6:00pm and 8:00pm from between October and March.	Substantial vegetation associated with orchid/olive tree planting as well as established native trees, ridgeline topography.	The location of this receptor is beyond the ridgeline and therefore unlikely to receive any glare impacts. The existing vegetation is considered sufficient given the distance of this OP from the site and low exposure.
OP 10	**Moderate** Yellow Glare with potential for after image	For <5 minutes between 7:00pm and 8:00pm during December.	Existing established vegetation	The location of this receptor is beyond the ridgeline and therefore unlikely to receive any glare impacts. The existing vegetation is considered sufficient given the distance of this OP from the site and low exposure
Route: Cosgrove-Caniambo Road	**Moderate** Yellow Glare with potential for after image	For <5 minutes between 5:00pm and 8:00pm every month except June.	No screening vegetation	Glare to this route is minimal. However, the applicant should provide perimeter planting and installation of mesh fencing to further minimise glare
Route: Shepparton-Dookie College Road	**Moderate** Yellow Glare with potential for after image	For up to 45 minutes 6:00am-8:00am & 4:00pm-6:00pm between March and October.	Minimal vegetation	Provide perimeter planting and installation of mesh screening to mitigate glare as priority.

6. Conclusion

Overall, the assessment determines that there will be moderate glare expected from the property to adjoining receptors, particular those elevated to the south. Notwithstanding, the assessment concludes that these locations can be appropriately screened and mitigated to an acceptable level

Give the minimal existing landscaping and exposed nature of the site as it addresses the south, new landscape perimeters are recommended along glare mitigation screening in the form of a screened mesh applied to the internal security fence addressing Cosgrove-Caniambo Road and Shepparton-Dookie College Road. Site specific recommendations from the receptors where glare impacts are deemed most significant are described in the following sections.

6.1. Eastern OP Recommendations (OP 2, OP 3, OP 9 and OP 10)

The eastern observation points (OP 2, OP 3, OP 9 and OP 10) were detected as having some of the most substantial glare, given their location and elevated positioning of some of these receptors on the nearby hill. It is noted that the GlareGuage tool does not account for the presence of vegetation that would provide screening to these receptors. These receptors are densely buffered by established trees which will likely minimises the potential impacts received as a result of glare.

Notwithstanding the above, the screening of the existing vegetation should be further complimented by screening plantings. It is recommended that plantings is provided within the boundary of the subject, using a range of large trees of a mature height of at least 20 metres high to establish a dense overstorey, small trees/shrubs of at least 2-3 metres high, and groundcover plantings along the entire portion of the perimeter of the southern and eastern boundaries. Native species should be chosen for the purpose of contributing to the habitat of local fauna, such as local large *Eucalyptus* species (eg. *E. microcarpa, E. luecoxylen*), and smaller *Acacia* species (*A. montana, A. pycantha*). The plantings should occur over a planting strip of at least 5 metres deep, to ensure that appropriate densities are established to block any glare.

In the interim period of establishment for of the proposed vegetation plantings, it is recommended that the proposal include the installation of glare mitigation screening in the form of a screened mesh applied to the internal security fence addressing Cosgrove-Caniambo Road. This screening should be applied to the full extent of the development and extend to the height of the proposed fence. The screen is to remain in place, and be maintained as required, until landscaping has developed to the height of security fencing.

Figure 5 View facing north along Cosgrove-Caniambo Road from the corner of Shepparton-Dookie College Road

Figure 6 View facing east along Shepparton-Dookie College Road away from the site

6.2. Western OP Recommendations (OP 5, OP 6, & OP 7)

The western affected observation points consist of less exposure than those to the east. Each of these receptors are screened appropriately through existing vegetation that is generously provided. Notwithstanding, the plantings screening and provision of mesh fencing prior to landscape establishment as recommended above, should extend around the southern boundary of the site, however this is recommended for the purposes of screening motorists along Shepparton-Dookie College Road.

In the interim period of establishment for of the proposed vegetation plantings, it is recommended that the proposal include the installation of glare mitigation screening in the form of a screened mesh applied to the internal security fence addressing Cosgrove-Caniambo Road. This screening should be applied to the full extent of the development and extend to the height of the proposed fence. The screen is to remain in place, and be maintained as required, until landscaping has developed to the height of security fencing.

Figure 7 View facing west along Shepparton-Dookie College Road, along the sites southern boundary

6.3. Shepparton-Dookie College Road Recommendations

Glare impacts in both the mornings and evenings between March and October were detected from along Shepparton-Dookie College Road. This road is illustrated above in both **Figure 7** and **Figure 8.** Despite the glare detected and its proximity to the site, the interface is screened along the southern boundary of the site, however there is minimal vegetation from along the eastern boundary. There are sections of the road in between planting areas that allow for intermittent views of the site and therefore there is potential for some impacts to occur.

The establishment of perimeter screening should be a priority for this road. Using the plantings recommendations addressed in **Section 6.1**, the provision of a strip of at least 5 metres along the southern and eastern boundary of the site is recommended for the purpose of screening Shepparton-Dookie College Road. It is also recommended that the installation of a mesh fence be used until the planted vegetation can provide sufficient screening.

In the interim period of establishment for of the proposed vegetation plantings, it is recommended that the proposal include the installation of glare mitigation screening in the form of a screened mesh applied to the internal security fence. This screening should be applied to the full extent of the development and extend to the height of the proposed fence. The screen is to remain in place, and be maintained as required, until landscaping has developed to the height of security fencing.

Appendix A: GlareGuage Glint and Glare Assessment

Site Configuration: Cosgrove Solar

Project site configuration details and results.

Created **Aug. 21, 2020 12:03 a.m.**
Updated **March 16, 2021 10:22 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC10**
Site Configuration ID: 42367.7707

Summary of Results

Glare with potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	1,201	12,083	-

Component Data

PV Array(s)

Note: PV array encompasses a large surface area (greater than 25 acres). Accuracy of path receptor glare analysis may be affected by footprint size. Additional analyses of array sub-sections may provide more information on expected glare.

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 0.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad
Approx. area: 110,539 sq-m

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.372477	145.628720	127.95	2.00	129.95
2	-36.377219	145.628784	128.79	2.00	130.79
3	-36.377228	145.630919	130.76	2.00	132.76
4	-36.376873	145.630919	131.00	2.00	133.00
5	-36.376873	145.631037	131.29	2.00	133.29
6	-36.376614	145.631016	131.42	2.00	133.42
7	-36.376614	145.631252	131.85	2.00	133.85
8	-36.373349	145.631230	130.78	2.00	132.78
9	-36.373358	145.630941	130.17	2.00	132.17
10	-36.372878	145.630941	129.86	2.00	131.86
11	-36.372874	145.630533	128.83	2.00	130.83
12	-36.372485	145.630522	128.82	2.00	130.82

Route Receptor(s)

Name: Cosgrove-Caniambo Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.346637	145.631220	130.22	1.50	131.72
2	-36.410903	145.631660	132.02	1.50	133.52

Name: Kay Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.352427	145.613187	125.03	1.50	126.53
2	-36.408271	145.613461	135.87	1.50	137.37

Name: Kellows Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.364579	145.595456	124.31	1.50	125.81
2	-36.364695	145.645492	166.51	1.50	168.01
3	-36.360859	145.653861	171.42	1.50	172.92
4	-36.360492	145.654258	172.66	1.50	174.16
5	-36.360125	145.654258	172.34	1.50	173.84
6	-36.355053	145.654204	163.00	1.50	164.50

Name: New Dookie Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.346646	145.631524	129.63	1.50	131.13
2	-36.347285	145.630688	129.82	1.50	131.32
3	-36.347493	145.629958	128.52	1.50	130.02
4	-36.347527	145.623843	128.05	1.50	129.55
5	-36.356090	145.606523	127.82	1.50	129.32
6	-36.362863	145.597725	127.62	1.50	129.12
7	-36.363537	145.596674	125.15	1.50	126.65
8	-36.364401	145.594463	125.74	1.50	127.24

Name: Shepparton-Dookie College Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.377605	145.584052	128.29	1.50	129.79
2	-36.377536	145.631602	134.05	1.50	135.55
3	-36.380324	145.645237	188.71	1.50	190.21
4	-36.380980	145.654249	180.31	1.50	181.81
5	-36.376143	145.674076	176.41	1.50	177.91

Name: Youngs Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-36.392747	145.631450	136.04	1.50	137.54
2	-36.392903	145.659120	154.05	1.50	155.55
3	-36.392695	145.660086	152.13	1.50	153.63
4	-36.391192	145.664624	170.08	1.50	171.58

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-36.378233	145.630553	129.68	1.50	131.18
OP 2	-36.382079	145.639395	175.60	1.50	177.10
OP 3	-36.370088	145.638791	156.02	1.50	157.52
OP 4	-36.365084	145.627142	128.05	1.50	129.55
OP 5	-36.367914	145.614652	129.48	1.50	130.98
OP 6	-36.379006	145.616776	129.81	1.50	131.31
OP 7	-36.384502	145.609734	129.79	1.50	131.29
OP 8	-36.394795	145.625492	134.77	1.50	136.27
OP 9	-36.369282	145.647061	201.51	1.50	203.01
OP 10	-36.364490	145.646685	165.64	1.50	167.14
OP 11	-36.360999	145.638522	143.09	1.50	144.59

PV Array Results

Summary of PV Glare Analysis PV configuration and predicted glare

PV Name	Tilt deg	Orientation deg	"Green" Glare min	"Yellow" Glare min	Energy Produced kWh	Data File
PV array 1	SA tracking	SA tracking	1,201	12,083	-	-

Click the name of the PV array to scroll to its results

PV & Receptor Analysis Results detailed results for each PV array and receptor

PV array 1 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	1185
OP: OP 3	0	1549
OP: OP 4	0	0
OP: OP 5	210	748
OP: OP 6	147	1543
OP: OP 7	729	214
OP: OP 8	0	0
OP: OP 9	111	2293
OP: OP 10	4	6
OP: OP 11	0	0
Route: Cosgrove-Caniambo Road	0	228
Route: Kay Road	0	0
Route: Kellows Road	0	0
Route: New Dookie Road	0	0
Route: Shepparton-Dookie College Road	0	4317
Route: Youngs Road	0	0

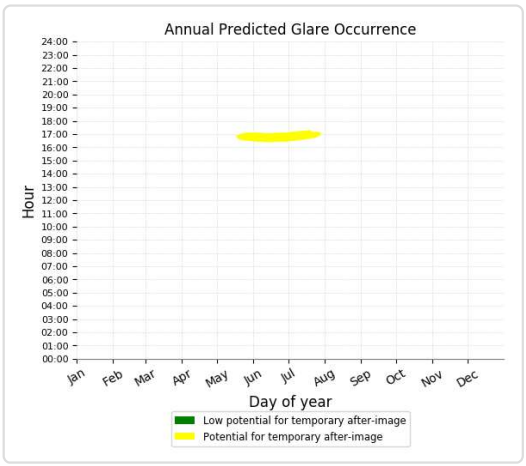
PV array 1 - OP Receptor (OP 1)

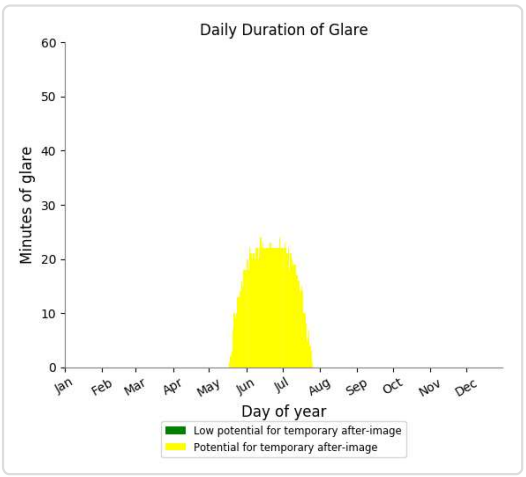
No glare found

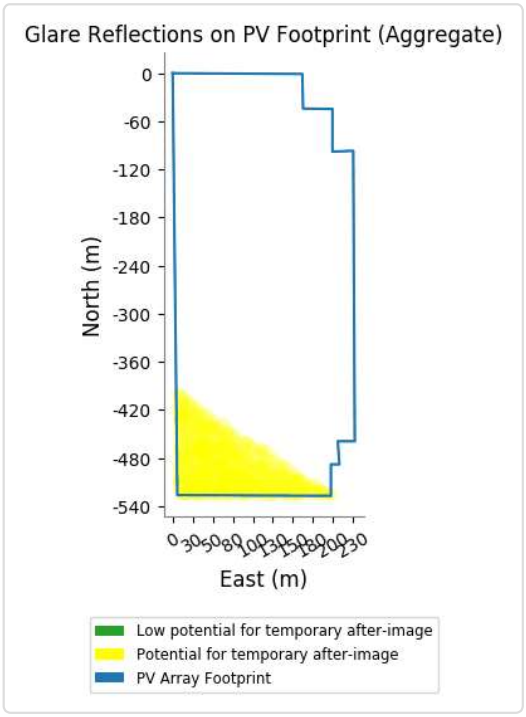
PV array 1 - OP Receptor (OP 2)

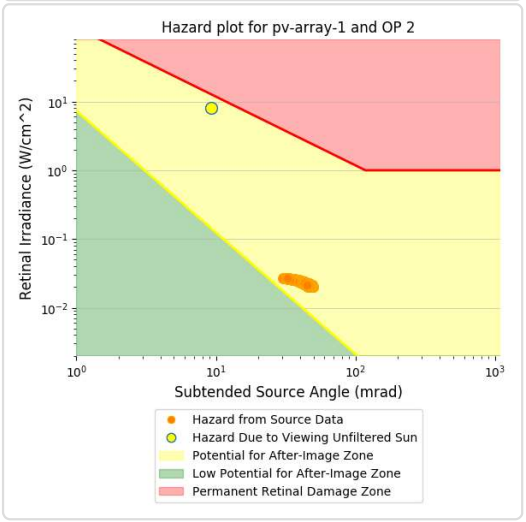
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,185 minutes of "yellow" glare with potential to cause temporary after-image.





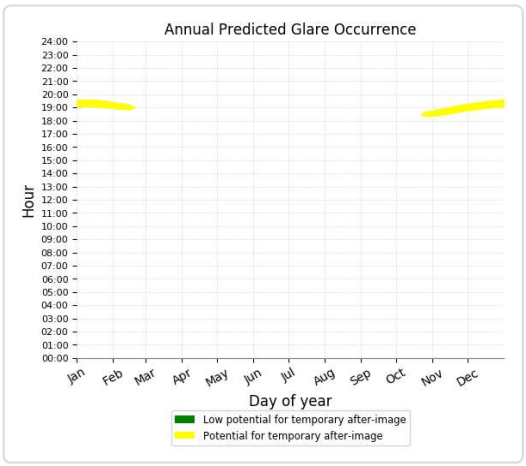


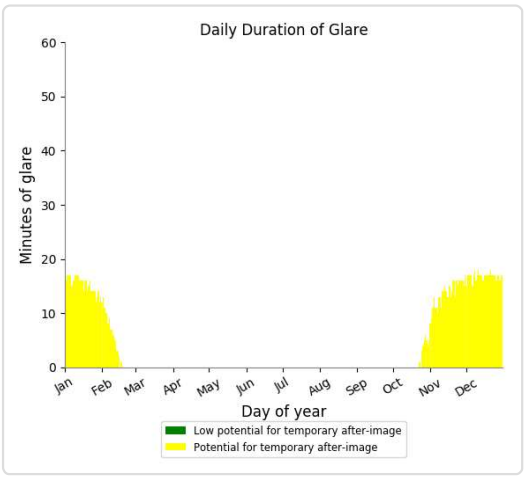


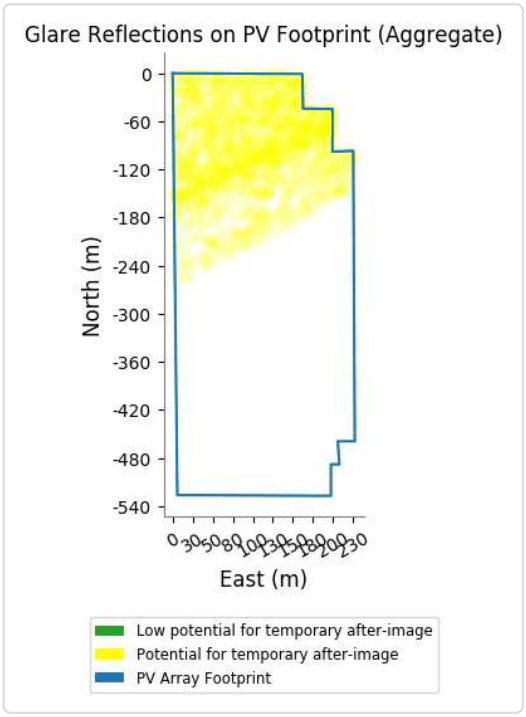
PV array 1 - OP Receptor (OP 3)

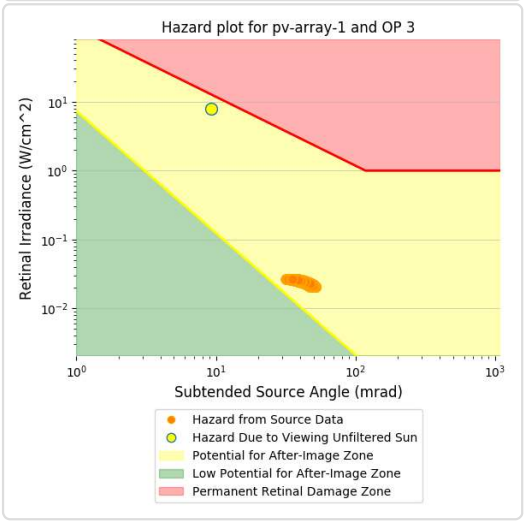
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,549 minutes of "yellow" glare with potential to cause temporary after-image.









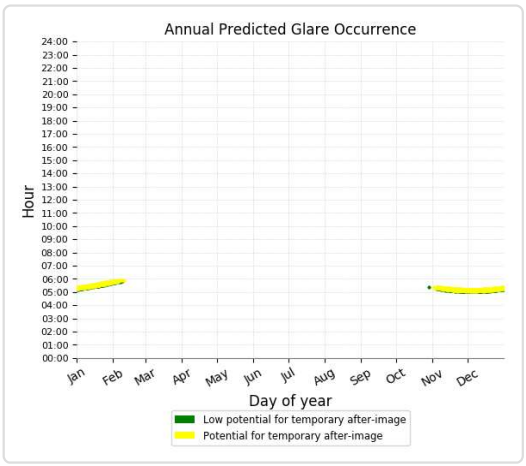
PV array 1 - OP Receptor (OP 4)

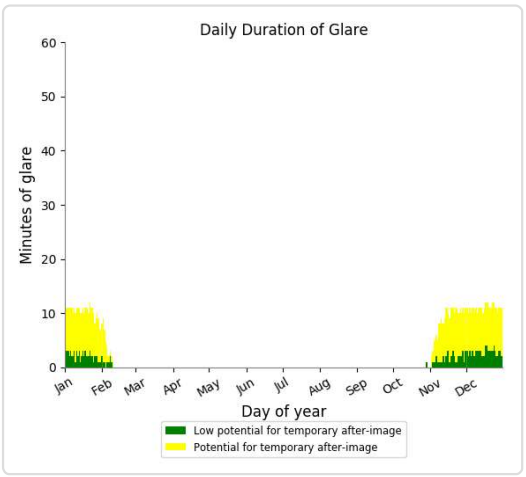
No glare found

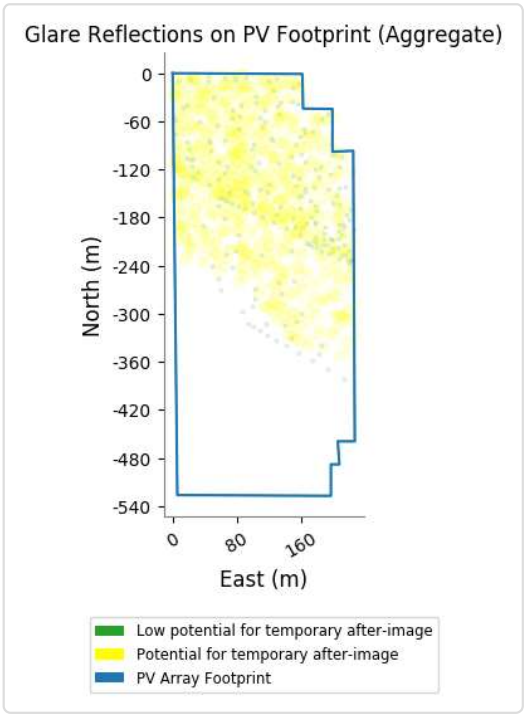
PV array 1 - OP Receptor (OP 5)

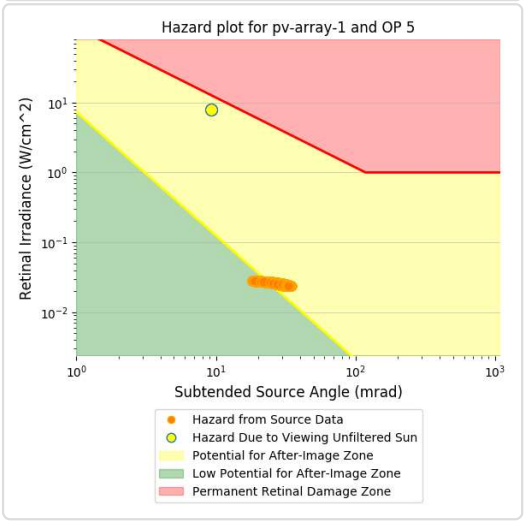
PV array is expected to produce the following glare for receptors at this location:

- 210 minutes of "green" glare with low potential to cause temporary after-image.
- 748 minutes of "yellow" glare with potential to cause temporary after-image.





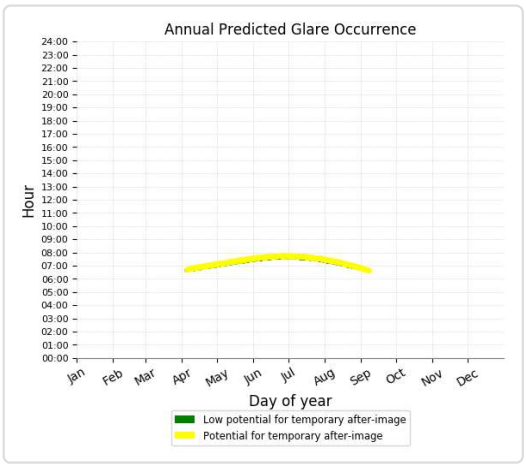


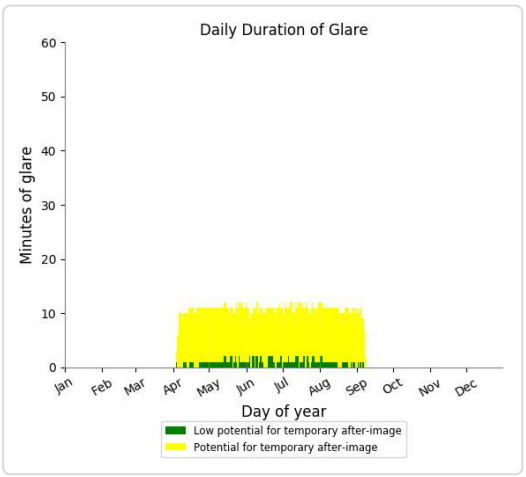


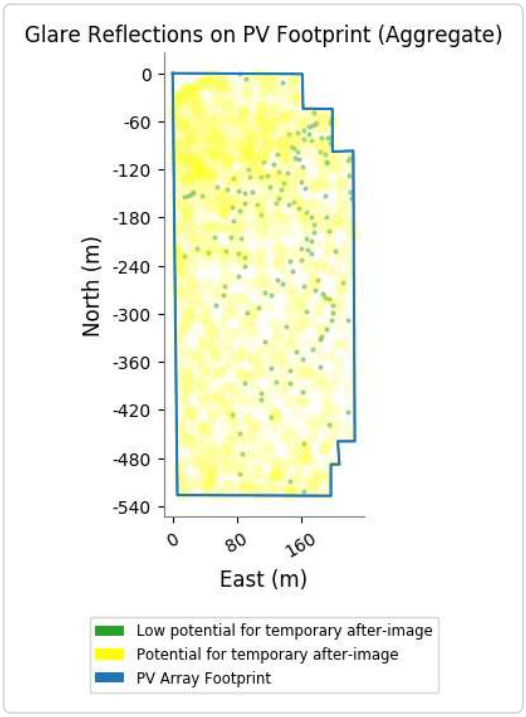
PV array 1 - OP Receptor (OP 6)

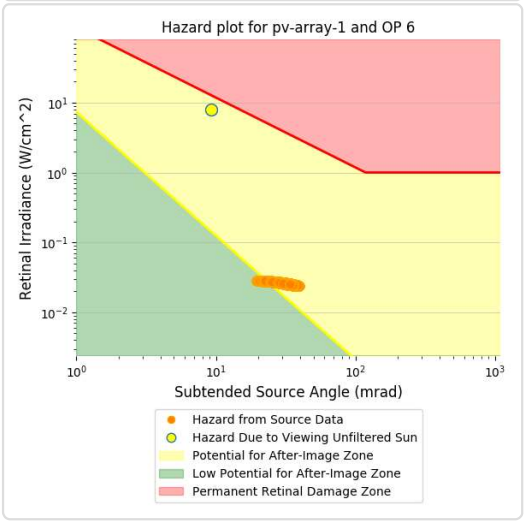
PV array is expected to produce the following glare for receptors at this location:

- 147 minutes of "green" glare with low potential to cause temporary after-image.
- 1,543 minutes of "yellow" glare with potential to cause temporary after-image.





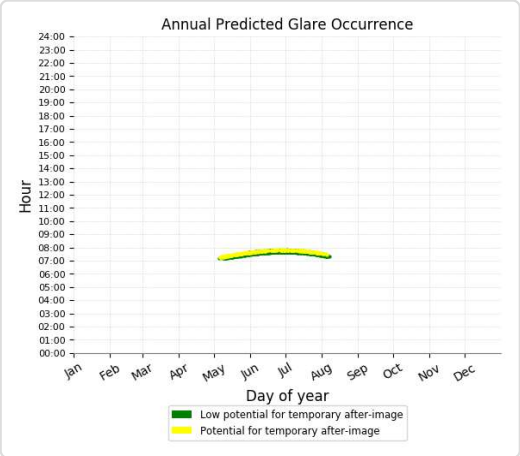


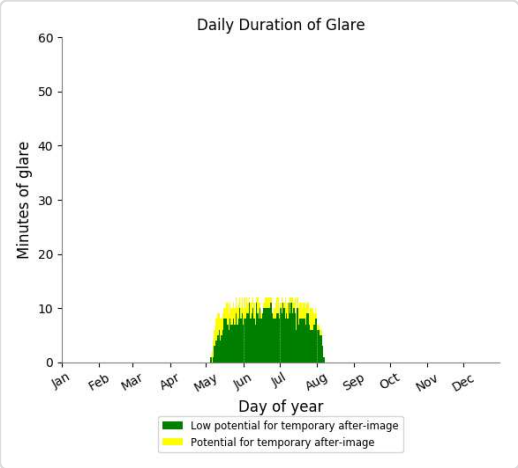


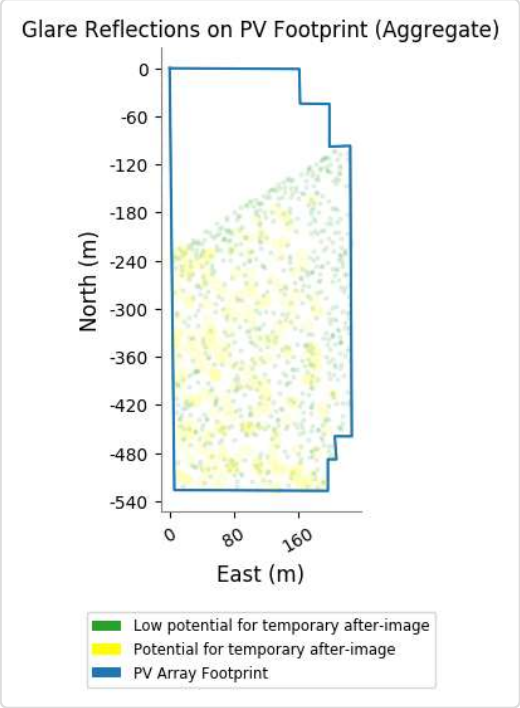
PV array 1 - OP Receptor (OP 7)

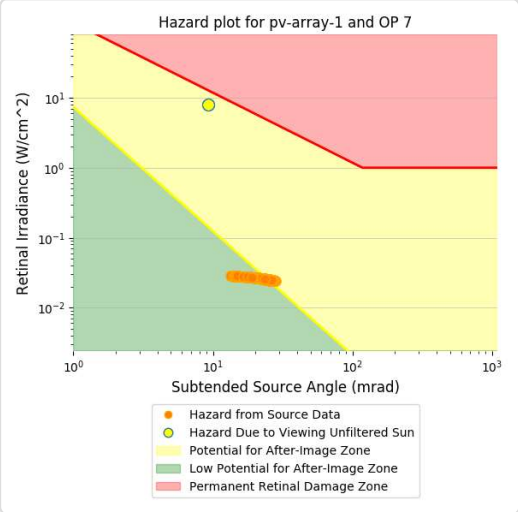
PV array is expected to produce the following glare for receptors at this location:

- 729 minutes of "green" glare with low potential to cause temporary after-image.
- 214 minutes of "yellow" glare with potential to cause temporary after-image.









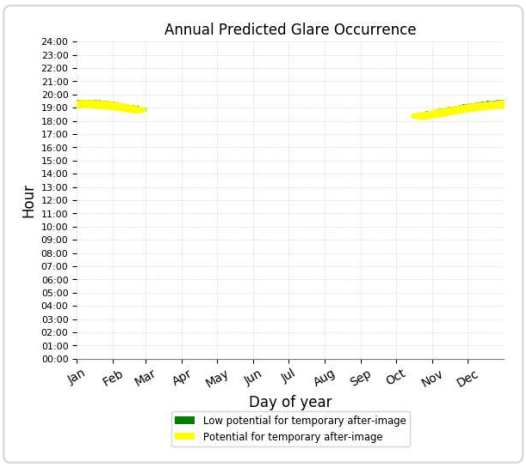
PV array 1 - OP Receptor (OP 8)

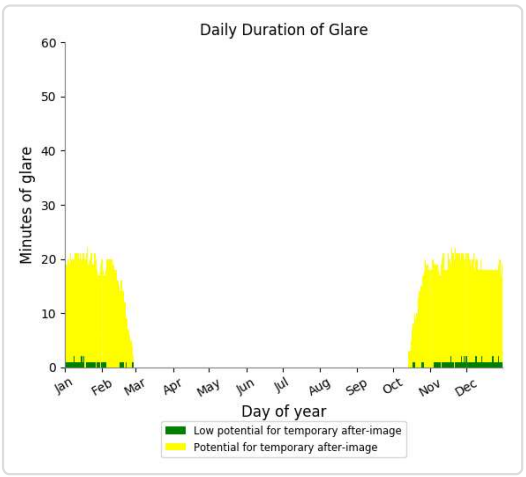
No glare found

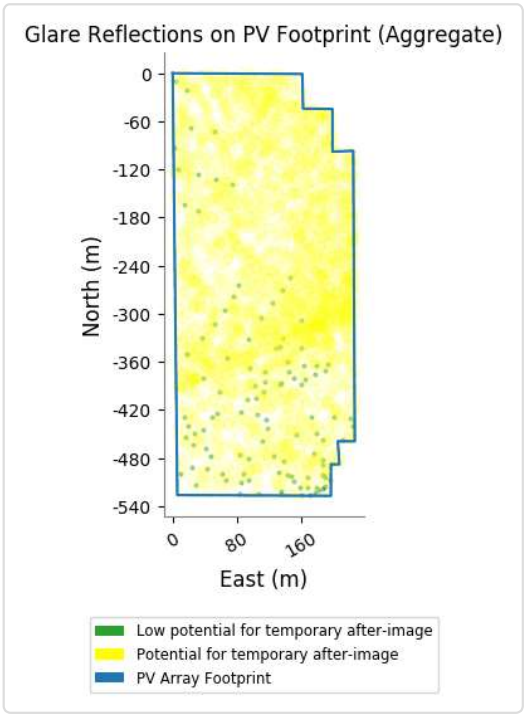
PV array 1 - OP Receptor (OP 9)

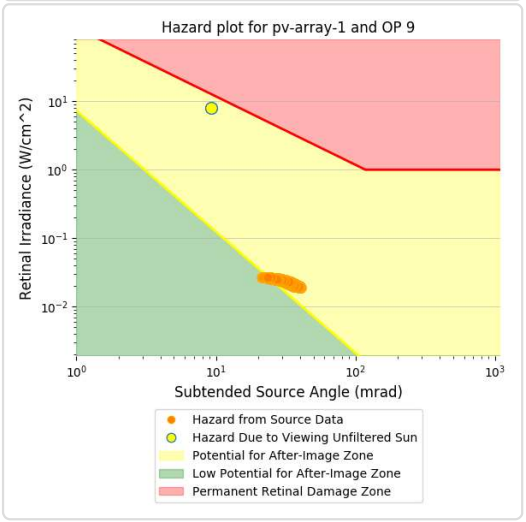
PV array is expected to produce the following glare for receptors at this location:

- 111 minutes of "green" glare with low potential to cause temporary after-image.
- 2,293 minutes of "yellow" glare with potential to cause temporary after-image.





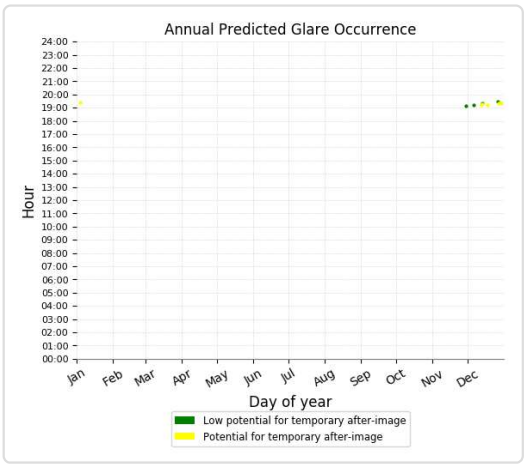


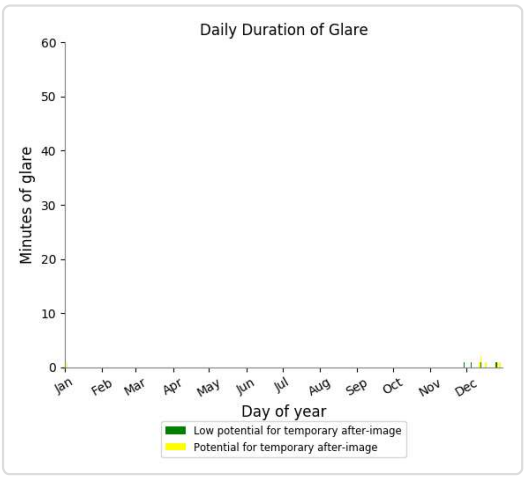


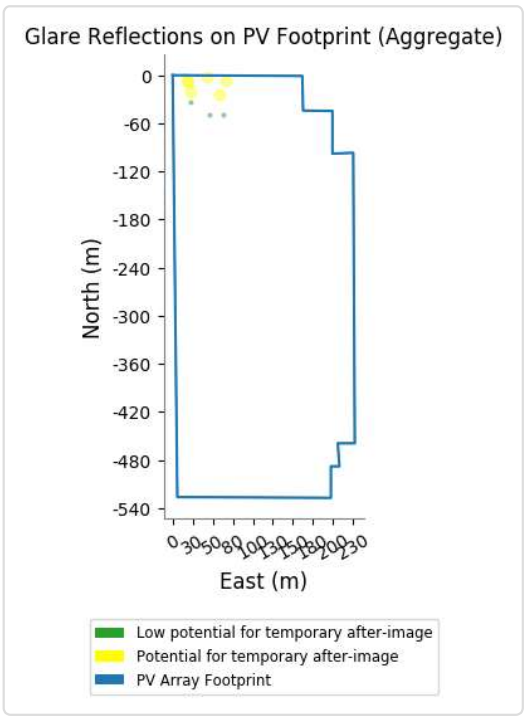
PV array 1 - OP Receptor (OP 10)

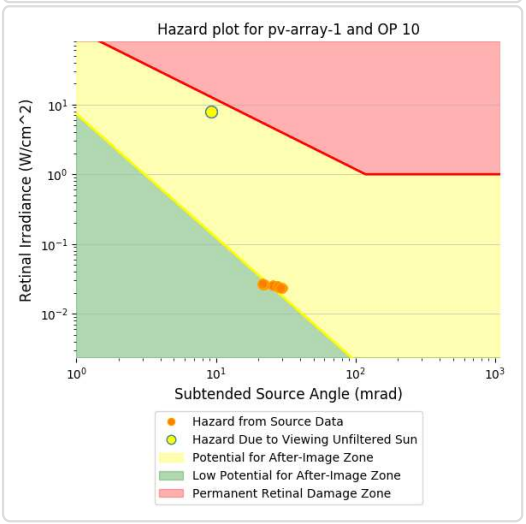
PV array is expected to produce the following glare for receptors at this location:

- 4 minutes of "green" glare with low potential to cause temporary after-image.
- 6 minutes of "yellow" glare with potential to cause temporary after-image.









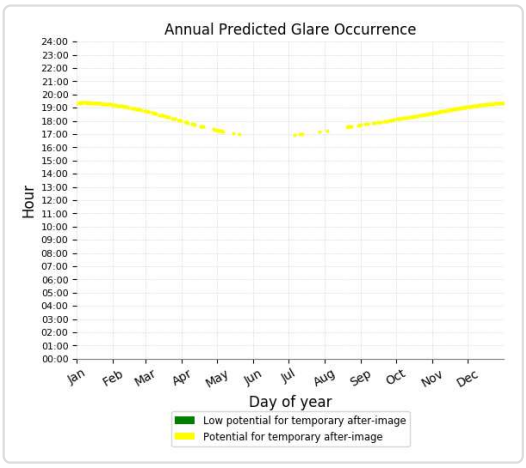
PV array 1 - OP Receptor (OP 11)

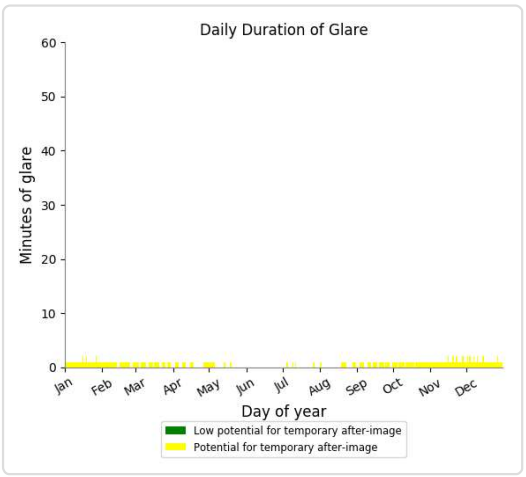
No glare found

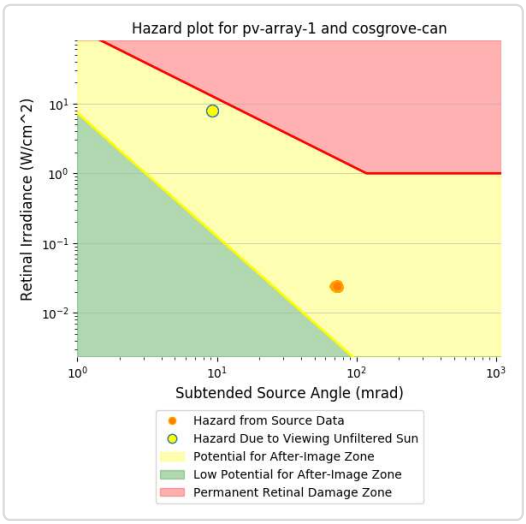
PV array 1 - Route Receptor (Cosgrove-Caniambo Road)

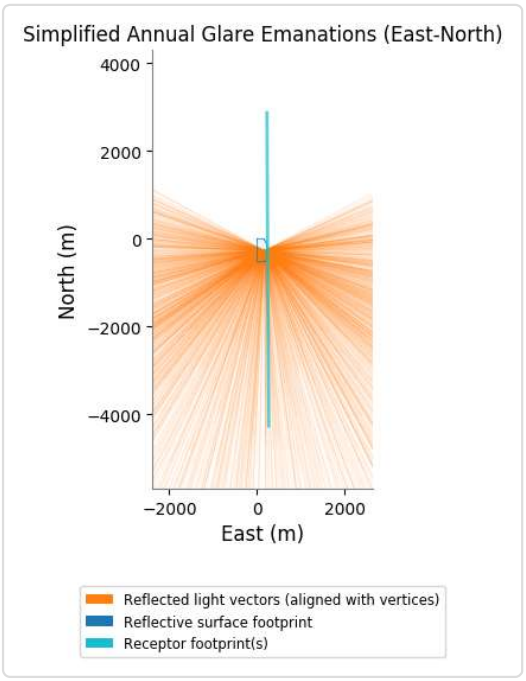
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 228 minutes of "yellow" glare with potential to cause temporary after-image.









re vectors placed at PV centroid for clarity. Actual glare-spot locations vary.

PV array 1 - Route Receptor (Kay Road)

No glare found

PV array 1 - Route Receptor (Kellows Road)

No glare found

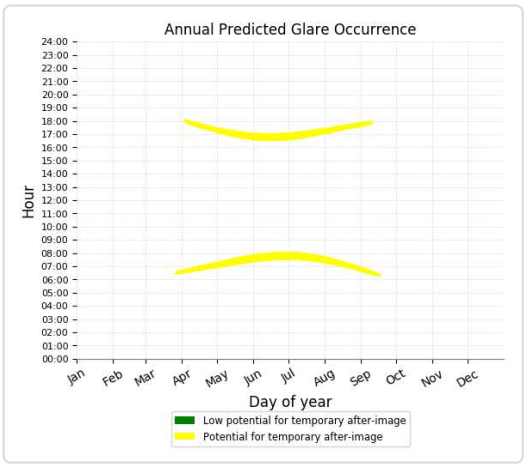
PV array 1 - Route Receptor (New Dookie Road)

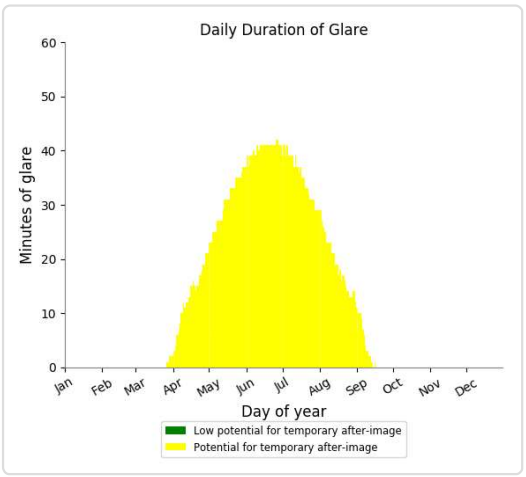
No glare found

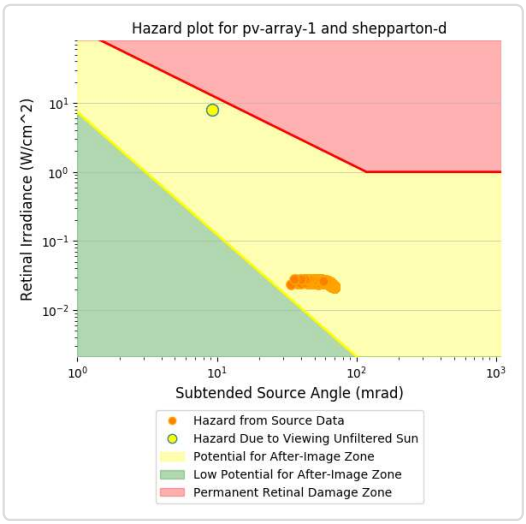
PV array 1 - Route Receptor (Shepparton-Dookie College Road)

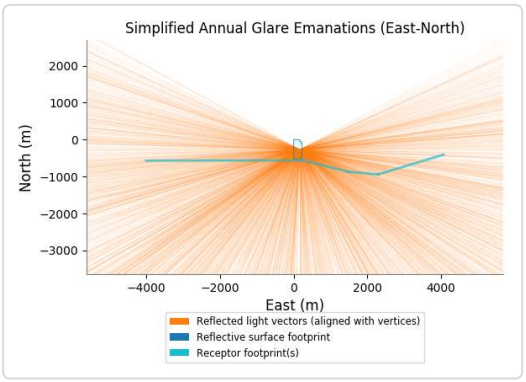
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,317 minutes of "yellow" glare with potential to cause temporary after-image.









Glare vectors placed at PV centroid for clarity. Actual glare-spot location vary.

PV array 1 - Route Receptor (Youngs Road)

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- 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.
- Several 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.
- 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.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Glare analysis methods used: OP V1, FP V1, Route V1
- Refer to the **Help page** for assumptions and limitations not listed here.