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Fulham Solar Farm

Glint & Glare Assessment

Report for Solis Renewable Energy Pty. Ltd.

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Executive summary

The following report details the findings of a solar photovoltaic (PV) glint & glare assessment for a 80MW PV array in Fulham, Victoria, Australia. The report has been prepared by Ricardo Energy & Environment (herein “Ricardo”) for the Project Developer, Solis Renewable Energy Pty. Ltd (herein “the client”).

The analysis was completed using industry standard glint and glare techniques, in full compliance with the Solar Energy Facilities – Design and Development Guidelines (herein “the Guidelines”) as set out by the Department of Environment, Land, Water and Planning (DELWP).

The surrounding area to the site was assessed to determine if there were any dwellings, roads, railway infrastructure or airport infrastructure (all defined as receptors) had the potential to be subject to glint and glare throughout the year. In total 29 observation point receptors, 4 route receptors and multiple flight paths at 2 nearby airports were identified within the surrounding area. The coordinates of each receptor were determined as well as all flight paths to and from the airport. Each receptor was then evaluated to determine the impact of glint and glare.

The conclusions of the initial analysis determined that moderate glint and glare would be present for some receptors, only at specific times of day, on certain days of the year, for short periods of time. The conclusions of this analysis were used to determine mitigation measures that would prevent glint and glare at these times, so no incidences of glint and glare would be experienced.

The mitigation measures proposed utilise current screening already in place and propose further measures (such as vegetation buffers and opaque screening) to fully mitigate against risk of glint and glare. The screening measures proposed, were designed to minimise visual impact and blend in with the surrounding biodiversity.

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Glossary

Abbreviation	Definition
ACT (ATCT)	Air Control Tower (Air Traffic Control Tower). These are located at airports and air bases and are key receptors of glint and glare.
FP	Flight paths. These are designated to flight path receptors for aircraft.
Glare	The reflection of the sky around the sun. Less intense than glint but is usually present for longer periods of time.
Glint	The direct reflection of the sun within the surface of an object, in this case a PV module. Glint is more intense than glare.
kWp	Kilo-watt-peak. This refers to the power rating of a single solar panel within the array.
MWp	Mega-Watt-peak. This refers to the combined power rating of all solar panels within the array.
OP	Observation point receptor subject to glint & glare. These are typically dwellings and other buildings.
PV	Photovoltaic – method for generating power using solar cells to convert the suns energy into useable power.
RR	Route receptors. These are designated to roads/vehicle paths.

1 Introduction

The following section provides an overview to the 80MW solar PV project and its location.

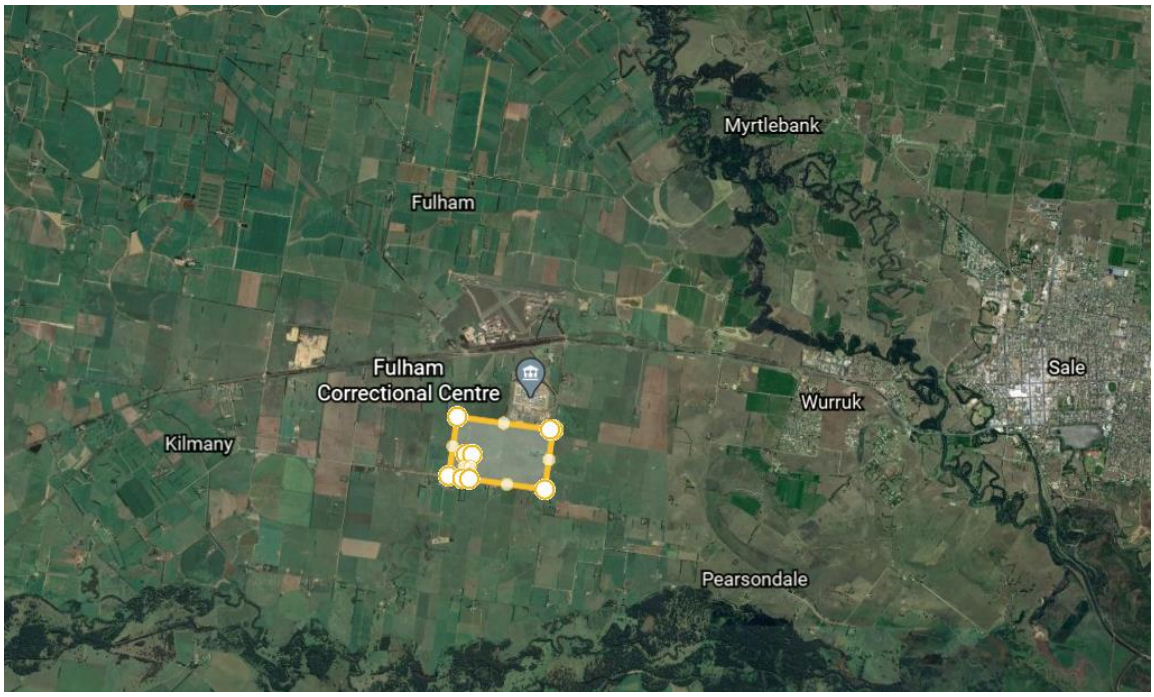
1.1 Project Site

The project (herein known as the 'Project') is in the State of Victoria, south-east Australia, approximately 225km east of Melbourne and 7km west of the town of Sale. The proposed location of the array is at the following address:

Hopkins Road, Fulham, Victoria, 3851, Australia

This area is approximately 160 hectares of agricultural land and is bound by two main roads: Hopkins Road and McLarens Road. The Fulham correctional facility lies immediately to the north of the site and the West Sale air base lies almost immediately north of the correctional facility.

Figure 1-1 – Location of proposed PV array (Google Earth, 2020)



1.2 PV array details

The Project is to be approximately 65-70MW capacity consisting of monocrystalline Trina 440W modules[1] with an anti-reflective coating (ARC). The array will be orientated due north and will implement single-axis tracking (a GAMECHANGE Solar – Genius Tracker 1P). The tracking system will have a 52° range of rotation in order to maximise generation. As part of the tracking system, torque tubes are installed to approximately 1800mm high, with the modules installed on top of these. As a result, the system designer has stated it would be rare for the array to stand higher than 1900mm off the ground including the modules at any given point.

[1] Trina TSM-DEG17MC.20(II)-440W modules

2 Stage 1: Site assessment

Stage 1 assesses the site by determining the site boundary, sizing the array within the site boundary, and then identifying a 'first-run' of receptors to be modelled. The results from the first simulation will then dictate the most appropriate array configuration to maximise generation whilst also minimising glint and glare impacts. Glint and glare impacts are discussed in detail in stage 2.

2.1 Array footprint

The area that will be utilised for the array is approximately 160 hectares.

Figure 2-1 – approximate footprint of entire area for development

It is important to note that the entire area is not covered with PV panels. To create a more realistic footprint for the purposes of modelling, it is assumed that there is an approximate 15-metre setback from the outside boundaries of the Project with a 15-metre internal setback from the buildings within the site boundary.

Table 2-1 – coordinates of each corner of the entire area for development

Point on map	Latitude	Longitude
1	-38.121180	146.973063
2	-38.119585	146.958636
3	-38.115959	146.959224
4	-38.115849	146.958018
5	-38.119414	146.957265
6	-38.119184	146.954701
7	-38.110250	146.956419

8	-38.112210	146.974659

2.2 Identification of receptors

Glint and glare receptors represent locations where people may be subject to the glint and glare effects from the PV array. Key receptors typically include:

1. Residents in surrounding dwellings;
2. Road users;
3. Train infrastructure; and
4. Aviation infrastructure (such as pilots and air traffic control towers).

The first task involves creating a 'longlist' of receptors, whereby all the potential receptors within a defined proximity are highlighted. In this case, all potential receptors within a 1km radius of the site are highlighted, as well as the East Sale and West Sale air bases.

2.2.1 East Sale air base

RAAF East Sale base and airport is situated approximately 15km north-east of the proposed array. It is an air force training base with two active runways. The Wing Commander has confirmed that three squadrons use the airport for take-off and landing. The Wing Commander has also provided details on each squadron flight paths, airplane types and details on the flight control tower. This information is provided in this subsection.

Figure 2-2 – location of East Sale air base (red) in relation to project (yellow)

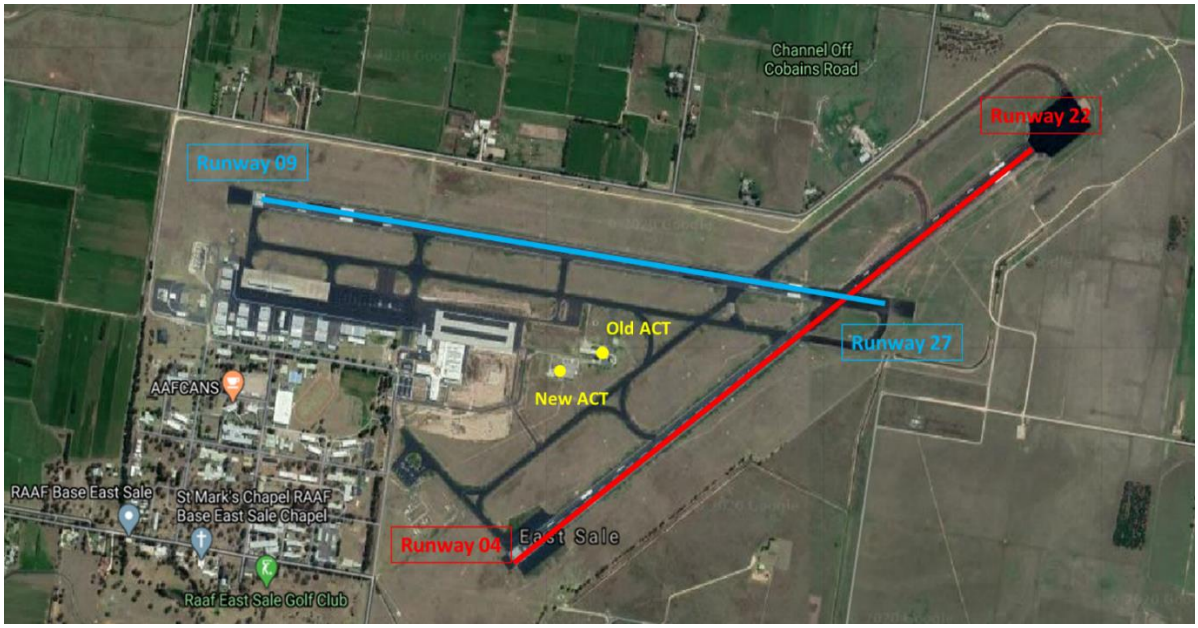
There are two runways at the site. Runway 04 is oriented 41°/221° from magnetic North whilst Runway 09 is oriented 086°/266° from magnetic North. The image below details the runways locations at the air base. details the landing and take-off approach direction and ascent/descent angles for the range of flight schools situated at the base.

The air control tower (ACT) is one of the key receptors from the Project. There are two towers present at the airbase. There is an old control tower currently in use and a new one that has been constructed. It is estimated the new ACT will be operational in a year. Note that the information has been provided by Air Traffic via the Wing Commander.

Table 2-2 – Air control tower details for East Sale air base

Metric	Old ACT	New ACT
Coordinates	-38.100238, 147.142419	-38.100576, 147.140473
Tower viewing level (m)	18	30
Elevation above sea level (m)	7	7

Figure 2-3 – Runways and air control towers at the RAAF East Sale Airbase (Google Maps)



Details of aircraft descent and climb paths vary by squadron and aircraft type. There are three squadrons: No 1 Flying Training School, Central Flying School and Air Missions Training School. Each of the squadrons have provided, via the Wing Commander, a range of flight path details to cover the aircraft operated as part of their squadron. It was confirmed by the squadrons that none of the aircraft are expected to have windows in the floor of the pilots' cabin.

Table 2-3 – East Sale air base flight path details

Squadron	Runway	Direction of land and take-off	Max / Min climb angle (deg)	Typical take-off distance at climb angle and in line with runway (km)	Max / Min descent angle (deg)	Typical approach distance at descent angle and in line with runway (km)
Central Flying School	Runway 04	041°/221°	0 – 25°	0 – 5km	0 – 15°	0 – 25km
	Runway 09	086°/266°	0 – 25°	0 – 5km	0 – 15°	0 – 25km
Air Mission Training School (32SQN King Air)	Runway 04	041°/221°	0-13°	9km	0-5.5°	18km
	Runway 09	086°/266°	0-13°	9km	0-5.5°	18km
No1 Flying Training School	Runway 04	211° [2]	0-13°	9km	0-5.5°	18km
	Runway 09	252° [3]/91°	0-13°	9km	0-5.5°	18km

As demonstrated, there are a range of take-off and landing approaches between the flight schools at the base. Typically, the climb angles are larger than descent angles. For modelling purposes, it is assumed that 2-mile (3.2km) flight paths used in the ForgeSolar modelling tool are in line with each runway with ascent/descent angles of 5°-25° in 5° increments.[4]

[2] Approach – landing only. Assume in line with runway orientation.

[3] Approach – landing only

[4] Gives a total of 20 flight paths with 5 flight ascent/descent angles *x* 4 runways.

2.2.2 West Sale airport

The West Sale airport is a public operational airport located approximately 2.5km north of the Project.

Figure 2-4 – location of West Sale airport in relation to the Project (Google Maps)

There is no ACT at West Sale as the airport uses the ACT located at East Sale. Therefore, only the flight paths at West Sale are required for modelling.

The East Sale contact, Sharyn Bolitho, also provided flight path data for the non-initial student flying aircraft movements at West Sale. The information provided notes that the single runway essentially faces east-west (87° and 267° from magnetic north) with most flights in the circuit or instrument arrival on the runway, but that there are a significant number of flights that come from random directions. However, for the purposes of this study, it is assumed that flights take-off and land in line with both ends of the instrument arrival (aligned 87° and 267°). It is also assumed that, as in East Sale, there are no windows in the floors of pilot cabins for flights. The maximum ascent/descent angle given is 20°, therefore 2-mile (3.2km) flight paths are modelled in 5° increments from 5°-20°.[5]

[5] Gives a total of 8 flight paths modelled with 4 ascent/descent angles *x* 2 runways.

Figure 2-5 – West Sale runway 09 flight path arrival

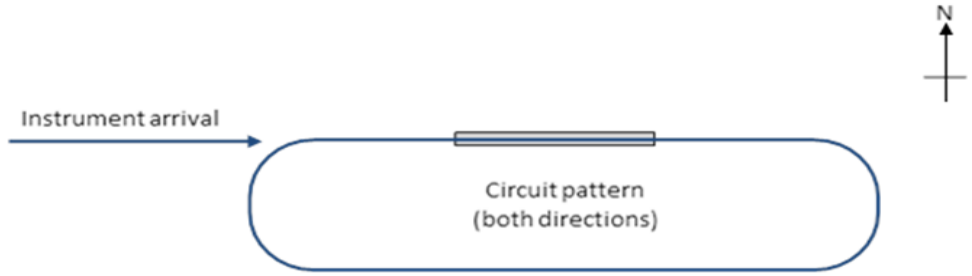


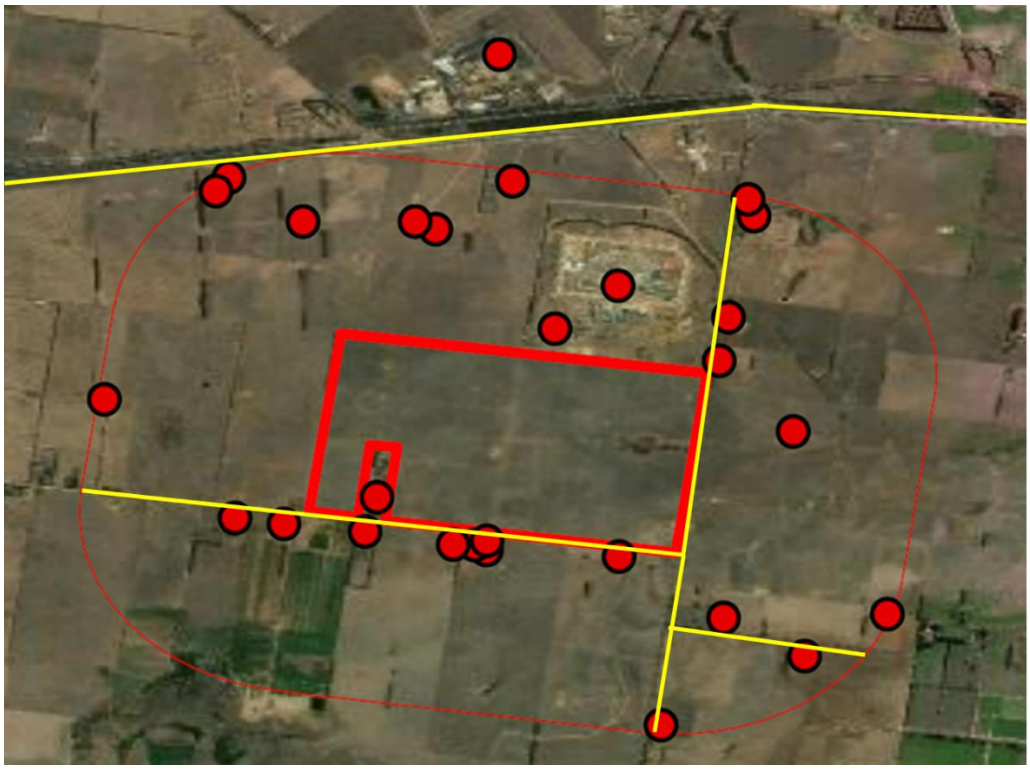
Table 2-4 – West Sale airport flight path details

Runway	Direction of land/take off (°)	Max/minimum climb angle (°)	Max/min descent angle (°)
09	87°/267°	20°	20°

2.2.3 Receptors

According to the State of Victoria's design and planning guidelines (herein referred to as the 'Guidelines'), '*dwellings and roads within 1km of the proposed facility*'[6] should be considered when assessing the impacts of glint and glare. A site buffer of 1km was drawn around the site of the Project, with receptors identified within these boundaries as demonstrated below. These are separated into both observation points (i.e. buildings) and route receptors (i.e. roads).

Figure 2-6 – Observation point (OP) receptors (red dots) and route receptors (yellow lines) within a 1km radius of the site with West Sale airport to the north of the boundary



[6] The State of Victoria Department of Environment, Land, Water and Planning (2019) *Solar Energy Facilities: Design and Development Guidelines*. DELWP. August 2019. Available at

2.2.4 Receptor summary

The table below provides an overview of the receptors modelled for the stage 1 analysis of glint and glare impacts.

Table 2-5 – Preliminary receptor summary

Receptor	Type of receptor	Latitude (°)	Longitude (°)	Observation height (m)
East Sale Royal Australian Air Force (RAAF)	Flight paths	As described in flight path details	As described in flight path details	Various
East Sale RAAF base	Old air control tower	-38.100238	147.142419	18
East Sale RAAF base	New air control tower	-38.100576	147.140473	30
West Sale airport	Flight paths	As described in flight path details	As described in flight path details	Various
McLarens Road	Route receptor 1	As defined in boundary	As defined in boundary	1.5
Hopkins Road	Route receptor 2	As defined in boundary	As defined in boundary	1.5
Settlement Road	Route receptor 3	As defined in boundary	As defined in boundary	1.5
Princes Highway	Route receptor 4	As defined in boundary	As defined in boundary	1.5
Fulham Correctional Centre	OP 1	-38.10789722200	146.97025833300	4
Dwelling/building	OP 2	-38.09638055600	146.96434166700	4
Dwelling/building	OP 3	-38.10271111100	146.96500833300	4
Dwelling/building	OP 4	-38.10506944400	146.96118888900	4
Dwelling/building	OP 5	-38.10471388900	146.96015277800	4
Dwelling/building	OP 6	-38.11842500000	146.95825277800	4
Dwelling/building	OP 7	-38.10249722200	146.95089722200	4
Dwelling/building	OP 8	-38.10319166700	146.95024166700	4
Dwelling/building	OP 9	-38.10470555600	146.95456944400	4
Dwelling/building	OP 10	-38.11355555600	146.94469166700	4
Dwelling/building	OP 11	-38.12136388900	146.97029166700	4
Dwelling/building	OP 12	-38.12103888900	146.96368888900	4
Dwelling/building	OP 13	-38.12079444400	146.96314166700	4
Dwelling/building	OP 14	-38.12058611100	146.96371666700	4

Dwelling/building	OP 15	-38.12077500000	146.96205000000	4
Dwelling/building	OP 16	-38.12013055600	146.95767777800	4
Dwelling/building	OP 17	-38.11973611100	146.95362500000	4
Dwelling/building	OP 18	-38.11944166700	146.95120000000	4
Dwelling/building	OP 19	-38.12975833300	146.97237500000	4
Dwelling/building	OP 20	-38.12424444400	146.98365277800	4
Dwelling/building	OP 21	-38.12631944400	146.97953055600	4
Dwelling/building	OP 22	-38.12443611100	146.97548888900	4
Dwelling/building	OP 23	-38.11162500000	146.97527500000	4
Dwelling/building	OP 24	-38.10947222200	146.97573611100	4
Dwelling/building	OP 25	-38.10444166700	146.97700277800	4

3 Methodology

The DELWP state that: '*The responsible authority will require a glint and glare assessment, and a proponent should agree a methodology for the assessment with the responsible authority. Where a solar energy facility is proposed close to an airfield, airport or road network, the proponent should consult the owner/operator of the facility and the relevant roads corporation.'*

The following methodological steps were used in this glint and glare assessment:

1. Identify the PV site and define configuration (carried out by the client)
2. Identify key receptors within the vicinity of the site such as the nearby Air Base (carried out by the client).
3. Desktop research to finalise list of key receptors to be included within the analysis process.
4. Collate all inputs required for analysis for the GlareGauge tool (PV footprint, configuration, receptor locations etc).
5. Design system within GlareGauge tool, accounting for all receptors and undertake glint and glare analysis process.
6. Collate and present the results of the assessment.
7. Analyse the results and review potential mitigating factors for any receptors affected by the development, where applicable.
8. Evaluate alternative array configurations (e.g. module position) to determine a lowest impact solution, where applicable.

3.1 Current glint and glare assessment guidelines

The physical impact of glint and glare on a receptor can be classified under the following categories:

Table 3-1– Categorisation of glint and glare impacts

Solar Glare Hazard Analysis Tool (SGHAT) categories	Victoria Government (2019)[7] equivalent impact categories
Green: Low potential for after image, reflection occurs with lesser strength.	**Low Impact:** Solar reflection geometrically possible but intensity/duration is small and can be mitigated through a screening measure.
Yellow: Potential for after image, reflection can occur instantly with some disturbance to vision.	**Moderate Impact:** Solar reflection geometrically possible and visible, but intensity/duration varies according to conditions. Mitigation measures will be required.
Red: Potential for permanent retinal damage, reflection occurs instantly with severe disturbance to vision.	**Major Impact:** Solar reflection geometrically possible and visible under a range of conditions with significant intensity/duration impacts. Significant mitigation measures are required.

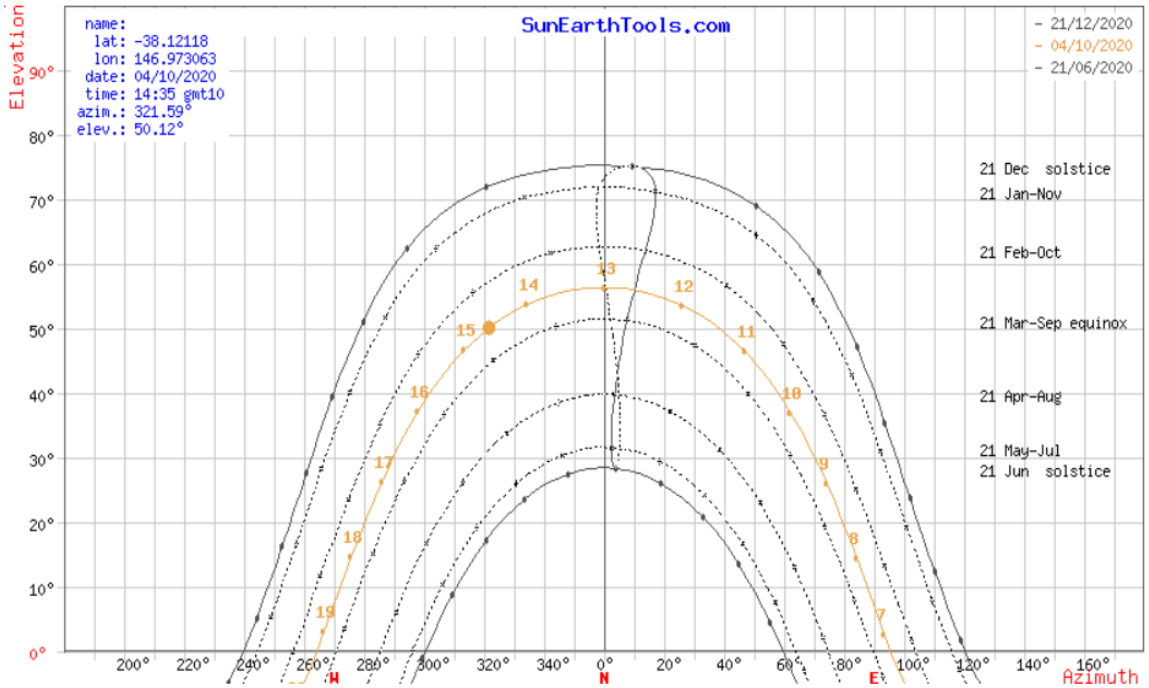
3.2 Sun behaviour

Because the position of the sun changes both daily and seasonally, the effects of glint and glare must be assessed on a minute-by-minute basis. The sun's light is essentially a beam of light that is reflected by, in this case, the PV panels. The position of the reflection from the panels determines the position where the observer can see the glare of the panels from. The impacts of glint and glare may

[7] The State of Victoria Department of Environment, Land, Water and Planning (2019) *Solar Energy Facilities: Design and Development Guidelines.* DELWP. August 2019. Available at https://www.planning.vic.gov.au/__data/assets/pdf_file/0028/428275/Solar-Energy-Facilities-Design-and-Development-Guideline-August-2019.pdf

present themselves in different times of the year. For example, glare intensity in the summer may be less intense in one location and become more apparent in winter and vice versa, hence the requirement for detailed analysis across the year. Australia is in the southern hemisphere; therefore, the sun path shifts south during the summer and north during the winter.

Figure 3-1 – Azimuth angle range for given location (sunrise to sunset)



4 Stage 1 assessment

4.1 Overview

Ricardo have used ForgeSolar's "GlareGauge" tool for the glint and glare analysis. This relies on the Solar Glare Hazard Analysis Tool (SGHAT) which is used internationally by industry, academia, and military to evaluate PV glint and glare on receptors. It has been independently verified and is recognised as an international standard approach to glint and glare analysis. This tool is of industry standard.

4.2 Model assumptions

4.2.1 Site configuration assumptions

The following table details the site configuration parameter assumptions used within GlareGauge. These are standard parameters to use in a project such as this.

Table 4-1 – Details of site configuration parameters

Parameter	Details
Subtended angle of the sun	9.3mrad (0.5°). This is the default setting given by the software.
Direct Normal Irradiance (DNI)	DNI scales with the position of the sun and has a peak value of 1000W/m2.
Ocular transmission coefficient	This is the radiation absorbed in the eye before reaching the retina. Value of 0.5 (default figure recommended by the software).
Pupil diameter	This is the diameter of the pupil when daylight is present. Value of 2mm (default figure recommended by the software).
Eye focal length	This is the projected image size on the retina from a given glare source for a given subtended angle. Value of 1.7cm This is the default figure recommended by the software.
Time interval	Value of 1 to represent 1 minute

4.2.2 PV array parameter assumptions

The following table details the PV parameter assumptions used within GlareGauge. The tracking type, rotation of tracking, PV material category and rated power were provided by the client. Other parameters represent typical parameters for a project such as this.

Table 4-2 – Details of PV array parameters

Parameter	Details
Tracking type	Single-axis tracking. Information provided by client.
Module tilt	0° (panels face upwards and rotate during operation)
Module orientation	0° (to maximise generation)
Axis offset	0°
Rotation of tracking	Maximum value of 52° (as provided in tracking technology datasheet)
Rest angle	0°
PV material category	Category 1. Defined as smooth glass with anti-reflective coating. Module details provided by client within technical datasheet.
Rated power	65-70MW as provided by the client.
Slope error value	A value of 'varies' to imply that this depends on the PV material selected. In this case, material category 1 was selected
Reflectivity value	A value of 'varies' to imply that this depends on the PV material selected. In this case, material category 1 was selected

4.2.3 Model parameters

Further to the site configuration and PV array parameter assumptions, the GlareGauge software requires further inputs such as observation points, 2-mile (3.2km) flight paths and route receptors (e.g. roads). The table below details the relevant model parameters.

Table 4-3 – Details of model parameters

Parameter	Details
Route receptors	3 roads in total within 1km of site (McLarens Road, Hopkins Road and Settlement Road)
2-mile flight path – path direction	Flight paths in line with all runways at both East and West Sale
Glide slope	Flight paths for East Sale air base and West Sale airport. Ascent/descent angles of 5-25° for East Sale and 5-20° for West Sale in increments of 5°
2-mile flight path – threshold crossing height	15.24m (50ft). This is the default setting within the software
2-mile flight path – max downward viewing angle	Default value of 30°. This is the default setting and acceptable to the FAA. For example, 90° would assume the pilot can see directly underneath the aircraft
Azimuthal viewing angle	50°. This is the default setting and assumes the pilot can see 50° to the left and right during their approach
Observation points	A total of 29 OP's including the new and old ACT at East Sale. All dwellings/buildings assigned a viewing height of 4m to represent a two-storey building and route receptors a viewing height of 1.5 metres to represent an approximate driving height

4.3 Limitations

It is important to consider the limitations of the software for this piece of analysis:

1. The geometry of the whole system is not considered. Therefore, variables such as gaps between panels and heights of the mounting structures and individual panels are not considered.
2. Surrounding obstacles and obstructions (such as trees, electricity poles and fences) aren't considered within the analysis as the ground is assumed flat. Therefore the modelling maximises the likely impact of glint and glare as it does not consider the mitigative role of existing vegetation/buildings.
3. The model does not consider daily variations in weather conditions (e.g. cloud cover) and instead uses a typical clear day as a default. This also overestimates the impacts of glint and glare.
4. The 2-mile (3.2km) flight path has been constructed as a straight line, with varying ascent/descent angles. The RAAF base notes that the approach to land direction is not limited to the runway direction. Currently, only approaches in-line with the runway have been modelled.
5. The software allows a maximum of 20 flights-paths per project, which have confirmed the varying LTO angles of decent and ascent. If further permutations of flight path are desired, a new simulation model can be created. We have considered approach/take-off angles within the advised minimum and maximum range if 5° increments.
6. The GlareGauge tool implements a simplified backtracking model. It is assumed that when the sun is beyond the east-west range of the single-axis tracking structure (in this case +/- 52° from due north), the panels instantaneously revert to the determined resting angle. In this case it is 0° (panels are flat). This creates a more conservative estimation of glare as there is greater glint/glare risk during sunrise/sunset on the flat panels.

These limitations have no material impact on the results of the study.

5 Stage 1 results

5.1 Summary of results

The following table details the glint and glare results for the Project, with a range of glare intensities analysed.

Table 5-1 – Glint and glare duration and intensity for flight paths for stage 1 assessment

Observation point**Error! Bookmark not defined.**	Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Hazard summary
FP: WS 09 E 10	0	2310	0	Yellow
FP: WS 09 E 15	0	2506	0	Yellow
FP: WS 09 E 20	116	2172	0	Yellow
FP: WS 09 E 5	0	1506	0	Yellow
FP: WS 09 W 10	0	0	0	None
FP: WS 09 W 15	0	0	0	None
FP: WS 09 W 20	0	0	0	None
FP: WS 09 W 5	0	0	0	None
FP: ES 04 10	0	0	0	None
FP: ES 04 15	0	0	0	None
FP: ES 04 20	0	0	0	None
FP: ES 04 25	0	0	0	None
FP: ES 04 5	0	0	0	None
FP: ES 09 10	0	0	0	None
FP: ES 09 15	0	0	0	None
FP: ES 09 20	0	0	0	None
FP: ES 09 25	0	0	0	None
FP: ES 09 5	0	0	0	None
FP: ES 22 10	933	0	0	Green
FP: ES 22 15	1475	0	0	Green
FP: ES 22 20	1901	0	0	Green
FP: ES 22 25	2286	0	0	Green
FP: ES 22 5	373	0	0	Green
FP: ES 27 10	667	0	0	Green

FP: ES 27 15	868	0	0	Green
FP: ES 27 20	1060	0	0	Green
FP: ES 27 25	1259	0	0	Green
FP: ES 27 5	416	0	0	Green

Table 5-2 - Glint and glare duration and intensity for all observation points (including air control towers) for stage 1 assessment

Observation point	Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Hazard summary
OP: OP 1	0	2259	0	Yellow
OP: OP 2	0	0	0	None
OP: OP 3	0	0	0	None
OP: OP 4	0	0	0	None
OP: OP 5	0	38442	0	Yellow
OP: OP 6	0	301	0	Yellow
OP: OP 7	0	709	0	Yellow
OP: OP 8	0	594	0	Yellow
OP: OP 9	0	4136	0	Yellow
OP: OP 10	0	6552	0	Yellow
OP: OP 11	0	6841	0	Yellow
OP: OP 12	0	7935	0	Yellow
OP: OP 13	0	9253	0	Yellow
OP: OP 14	0	8011	0	Yellow
OP: OP 15	0	8396	0	Yellow
OP: OP 16	0	6562	0	Yellow
OP: OP 17	0	4745	0	Yellow
OP: OP 18	0	0	0	None
OP: OP 19	0	1601	0	Yellow
OP: OP 20	0	973	0	Yellow
OP: OP 21	0	1344	0	Yellow
OP: OP 22	0	5525	0	Yellow
OP: OP 23	0	3086	0	Yellow
OP: OP 24	0	1365	0	Yellow
OP: OP 25	0	1028	0	Yellow

OP: OP 26	0	5637	0	Yellow
OP: OP 27	0	7491	0	Yellow
OP: 28-ATCT	32	0	0	Green
OP: 29-ATCT	55	0	0	Green
Route: RR 1 Hopkins Road	0	22290	0	Yellow
Route: RR 2 Settlement Road	0	0	0	None
Route: RR 3 McLarens Road	0	833	0	Yellow
Route: RR4 Princes Highway	0	0	0	None

5.2 Mitigation justification

As demonstrated by the stage 1 results, each observation point is subject to varying degrees of intensity and duration of glint and glare, with glint and glare completely absent at other points. As a result, mitigation measures will be required for various OP's. The stage 1 simulation is not the final design; therefore, mitigation measures will not be required for analysis until after the final array design is modelled.

6 Stage 2: Site reassessment

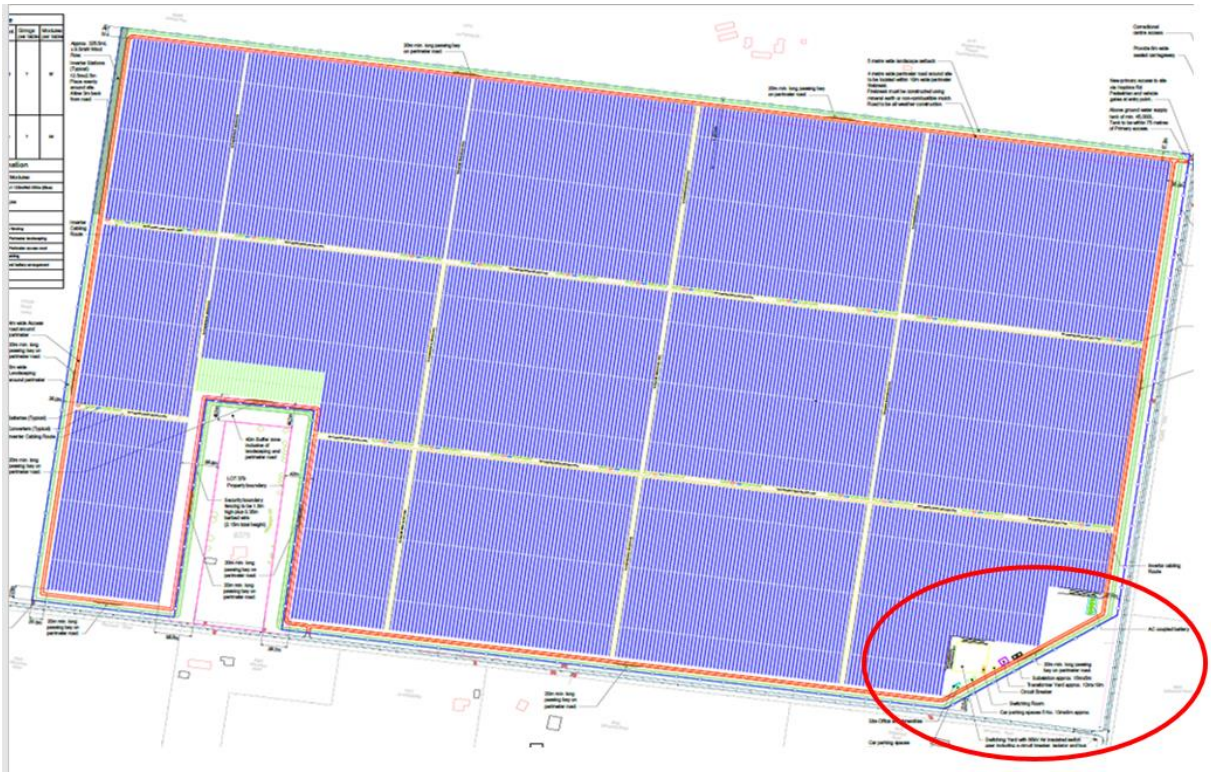
The remainder of the report investigates the glint & glare impacts on receptors from the revised project layout and assesses the effectiveness of the mitigation strategies proposed for those receptors that aren't subject to a pre-existing mitigation method (i.e. existing trees/buildings).

6.1 Site layout revision

The revised site layout is largely the same as the original assumed (Figure 2-1), although there are some minor adjustments:

1. There are no modules in a small section in the south-east corner (see Figure 6-1).
2. The modules are orientated at 8° east to accommodate more modules and increase total capacity (original design assumed an orientation of 0°).
3. The original setback/buffer zones of 15 metres have been altered, ranging from 17.2m (in the north, adjacent to the correctional facility) to 56.8m (in the south-west next to OP 5).

Figure 6-1 – revised site layout provided by REEP with adjustments to module area circled (red)



However, as a conservative estimate, it is assumed that both the northern and western sections (1 & 2 in Figure 6-1) with a larger setback still contain modules as a conservative estimate. Therefore, the only material adjustments to the modelling process will be:

1. Eliminating the modules in the south east corner of the array (section 3).
2. Changing the module orientation from 0° to 8°.
3. The change in setback from 15 metres to those given with the final array design, ranging from 17.2-56.8m.

6.2 Re-simulation results

The following tables demonstrate both the glint and glare intensity and duration for the final design of the project.

Table 6-1 – Glint and glare duration and intensity for flights paths for stage 2 assessment

Observation point	Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Hazard summary
FP: WS 09 E 10[8]	0	2235	0	Yellow
FP: WS 09 E 15	0	2465	0	Yellow
FP: WS 09 E 20	74	2245	0	Yellow
FP: WS 09 E 5	0	1547	0	Yellow
FP: WS 09 W 10	0	0	0	None
FP: WS 09 W 15	0	0	0	None
FP: WS 09 W 20	0	0	0	None
FP: WS 09 W 5	0	0	0	None
FP: ES 04 10	0	0	0	None
FP: ES 04 15	0	0	0	None
FP: ES 04 20	0	0	0	None
FP: ES 04 25	0	0	0	None
FP: ES 04 5	0	0	0	None
FP: ES 09 10	0	0	0	None
FP: ES 09 15	0	0	0	None
FP: ES 09 20	0	0	0	None
FP: ES 09 25	0	0	0	None
FP: ES 09 5	0	0	0	None
FP: ES 22 10	237	0	0	Green
FP: ES 22 15	396	0	0	Green
FP: ES 22 20	575	0	0	Green
FP: ES 22 25	751	0	0	Green
FP: ES 22 5	82	0	0	Green
FP: ES 27 10	229	0	0	Green
FP: ES 27 15	384	0	0	Green
FP: ES 27 20	542	0	0	Green

[8] Note that flight paths (FP) are given as an abbreviation of the airport, the runway number, the direction then the ascent/descent angle modelled. For example, FP: WS 09 E 10 represents West Sale, runway 09 in the east direction with an ascent/descent angle of 10°.

FP: ES 27 25	711	0	0	Green
FP: ES 27 5	84	0	0	Green

Table 6-2 – Glint and glare duration and intensity for all observation points (including air control towers) for stage 2 assessment

Observation point	Green glare (minutes per year)	Yellow glare (minutes per year)	Red glare (minutes per year)	Hazard summary
OP: OP 1	0	1824	0	Yellow
OP: OP 2	0	0	0	None
OP: OP 3	0	0	0	None
OP: OP 4	0	0	0	None
OP: OP 5	0	69	0	Yellow
OP: OP 6	0	48	0	Yellow
OP: OP 7	0	217	0	Yellow
OP: OP 8	0	238	0	Yellow
OP: OP 9	0	48	0	Yellow
OP: OP 10	0	1848	0	Yellow
OP: OP 11	0	11	0	Yellow
OP: OP 12	0	26	0	Yellow
OP: OP 13	0	23	0	Yellow
OP: OP 14	0	22	0	Yellow
OP: OP 15	0	37	0	Yellow
OP: OP 16	0	34	0	Yellow
OP: OP 17	0	40	0	Yellow
OP: OP 18	0	0	0	None
OP: OP 19	0	2026	0	Yellow
OP: OP 20	0	1159	0	Yellow
OP: OP 21	0	1492	0	Yellow
OP: OP 22	0	5201	0	Yellow
OP: OP 23	0	2767	0	Yellow
OP: OP 24	0	1031	0	Yellow
OP: OP 25	0	862	0	Yellow
OP: OP 26	0	4021	0	Yellow
OP: OP 27	0	6389	0	Yellow

OP: 28-ATCT	174	0	0	Green
OP: 29-ATCT	171	0	0	Green
Route: RR 1 Hopkins Road	0	32875	0	Yellow
Route: RR 2 Settlement Road	0	0	0	None
Route: RR 3 McLarens Road	0	0	0	Yellow
Route: RR 4 Princes Highway	0	0	0	None

7 Mitigation measures

As discussed within the Limitations section, the GlareGauge tool does not consider the mitigative role of existing objects such as trees and buildings. This section evaluates a range of mitigation measures for receptors that will likely be subject to glare as well as those that likely already have their own mitigation measures present.

7.1 Receptors not subject to glint and glare

The table below highlights the receptors not subject to glint and glare as in the first simulation and explains the potential reasons for this.

Table 7-1 – Justification for the absence of glint/glare at receptors

Observation point	Details
OP 2	This observation point is at a significantly higher altitude than the array. Although undulating, the land that the PV array is situated on sits at approximately 8-18m elevation. Although north of the site, OP 2 is situated 27.60m elevation. It is therefore likely that the observation height is not within the reflectance range of the array.
OP 3	As with OP 3, however the elevation at this point is 28.12m.
OP 4	As with OP 2 & 3, however the elevation is 28.99m.
OP 18	This observation point is the most southerly of all those modelled and is almost directly south (i.e. behind) the proposed array. This negates any risk of glint/glare emanating from the south east/west of the project as the modules rotate along their 52° tracking range due to the panels facing north.
RR 2 (Settlement Road)	This route receptor lies behind the array in a south-east direction. Although it is near other receptors (e.g. OP's 19-21) that receive some glare (although minimal), the elevation of the road is approximately 7-9m. This is lower than many portions of the array. Further, the viewing height of 1.5m is lower than that of the OP's nearby at 4m. This makes it likely that the road lies below the reflectance range of the panels tracking range.
RR 4 (Princes Highway)	This receptor lies to the North of the site, approximately 1.2km in a straight-line at its closest point. As with OP 2-4, this route receptor is at a significantly higher elevation than the PV array (range of 19.46m-35.96m) and is therefore likely not within the reflectance height range of the system. This is also confirmed by the visual impact assessment.

7.2 Scoping of receptors

This section demonstrates the receptors that will unlikely require their own mitigation strategies due to existing obstacles. It is assumed that all other receptors will require their own mitigation measures where possible, which will be further examined in stage 2 of the report with the final, confirmed array footprint.

OP 17 is the first receptor unlikely to require a mitigation strategy. This receptor lies to the south-west (array to the north-east) of the site and is surrounded by dense vegetation in multiple layers around the entire perimeter. This includes vegetation along the road as well as multiple large trees within the property area.

Figure 7-1 – OP 17 (circled red) with surrounding vegetation

OP 20 lies to the south-east of the array (array to the north-west) and has multiple vegetation layers in line with the array as well as dense vegetation immediately around the property.

Figure 7-2 – OP 20 (circled red) with surrounding vegetation

OP 21 lies to the south-east of the array (array to the north-west) and has dense tree cover adjacent to the west of the property as well as multiple trees surrounding the dwelling and dwelling area in the direction of the array.

Figure 7-3 – OP 21 (circled red) with vegetation layers to the west and around the property

OP 23 lies to the north-east of the array (array to the south-west) with a long line of vegetation to the east of the property running adjacent to Hopkins Road (RR 1). This vegetation cover has a slight break towards OP 22 then resumes in line with the array. It is therefore unlikely this receptor will require its own mitigation strategy.

Figure 7-4 – OP 23 (circled red) with vegetation layer adjacent to the receptor along RR 1

Finally, OP 24 and 25 lie to the north-east of the array (array to the south-west). Similarly, to OP 23, both OP 24 and 25 have a long strip of vegetation cover along their boundary adjacent to RR 1. They also have a denser set of trees scattered around the properties, making it unlikely the receptors will require a separate mitigation strategy.

Figure 7-5 – OP 23 and 25 (circled red) with vegetation layer adjacent to RR 1 along site boundary with multiple single trees within the property boundary

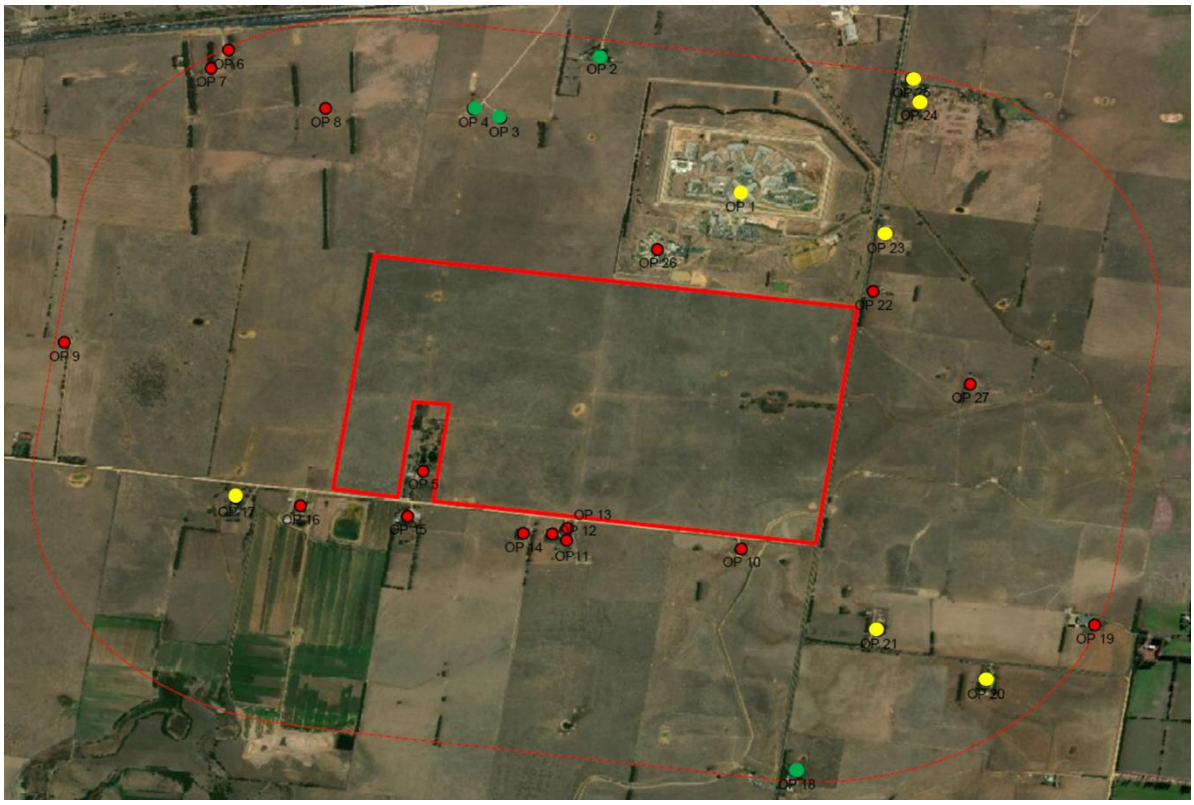
The table below summarises the receptors that are unlikely to require a mitigation strategy. A full table detailing all the receptors can be found in the appendix.

Table 7-2 – Receptors unlikely to require mitigation strategies

Observation point	Mitigation requirement	Details
OP 1	Unlikely	Walls and vegetation surrounding the correctional facility.
OP 17	Unlikely	Multiple trees surrounding property.
OP 20	Unlikely	Dense tree coverage around the front and west of the property (i.e. the direction of the array).
OP 21	Unlikely	Dense tree coverage around the front and west of the property (i.e. the direction of the array).
OP 23	Unlikely	Vegetation layer adjacent to the road.
OP 24	Unlikely	Dense vegetation surrounding the property.
OP 25	Unlikely	Dense vegetation surrounding the property.
OP 28 ATCT	Unlikely	Far from site with multiple vegetation layers closer to the site thus obscuring the view.
OP 29 ATCT	Unlikely	Far from site with multiple vegetation layers closer to the site thus obscuring the view.

The receptors detailed above that will likely not require their own mitigation strategy are highlighted

Figure 7-6 – Receptors likely to not require their own mitigation strategy (yellow) and not subject to glint and glare (green)



8 Discussion

8.1 Summary of impacted receptors

As demonstrated, there is some potential for a few observation points and route receptors to experience low to moderate intensity glare with some potential for after images at various times of the day/year, if no mitigation measures were implemented. The following table summarises these results along with the types of mitigation measures that could be implemented.

Figure 8-1 – time/duration of glint and glare subject to flight paths with suggested mitigation measures

Receptor	Glint/glare summary	Time/maximum duration of daily glint/glare	Suggested mitigation measure
FP: WS 09 E 10	Yellow	Up to 25 minutes from 6-7.30pm in Jan-Feb, Oct-Dec	Consider a range of options proposed by the FAA, including; 1. The use of polarized eye wear for pilots. 2. Anti-reflective glazing used in cockpits. 3. Field tests to assess the magnitude of glint/glare at varying approach heights/tilts.
FP: WS 09 E 15	Yellow	Up to 32 minutes from 6-7.15pm in Jan-Feb, Nov-Dec	As above.
FP: WS 09 E 20	Yellow	Up to 40 minutes from 6-8pm in Jan-Feb, Nov-Dec	As above
FP: WS 09 E 5	Yellow	Up to 17 minutes from 6-8pm in Jan-Feb, Oct-Dec	As above
FP: ES 22 10	Green	Up to 8 minutes from 6-7pm in Feb-Mar and Oct	As above
FP: ES 22 15	Green	Up to 12 minutes from 6-7pm in Feb-Mar and Oct	As above
FP: ES 22 20	Green	Up to 16 minutes from 6-7pm in Feb-Mar and Oct	As above
FP: ES 22 25	Green	Up to 20 minutes from 6-7pm in Feb-Mar and Oct	As above
FP: ES 22 5	Green	Up to 3 minutes from 6-7pm in Feb-Mar and Oct	As above
FP: ES 27 10	Green	Up to 9 minutes from 6-7pm in Mar-Sep and Oct	As above
FP: ES 27 15	Green	Up to 12 minutes from 6-7pm in Mar-Sep and Oct	As above
FP: ES 27 20	Green	Up to 20 minutes from 6-7pm in Mar-Sep and Oct	As above
FP: ES 27 25	Green	Up to 23 minutes from 6-7pm in Mar-Sep and Oct	As above

FP: ES 27 5	Green	Up to 4 minutes from 6-7pm in Mar-Sep and Oct	As above

Figure 8-2 - time/duration of glint and glare subject to OP's and RR's with suggested mitigation measures

Receptor	Glint/glare summary	Time/maximum duration of daily glint/glare	Suggested mitigation measure
OP: OP 1	Yellow	Up to 20 minutes from 6-8pm in Jan-Feb and Oct-Dec	Assess the effectiveness of vegetation and consider the introduction of further vegetation/opaque screening where existing is insufficient.
OP: OP 5	Yellow	Up to 1 minute from 5.15-7.30am Jan-May and Aug-Nov	As above.
OP: OP 6	Yellow	Up to 5 minutes from 4.45-5.30am in Jan and Nov-Dec	As above.
OP: OP 7	Yellow	Up to 10 minutes from 4.45-5.45am in Jan and Nov-Dec	As above.
OP: OP 8	Yellow	Up to 12 minutes from 4.45am-5.45am in Jan and Nov-Dec	As above.
OP: OP 9	Yellow	Up to 1 minute from 4.45am-7am in Jan-Apr and Aug-Nov	As above.
OP: OP 10	Yellow	Up to 18 minutes from 4-6pm in Apr-Sep	As above.
OP: OP 11	Yellow	Up to 1 minute from 6-7.30am in Mar-may and Aug-Sep	As above.
OP: OP 12	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.
OP: OP 13	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.
OP: OP 14	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.
OP: OP 15	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.
OP: OP 16	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.

OP: OP 17	Yellow	Up to 1 minute from 6-7.30am in Mar-May and Aug-Sep	As above.
OP: OP 19	Yellow	Up to 20 minutes from 4-6pm in Apr-Sep	As above.
OP: OP 20	Yellow	Up to 18 minutes from 4-5.30pm in Apr-Aug	As above.
OP: OP 21	Yellow	Up to 15 minutes from 4-6pm in Apr-Aug	As above.
OP: OP 22	Yellow	Up to 35 minutes from 5.30-8pm in Jan-Apr and Sep-Dec	As above.
OP: OP 23	Yellow	Up to 20 minutes from 6-8pm in Jan-Mar and Sep-Dec	As above.
OP: OP 24	Yellow	Up to 15 minutes from 6.30-8pm in Jan-Feb and Nov-Dec	As above.
OP: OP 25	Yellow	Up to 17 minutes from 6.30-8pm in Jan and Nov-Dec	As above.
OP: OP 26	Yellow	Up to 42 minutes from 4.45-6am and 6-8pm in Jan-Mar and Sep-Dec	As above.
OP: OP 27	Yellow	Up to 25 minutes from 4-8pm all year	As above.
OP: 28-ATCT	Green	Up to 10 minutes from 6-7pm in Feb-Mar and Sep-Oct	Consider the use of anti-reflective coating on ATCT windows.
OP: 29-ATCT	Green	Up to 10 minutes from 6-7pm in Feb-Mar and Sep-Oct	As above.
RR 1 Hopkins Lane	Yellow	Up to 100 minutes from 3-8pm all year.	Assess the effectiveness of vegetation and consider the introduction of further vegetation/opaque screening where existing is insufficient.

9 Implementation of mitigation measures

The following sections detail the proposed mitigation measures and their likely relevant merits, drawing on information from the landscape study and visual impact assessment.

9.1 Mitigation measure details

This glint and glare assessment and the relevant mitigation measures are based on the finalised site plan (Figure 6-1). As a response to the outlined glint and glare risks, Ricardo have proposed a landscape management plan. It was identified that the area would have consisted of an open Eucalypt woodland up to 15m tall with few sparse shrubs and a species-rich grassy and herbaceous layer.

A 5-metre wide planting buffer is proposed around the site, composing of species from the Plains Grassy Woodland (EVC 55), Plains Grassy Wetland (EVC 125) and Swamp Scrub (EVC 53) classes (Gippsland Plain Bioregion). All construction/management of vegetation is within accordance of all Australian Standards, including all revisions, council requirements and industry standards.

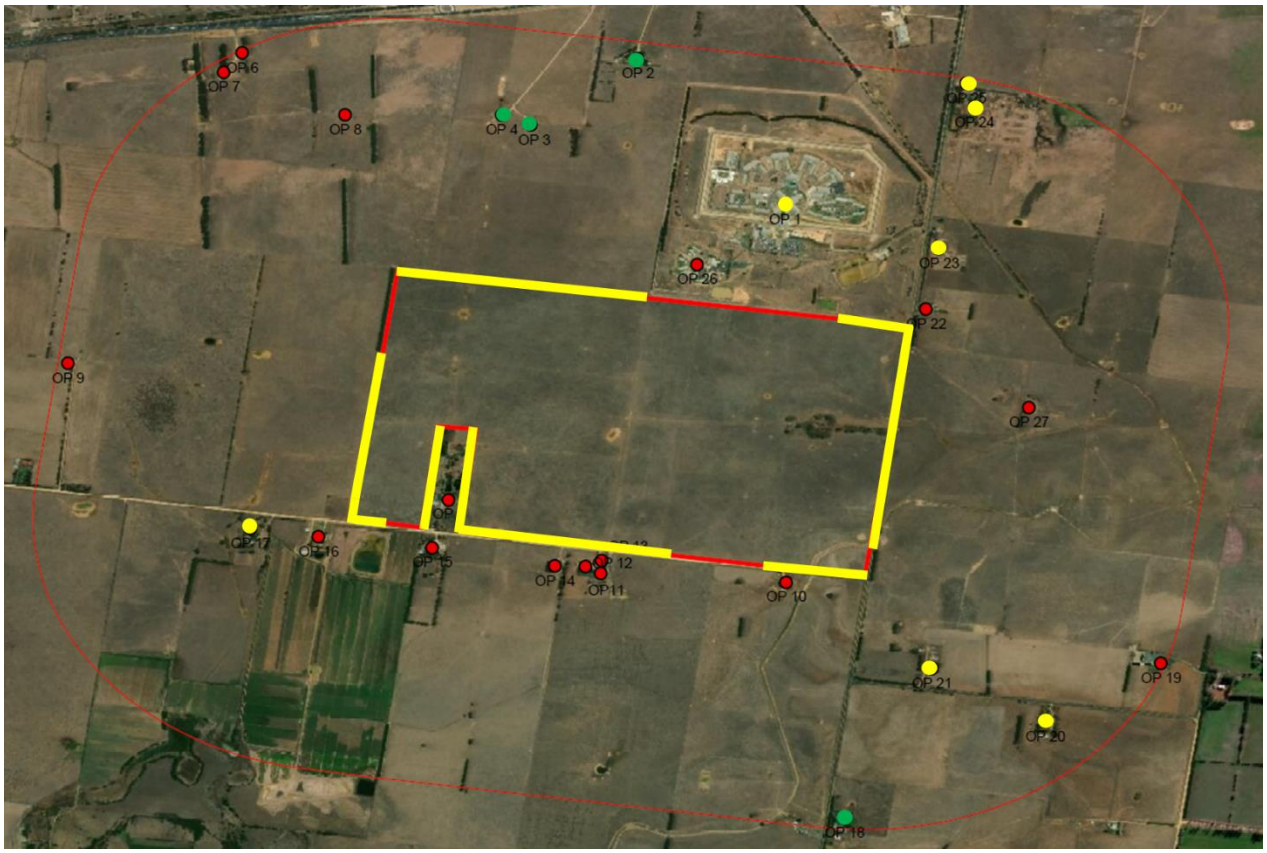
Figure 9-1 - details of planting schedule mitigation measure

GIPPSLAND PLAIN BIOREGION
SPECIES FROM PLAINS GRASSY WOODLAND (EVC 55), PLAINS GRASSY WETLAND (EVC 125) & SWAMP SCRUB (EVC 53)
BUFFER ZONE AREA: 27,441m²

CODE	BOTANIC NAME	COMMON NAME	SIZE (MATURITY)	RECOMMEND POT SIZE	% COVER	PLANTING DENSITY	QUANTITY
TREES					**N/A**		
	Acacia pycnantha	Golden Wattle	5-8 x 3.5	150mm	50%	n/a	548
	Eucalyptus kitsoniana	Gippsland Mallee	5-8 x 5	150mm	50%	n/a	548
SHRUBS					**15% (3,107m²)**		
	Kunzea ericoides	Burgan	2-5 x 2-4	Tubestock	25%	0.25 per 1m²	257
	Leptospermum lanigerum	Silky Tea-tree	3 x 2	Tubestock	75%	0.25 per 1m²	772
GRASSES					**75% (15,532m²)**		
	Lomandra filiformis	Wattle Mat-rush	1 x 1	Tubestock	33%	1 per 1m²	6,860
	Poa labillardieri	Common Tussock-grass	1 x 1	Tubestock	33%	1 per 1m²	6,860
	Themeda triandra	Kangaroo Grass	1 x 1	Tubestock	33%	1 per 1m²	6,860
GROUNDCOVERS					**10% (2,071m²)**		
	Dichondra repens	Kidney Weed	prostrate	Tubestock	50%	4 per 1m²	5,488
	Microlaena stipoides var. stipoides	Weeping Grass	0.1 x prostrate	Tubestock	50%	4 per 1m²	5,488

The landscape management plan indicates that the security fencing around the perimeter of the site has a total height of 2.15m when including the barbed wire portion at the top. It is recommended that the lower portion of this fencing (which stands at a height of 1.8m) implements opaque screening to mitigate against glint and glare until the planting buffer grows to this height. It is recommended that the screening is implemented around the entire perimeter of the site, although this could be a costly measure. At a minimum, the screening should be constructed in areas where receptors are subject to glare (see Figure 9-2).

Figure 9-2 - Site layout boundary with receptors and proposed opaque fencing areas (yellow lines)



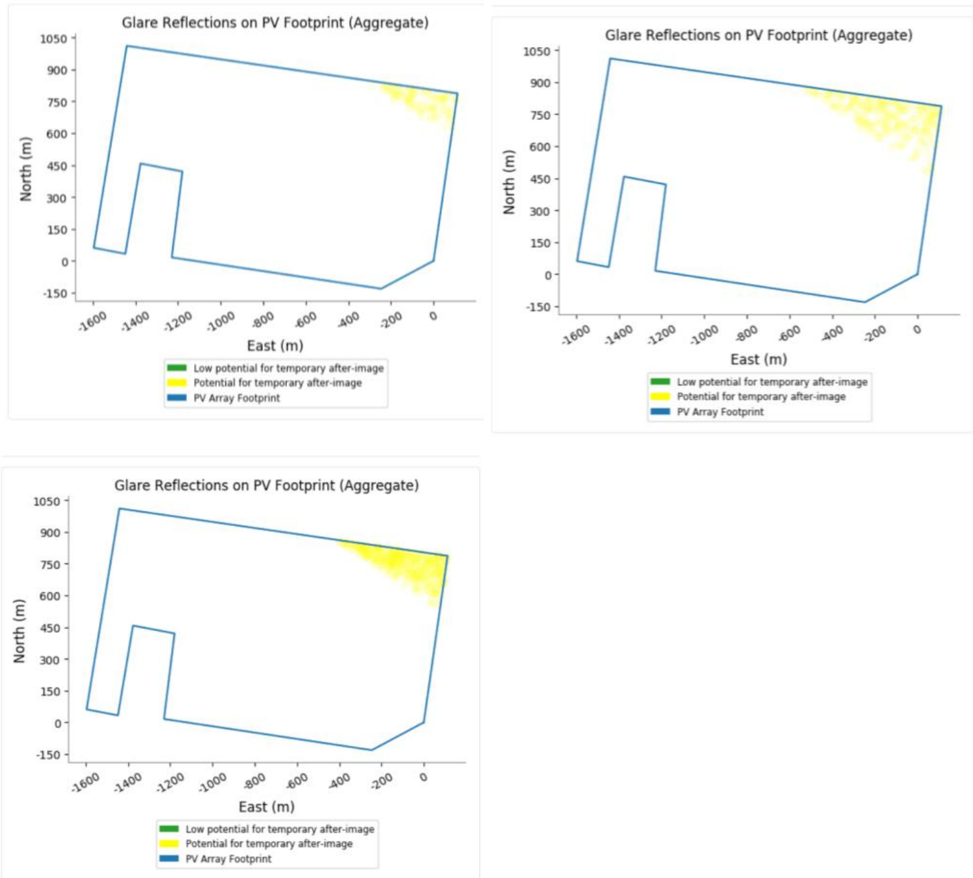
9.2 Assessment of mitigation measures

It can be determined that the proposed mitigation of a 5-metre landscaping buffer and the possible inclusion of opaque screening incorporated within the security fencing around the entire site where current/planned vegetation is not present is sufficient to mitigate against glint and glare for all receptors except for flight paths at East and West Sale Airbases. These may require their own mitigation strategy as presented in Table 7-1. Below presents analysis for receptors that are subject to glint and glare and don't likely have their own existing mitigation strategy (i.e., red receptors).

OP's 6, 7 and 8 lie to the north-west of the array. They are subject to glare however, this only emanates from the north eastern corner of the proposed development. As a result, it is likely that Fulham Correctional Centre mitigates against most of, if not, all of the glare impact for OP's 6-8. Further, there are already vegetation windbreak layers surrounding some portions of OP's 6-8 that could mitigate against glare/ As a conservative estimate, it is suggested that screening could be required along the northern perimeter from the western corner until the northern perimeter is perpendicular to the Correction Facility boundary.

Figure 9-3: OP's 6-8 north-west of the array with proposed screening (yellow)

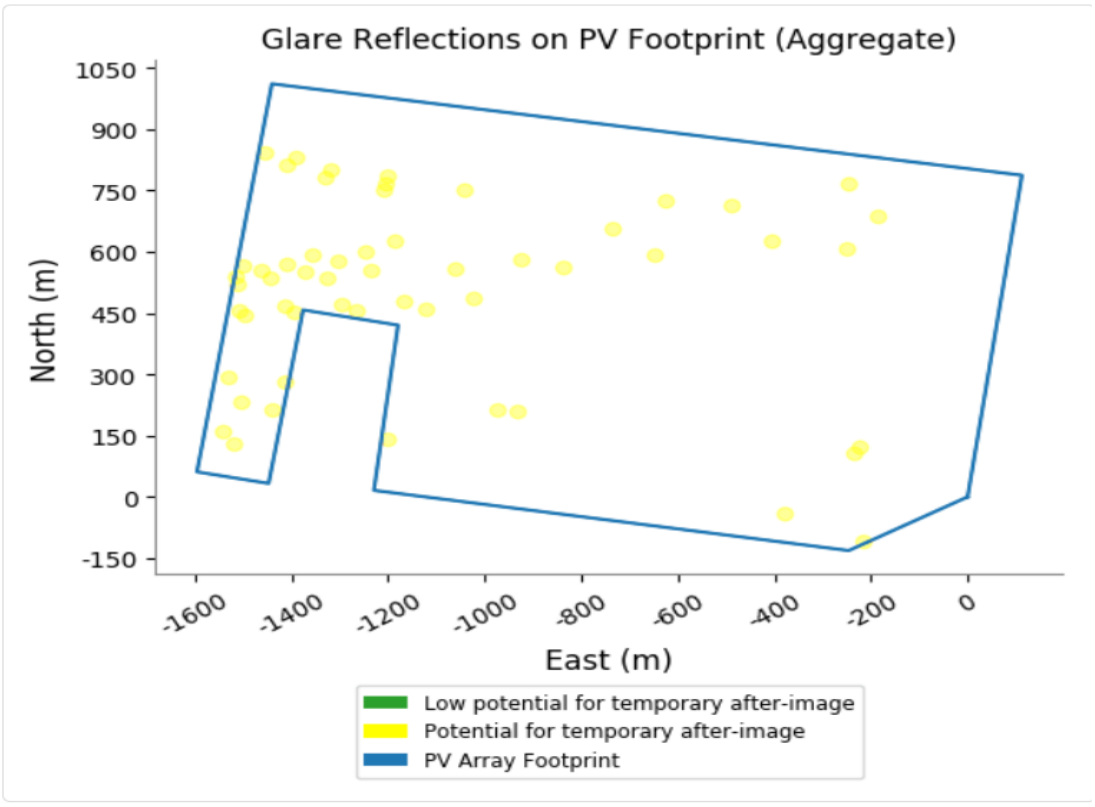
Figure 9-4: Glare emanations for OP's 6, 7 and 8 (clockwise from top left)



OP 9 is situated to the west of the array, almost 1km from the western perimeter. Glare emanates from across the array, from both a north/south and east/west perspective. As a result, it is suggested that screening is developed across a majority of the western perimeter of the array, from the south west corner running northwards until the existing vegetation buffer is present. This will then negate all glint and glare impacts for this receptor.

Figure 9-5: OP 9 west of the proposed development with suggested screening (yellow)

Figure 9-6: Glare emanations for OP 9

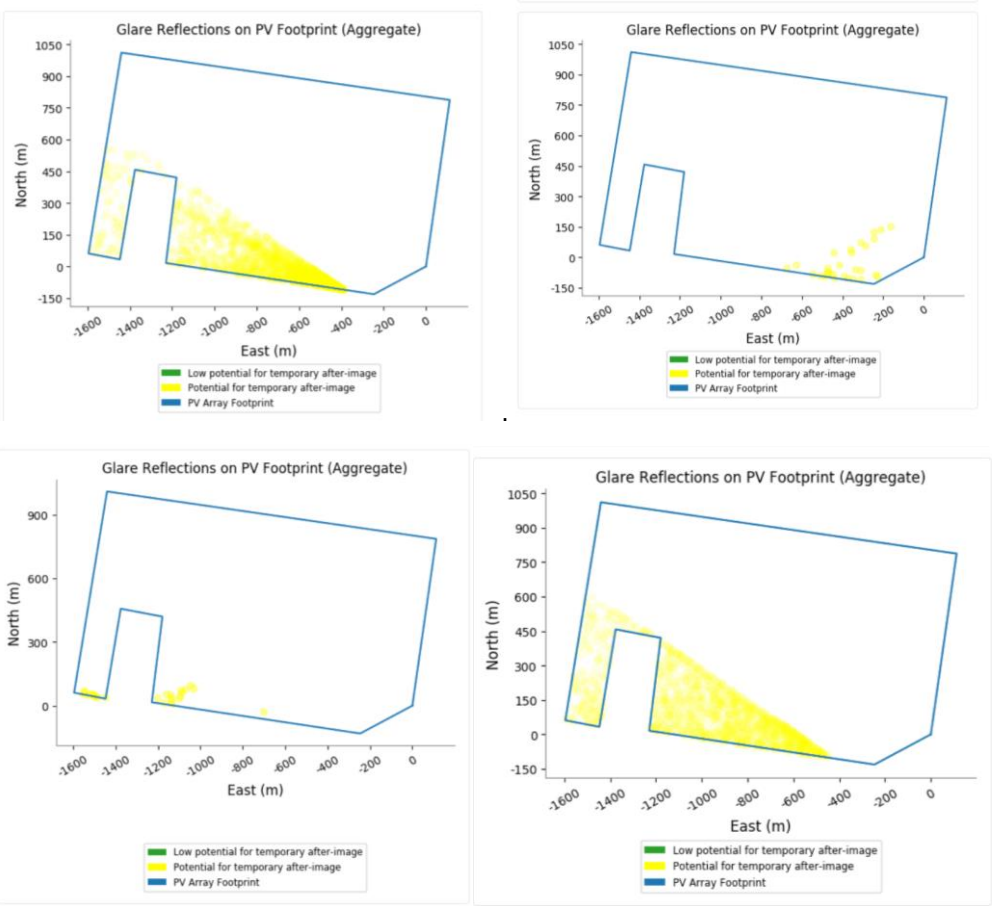


OP's 10-15 lie immediately to the south of the proposed development, whilst OP's 16, 17 and 21 lie to the south east/west.

Figure 9-7: OP's 10-17 & 21 south of the proposed development with suggested screening (yellow)

Glare emanates predominantly from the southern portions of the array in the opposing direction for each of the receptors (i.e. a southern receptor to the east will experience glare from the south-west portion of the array). The proposed screening boundary covers the perimeter of the proposed development in line with where glare emanates from for these receptors.

Figure 9-8: Glare emanations for OP's 10, 11, 16 and 21 (clockwise from top left)

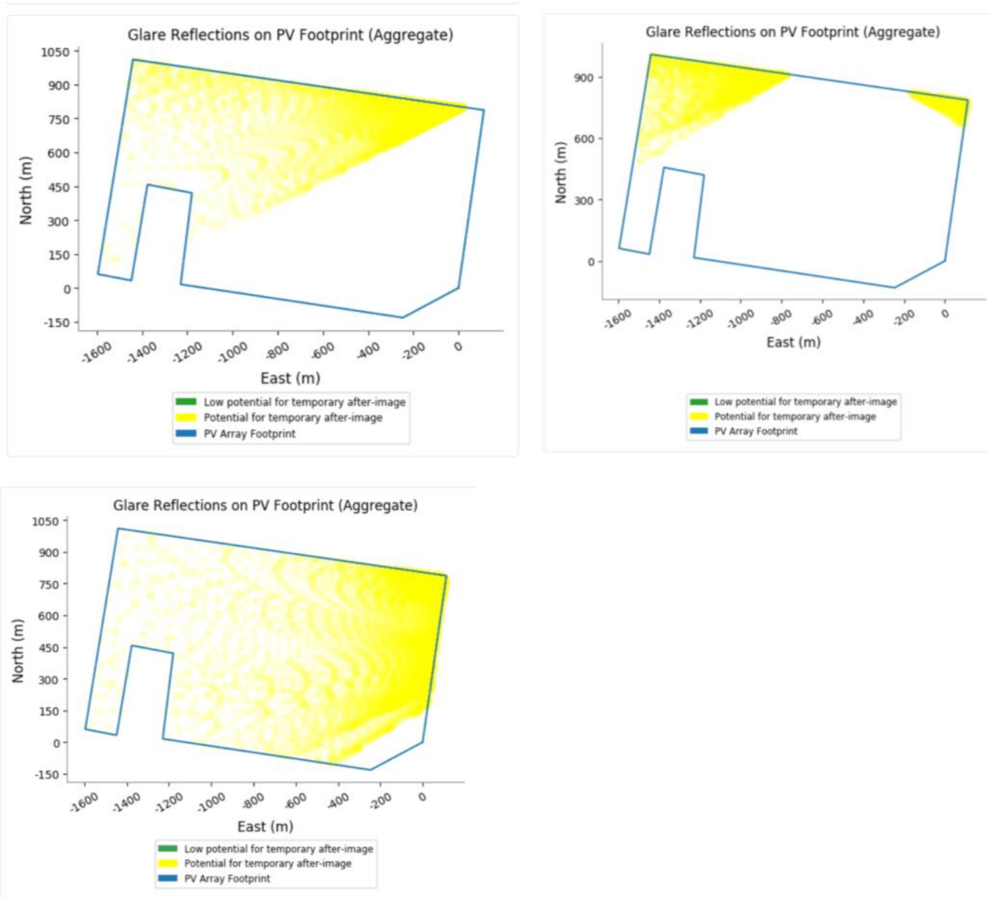


OP's 22, 26 and 27 lie to the north, north-east and east of the PV array respectively. For OP 22, glare emanates from most of the norther half of the array, although this receptor is situated at the north-eastern corner. Due to the presence of the Correctional Facility boundary, it is likely that only a small

proportion of the north-eastern perimeter will require screening. OP 26 is subject to glare emanating from the north-east/west tips of the array. Screening is already present in these areas for OP 6-8 and 22 mitigation purposes. OP 27 is subject to glint and glare from most of the array apart from the south-east portion. As it lies to the east, it is suggested that screening is utilised in areas along the eastern perimeter where vegetation is not present.

Figure 9-9: OP's 22, 26 and 27 with suggested screening (yellow)

Figure 9-10: Glare emanations for OP's 22, 26 and 27 (clockwise from top left)



Along with the proposed landscape buffer and temporary screening, the PV modules implement the use of anti-reflective coating (ARC), like the technology used for items such as cameras. The CASA (Civil Aviation Safety Authority) and West Sale airbase have also been contacted regarding the project and have raised no issues with the proposed development.

10 Conclusions

A glint and glare assessment for the proposed Fulham Solar Farm has been completed, which has been detailed throughout this report. A total of 33 receptors (OP's and RR's) were identified, along with a further 28 flight path permutations. The resulted in a total of 61 receptors that were assessed.

The assessment used the GlareGauge software (by Forgesolar) to identify the impacts on the identified receptors, looking at the duration, intensity, and time of occurrence of glint and glare. The GlareGauge tool has some limitations as identified in section 4.3, such as overestimating impacts due to not considering any topographical features that may reduce or negate glint and glare such as vegetation and buildings. As a result, this analysis likely overestimates the impacts of glint and glare. The model can conduct a simple backtracking method to consider the role of the single-axis tracker used by the solar system. The model therefore assumes the panels return to the determined resting angle (in this case 0°).

Glint and glare is considered largely moderate in impact, with the modal intensity of glint and glare classified as 'yellow', although there are a number of receptors where the majority of the impact is considered 'green' (i.e. low). The flight paths and ATCT's at both East and West Sale are subject to glint and glare, however the anti-reflective glass used in cockpits as well as a limited viewing angle are sufficient to negate glint & glare impacts. Further, the impact of glare from a solar PV panel is similar to that from bodies of water and should therefore be considered as non-material in their impact.

In conclusion, the mitigation measures proposed that utilise current screening and propose further measures fully mitigate against the impacts of glint and glare from the development.

Appendices

A1 Screenshots of modelling map

The following section indicates the positioning of all receptors within the GlareGauge tool (OP's, RR's and FP's) in relation to the Project.

A2 Component data

The following section details the component data entries used within the GlareGauge tool. This includes receptor details such as coordinates, elevation, height from ground etc

Name: PV1
Axis tracking: Single-axis rotation
Tracking axis orientation: 8.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 52.0 deg
Resting angle: 0.0 deg
Footprint area: 1,408,242 m^2
Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-38.119525	146.973143	9.00	1.00	10.00
2	-38.120709	146.970336	10.00	1.00	11.00
3	-38.119383	146.959122	13.00	1.00	14.00
4	-38.115740	146.959692	15.00	1.00	16.00
5	-38.115405	146.957450	16.00	1.00	17.00
6	-38.119230	146.956636	16.00	1.00	17.00
7	-38.118975	146.954944	16.00	1.00	17.00
8	-38.110420	146.956714	19.00	1.00	20.00
9	-38.112435	146.974426	14.00	1.00	15.00

2-Mile Flight Path Receptor(s)

Name: ES 04 10
Description:
Threshold height : 15 m
Direction: 56.9 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.105577	147.138093	7.00	15.24	22.24
2-mile point	-38.121366	147.107277	8.63	581.15	589.78

Name: ES 04 15
Description:
Threshold height : 15 m
Direction: 55.6 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.105769	147.138222	7.00	15.24	22.24
2-mile point	-38.122104	147.107869	8.42	876.26	884.69

Name: ES 04 20
Description:
Threshold height : 15 m
Direction: 56.6 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.105946	147.138426	7.00	15.24	22.24
2-mile point	-38.121862	147.107715	8.85	1184.90	1193.75

Name: ES 04 25
Description:
Threshold height : 15 m
Direction: 58.4 deg
Glide slope: 25.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.106132	147.138619	6.99	15.24	22.23
2-mile point	-38.121282	147.107287	8.55	1514.58	1523.13

Name: ES 04 5
Description:
Threshold height : 15 m
Direction: 55.8 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.106342	147.138823	6.83	15.24	22.07
2-mile point	-38.122593	147.108397	8.14	182.62	190.76

Name: ES 09 15
Description:
Threshold height : 15 m
Direction: 101.2 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.095607	147.128308	8.54	15.24	23.78
2-mile point	-38.089992	147.092226	10.75	875.48	886.23

Name: ES 09 20
Description:
Threshold height : 15 m
Direction: 101.0 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.095705	147.128281	8.78	15.24	24.02
2-mile point	-38.090188	147.092175	10.93	1184.60	1195.53

Name: ES 09 10
Description:
Threshold height : 15 m
Direction: 101.3 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.095502	147.128313	8.24	15.24	23.48
2-mile point	-38.089837	147.092244	10.61	580.41	591.02

Name: ES 09 25
Description:
Threshold height : 15 m
Direction: 99.2 deg
Glide slope: 25.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.095781	147.128275	9.00	15.24	24.24
2-mile point	-38.091158	147.091967	10.66	1514.48	1525.14

Name: ES 09 5
Description:
Threshold height : 15 m
Direction: 101.3 deg
Glide slope: 5.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.095857	147.128259	8.88	15.24	24.12
2-mile point	-38.090192	147.092191	10.93	294.80	305.72

Name: ES 22 10
Description:
Threshold height : 15 m
Direction: 233.9 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.092983	147.160873	5.00	15.24	20.24
2-mile point	-38.075948	147.190591	3.10	584.68	587.78

Name: ES 22 15
Description:
Threshold height : 15 m
Direction: 234.9 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.093034	147.160921	5.00	15.24	20.24
2-mile point	-38.076409	147.191013	3.35	879.34	882.69

Name: ES 22 20
Description:
Threshold height : 15 m
Direction: 234.9 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.093123	147.160991	5.00	15.24	20.24
2-mile point	-38.076498	147.191083	3.38	1188.38	1191.75

Name: ES 22 25
Description:
Threshold height : 15 m
Direction: 235.7 deg
Glide slope: 25.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.093190	147.161045	5.00	15.24	20.24
2-mile point	-38.076897	147.191429	3.50	1517.64	1521.14

Name: ES 22 5
Description:
Threshold height : 15 m
Direction: 232.6 deg
Glide slope: 5.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.093241	147.161107	5.00	15.24	20.24
2-mile point	-38.075680	147.190325	2.85	298.99	301.84

Name: ES 27 10
Description:
Threshold height : 15 m
Direction: 275.0 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.098630	147.153433	6.11	15.24	21.35
2-mile point	-38.101150	147.190077	2.27	586.62	588.89

Name: ES 27 15
Description:
Threshold height : 15 m
Direction: 274.6 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.098716	147.153423	6.20	15.24	21.44
2-mile point	-38.101035	147.190087	2.46	881.43	883.89

Name: ES 27 20
Description:
Threshold height : 15 m
Direction: 276.8 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.098788	147.153396	6.26	15.24	21.50
2-mile point	-38.102206	147.189921	2.87	1190.14	1193.01

Name: ES 27 25
Description:
Threshold height : 15 m
Direction: 278.1 deg
Glide slope: 25.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.098885	147.153396	6.36	15.24	21.60
2-mile point	-38.102949	147.189814	3.86	1518.64	1522.50

Name: ES 27 5
Description:
Threshold height : 15 m
Direction: 278.6 deg
Glide slope: 5.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.098957	147.153380	6.41	15.24	21.65
2-mile point	-38.103275	147.189750	3.47	299.78	303.25

Name: WS 09 E 10
Description:
Threshold height : 15 m
Direction: 279.5 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.092222	146.977053	23.69	15.24	38.93
2-mile point	-38.096994	147.013329	15.76	590.71	606.47

Name: WS 09 E 15
Description:
Threshold height : 15 m
Direction: 280.1 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.092315	146.976989	23.73	15.24	38.97
2-mile point	-38.097386	147.013199	15.48	885.94	901.42

Name: WS 09 E 20
Description:
Threshold height : 15 m
Direction: 280.8 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.092425	146.976978	23.99	15.24	39.23
2-mile point	-38.097843	147.013107	14.36	1196.38	1210.74

Name: WS 09 E 5
Description:
Threshold height : 15 m
Direction: 279.1 deg
Glide slope: 5.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.092497	146.976971	24.17	15.24	39.41
2-mile point	-38.097070	147.013289	15.88	305.14	321.01

Name: WS 09 W 10
Description:
Threshold height : 15 m
Direction: 101.7 deg
Glide slope: 10.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.089597	146.956748	20.72	15.24	35.96
2-mile point	-38.083734	146.920734	21.92	581.59	603.50

Name: WS 09 W 15
Description:
Threshold height : 15 m
Direction: 100.9 deg
Glide slope: 15.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.089673	146.956727	20.75	15.24	35.99
2-mile point	-38.084206	146.920612	21.55	876.89	898.44

Name: WS 09 W 20
Description:
Threshold height : 15 m
Direction: 100.6 deg
Glide slope: 20.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.089751	146.956719	20.76	15.24	36.00
2-mile point	-38.084433	146.920568	21.31	1186.20	1207.52

Name: WS 09 W 5
Description:
Threshold height : 15 m
Direction: 101.9 deg
Glide slope: 5.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-38.089808	146.956700	20.79	15.24	36.03
2-mile point	-38.083846	146.920712	21.87	295.76	317.63

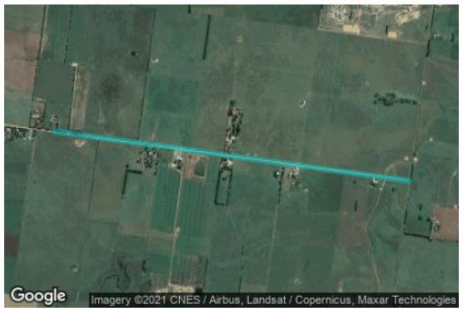
Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-38.103427	146.976212	25.01	1.50	26.51
2	-38.130077	146.971673	9.95	1.50	11.45
3	-38.130238	146.971630	10.13	1.50	11.63

Name: Route 2
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	-38.124895	146.972578	7.74	1.50	9.24
2	-38.126211	146.984995	9.28	1.50	10.78

Name: Route 3
Route type Two-way
View angle: 50.0 deg



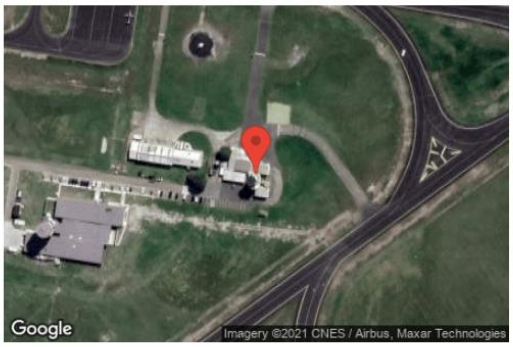
Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-38.117951	146.943022	16.51	1.50	18.01
2	-38.121257	146.973171	8.00	1.50	9.50

Route Receptor(s)

Name: Route 4
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	-38.105654	146.909557	33.10	1.50	34.60
2	-38.104239	146.923210	34.46	1.50	35.96
3	-38.103337	146.932233	32.01	1.50	33.51
4	-38.101201	146.953873	29.08	1.50	30.58
5	-38.100632	146.961773	30.38	1.50	31.88
6	-38.100344	146.967180	29.89	1.50	31.39
7	-38.099230	146.975044	32.98	1.50	34.48
8	-38.099331	146.978477	27.89	1.50	29.39
9	-38.100070	146.988809	28.72	1.50	30.22
10	-38.100948	146.999453	24.72	1.50	26.22
11	-38.101522	147.007092	23.21	1.50	24.71
12	-38.103582	147.022070	21.18	1.50	22.68
13	-38.103751	147.023185	17.96	1.50	19.46

28-ATCT map image



29-ATCT map image

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-38.107897	146.970258	19.90	4.00	23.90
OP 2	-38.102711	146.965008	27.60	4.00	31.60
OP 3	-38.105069	146.961189	28.12	4.00	32.12
OP 4	-38.104714	146.960153	28.99	4.00	32.99
OP 5	-38.118425	146.958253	15.55	4.00	19.55
OP 6	-38.102497	146.950897	31.40	4.00	35.40
OP 7	-38.103192	146.950242	31.41	4.00	35.41
OP 8	-38.104706	146.954569	30.89	4.00	34.89
OP 9	-38.113556	146.944692	18.00	4.00	22.00
OP 10	-38.121364	146.970292	10.00	4.00	14.00
OP 11	-38.121039	146.963689	12.00	4.00	16.00
OP 12	-38.120794	146.963142	12.65	4.00	16.65
OP 13	-38.120586	146.963717	12.00	4.00	16.00
OP 14	-38.120775	146.962050	14.00	4.00	18.00
OP 15	-38.120131	146.957678	16.20	4.00	20.20
OP 16	-38.119736	146.953625	16.75	4.00	20.75
OP 17	-38.119442	146.951200	15.54	4.00	19.54
OP 18	-38.129758	146.972375	9.98	4.00	13.98
OP 19	-38.124244	146.983653	8.30	4.00	12.30
OP 20	-38.126319	146.979531	9.50	4.00	13.50
OP 21	-38.124436	146.975489	11.06	4.00	15.06
OP 22	-38.111625	146.975275	16.98	4.00	20.98
OP 23	-38.109472	146.975736	17.06	4.00	21.06
OP 24	-38.104442	146.977003	23.25	4.00	27.25
OP 25	-38.103586	146.976714	25.03	4.00	29.03
OP 26	-38.110042	146.967115	17.23	4.00	21.23
OP 27	-38.115138	146.978951	14.12	4.00	18.12
28-ATCT	-38.100238	147.142419	7.68	18.00	25.68
29-ATCT	-38.100576	147.140473	6.17	30.00	36.17

A3 Details of results

The following section details the results of the assessment on all receptors included within the simulation. This includes the duration, intensity and times of the year that glint & glare occurs as well as the direction/areas of the PV array that this emanates from.

Summary of PV Glare Analysis PV configuration and predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV1	SA tracking	SA tracking	388	71,671	-	-

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV1	SA tracking	SA tracking	3,991	0	-	-

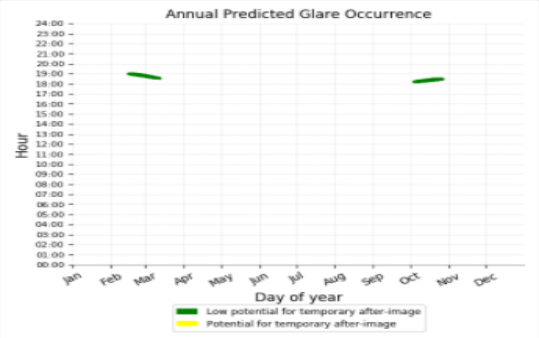
Component	Green glare (min)	Yellow glare (min)
FP: ES 04 10	0	0
FP: ES 04 15	0	0
FP: ES 04 20	0	0
FP: ES 04 25	0	0
FP: ES 04 5	0	0
FP: ES 09 10	0	0
FP: ES 09 15	0	0
FP: ES 09 20	0	0
FP: ES 09 25	0	0
FP: ES 09 5	0	0
FP: ES 22 10	237	0
FP: ES 22 15	396	0
FP: ES 22 20	575	0
FP: ES 22 25	751	0
FP: ES 22 5	82	0
FP: ES 27 10	229	0
FP: ES 27 15	384	0
FP: ES 27 20	542	0
FP: ES 27 25	711	0
FP: ES 27 5	84	0
Route: Route 4	0	0

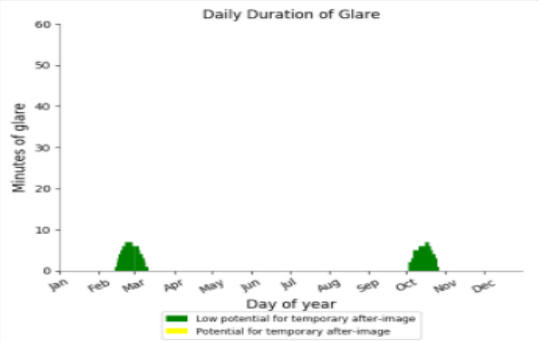
Component	Green glare (min)	Yellow glare (min)
FP: WS 09 E 10	0	2235
FP: WS 09 E 15	0	2465
FP: WS 09 E 20	74	2245
FP: WS 09 E 5	0	1547
FP: WS 09 W 10	0	0
FP: WS 09 W 15	0	0
FP: WS 09 W 20	0	0
FP: WS 09 W 5	0	0
OP: OP 1	0	1833
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	69
OP: OP 6	0	103
OP: OP 7	0	236
OP: OP 8	0	424
OP: OP 9	0	55
OP: OP 10	0	1831
OP: OP 11	0	21
OP: OP 12	0	29
OP: OP 13	0	28
OP: OP 14	0	33
OP: OP 15	0	29
OP: OP 16	0	27
OP: OP 17	0	42
OP: OP 18	0	0
OP: OP 19	0	2037
OP: OP 20	0	1131
OP: OP 21	0	1190
OP: OP 22	0	5155
OP: OP 23	0	2744
OP: OP 24	0	955
OP: OP 25	0	853
OP: OP 26	0	4003
OP: OP 27	0	7476
OP: 28-ATCT	150	0
OP: 29-ATCT	164	0
Route: Route 1	0	32875
Route: Route 2	0	0
Route: Route 3	0	0

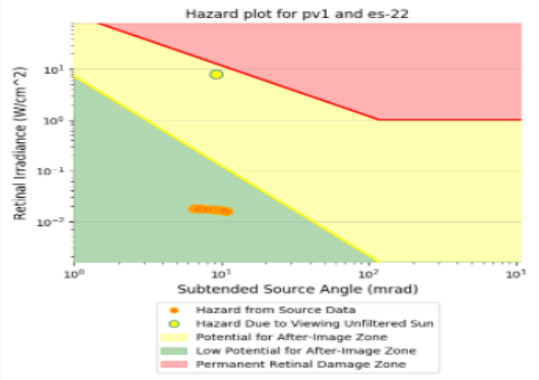
PV1 - Receptor (ES 22 10)

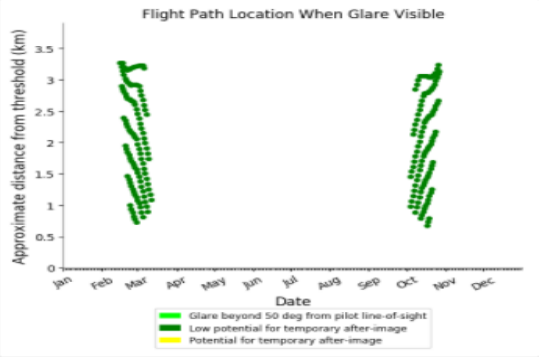
PV array is expected to produce the following glare for observers on this flight path:

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





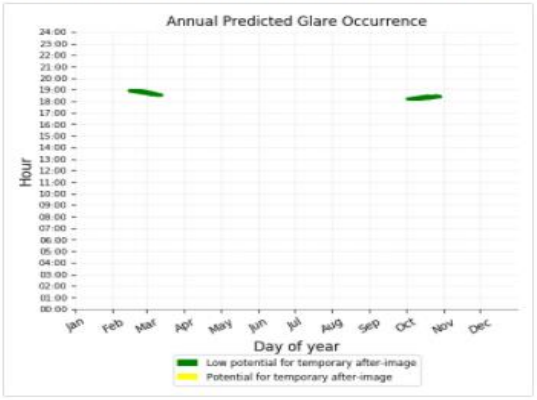


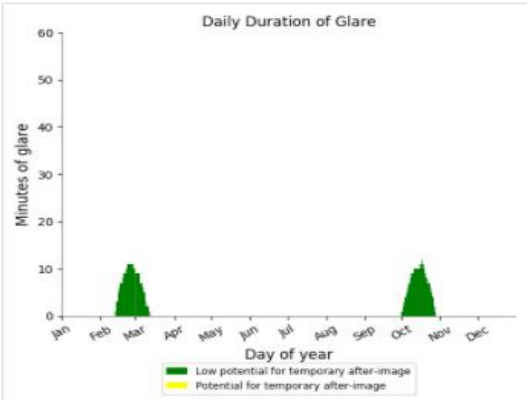


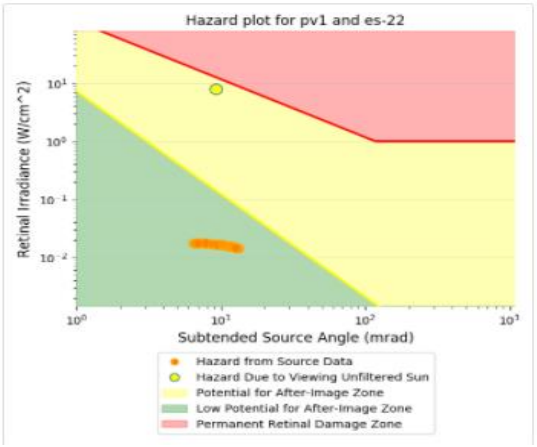
PV1 - Receptor (ES 22 15)

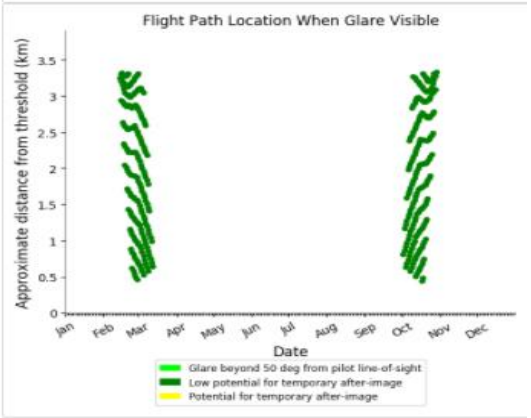
PV array is expected to produce the following glare for observers on this flight path:

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





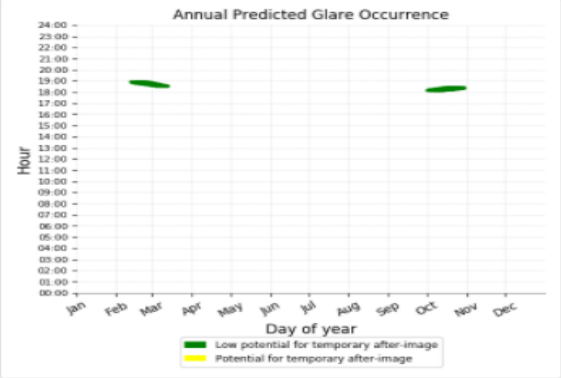


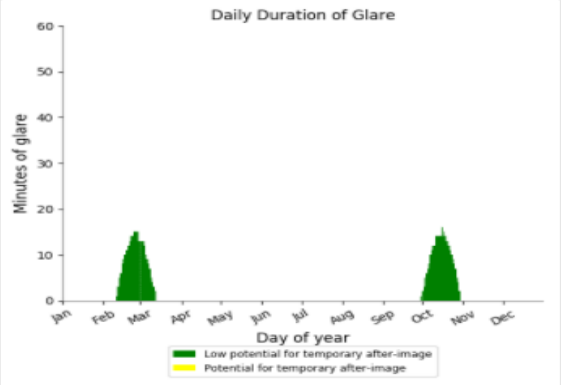


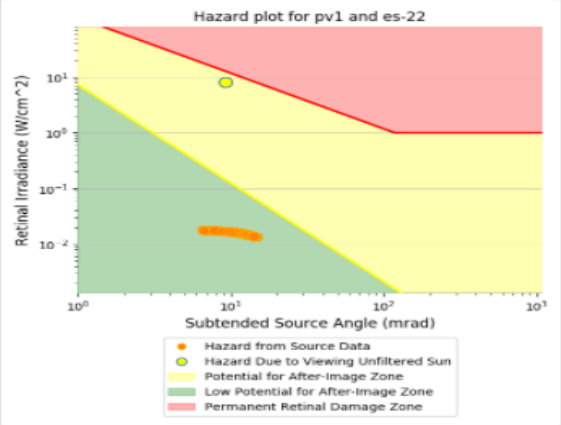
PV1 - Receptor (ES 22 20)

PV array is expected to produce the following glare for observers on this flight path:

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



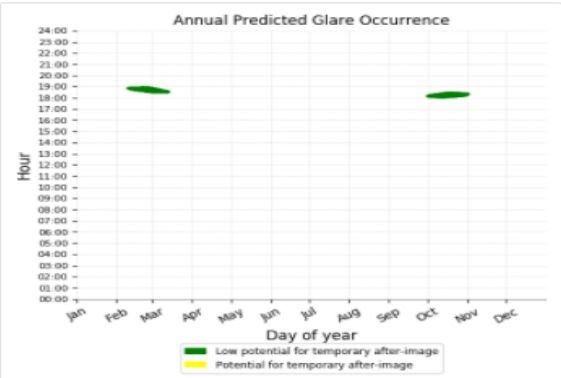


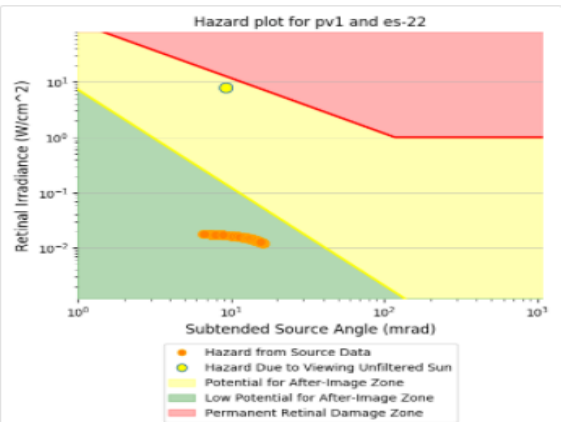


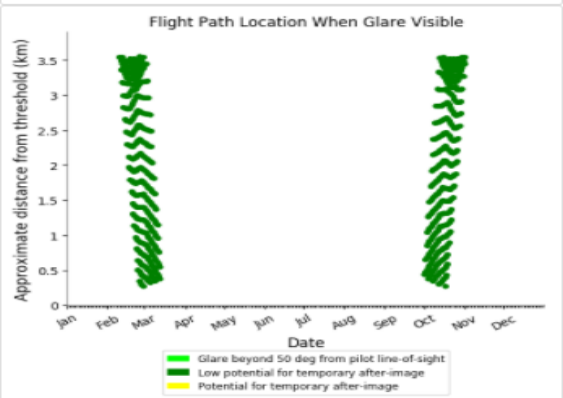
PV1 - Receptor (ES 22 25)

PV array is expected to produce the following glare for observers on this flight path:

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



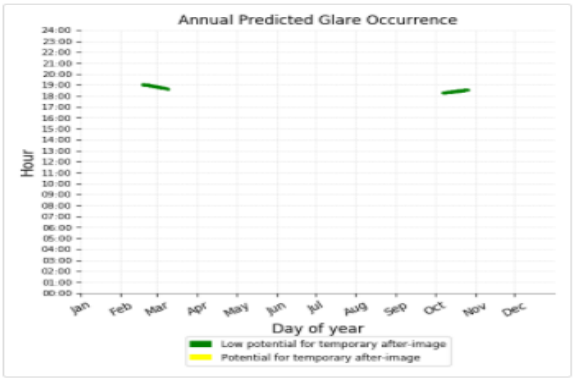


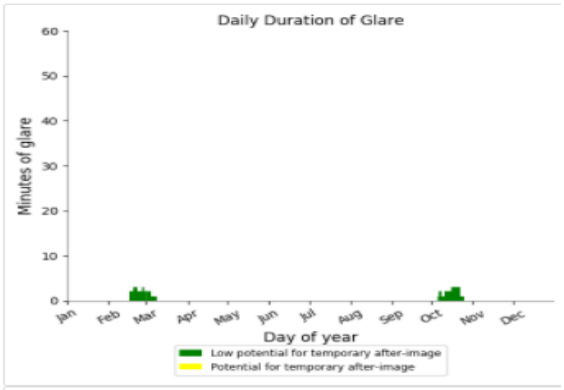


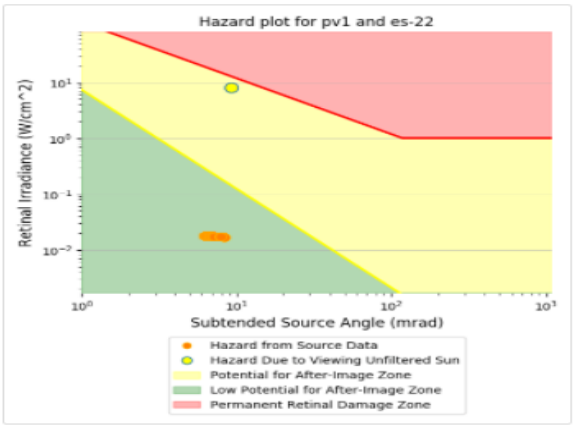
PV1 - Receptor (ES 22 5)

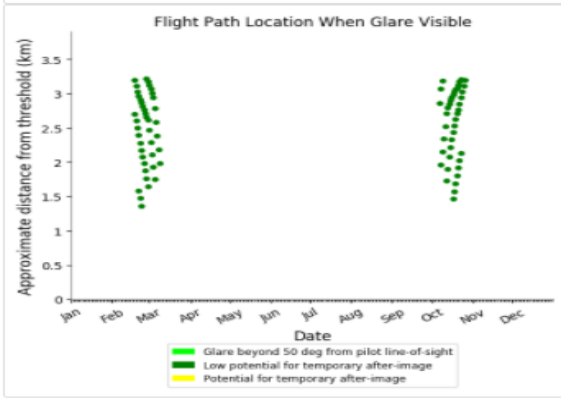
PV array is expected to produce the following glare for observers on this flight path:

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





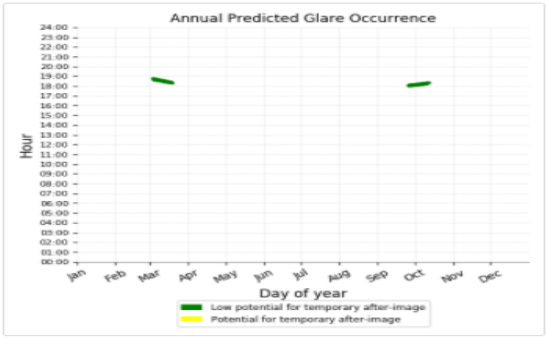


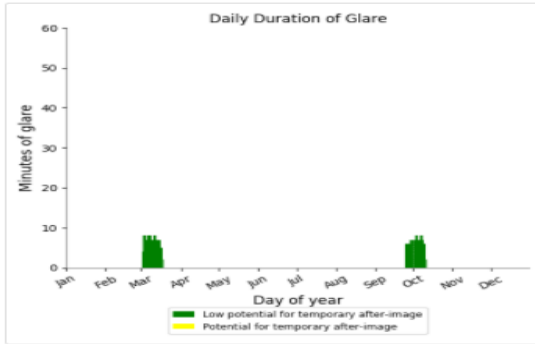


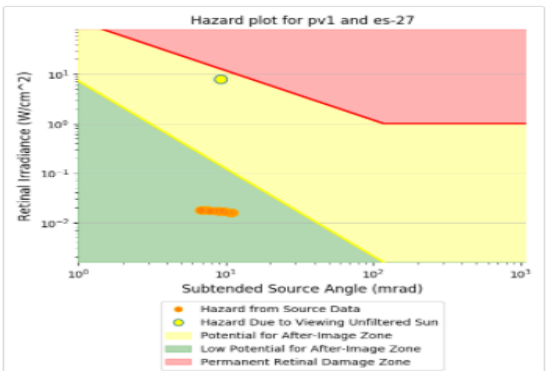
PV1 - Receptor (ES 27 10)

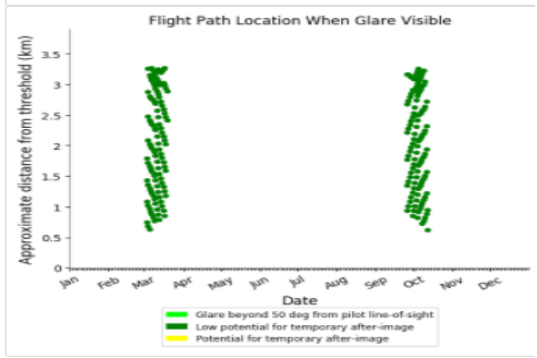
PV array is expected to produce the following glare for observers on this flight path:

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





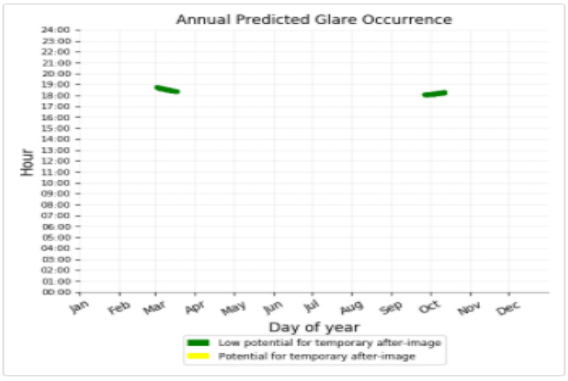


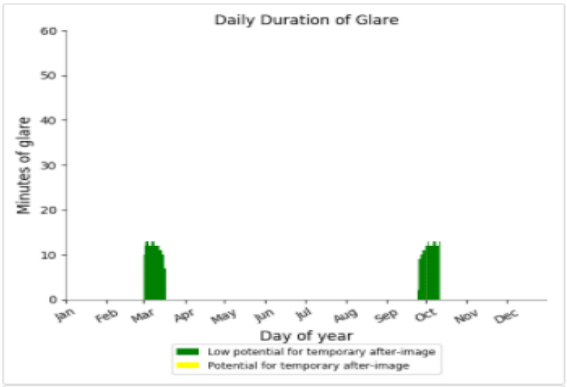


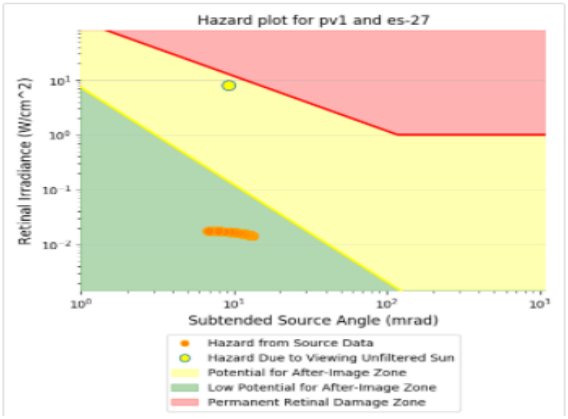
PV1 - Receptor (ES 27 15)

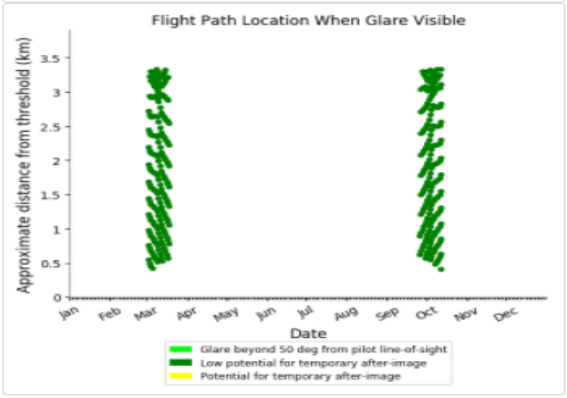
PV array is expected to produce the following glare for observers on this flight path:

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





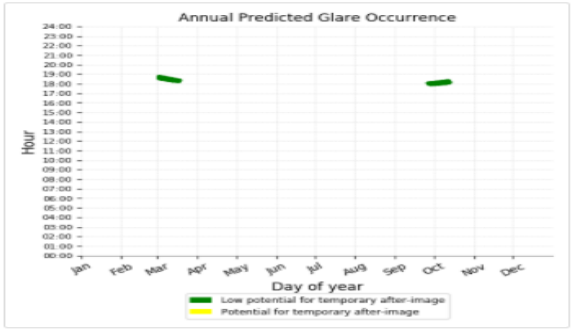


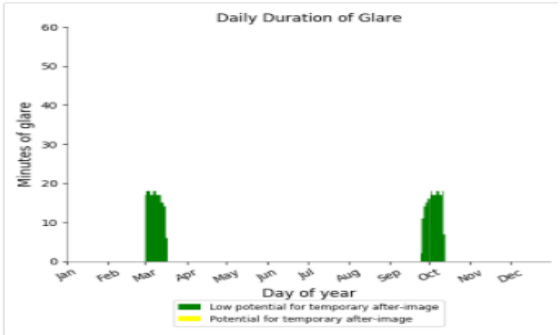


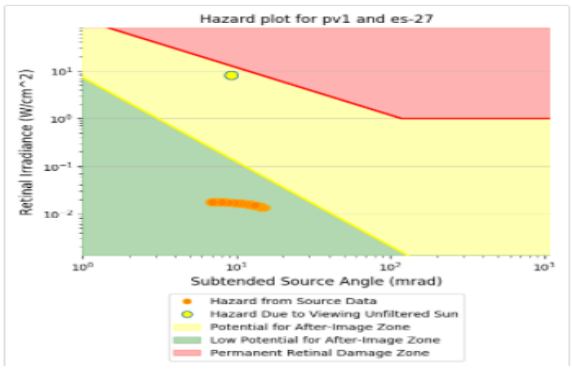
PV1 - Receptor (ES 27 20)

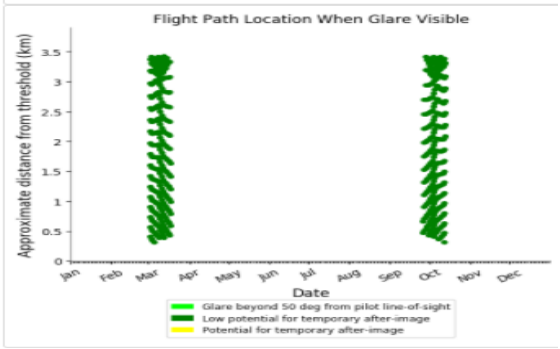
PV array is expected to produce the following glare for observers on this flight path:

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





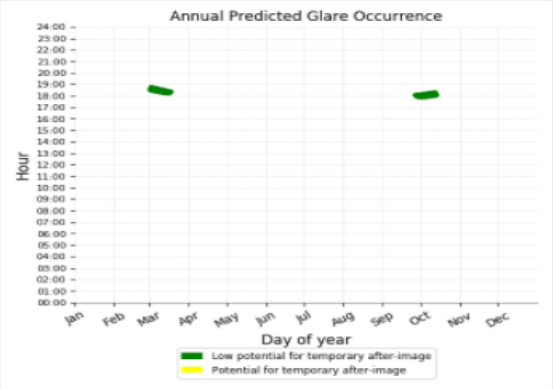


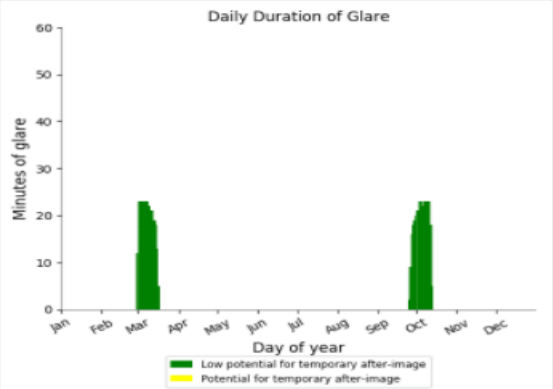


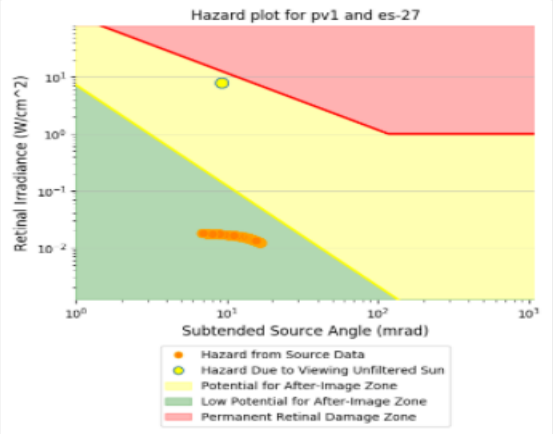
PV1 - Receptor (ES 27 25)

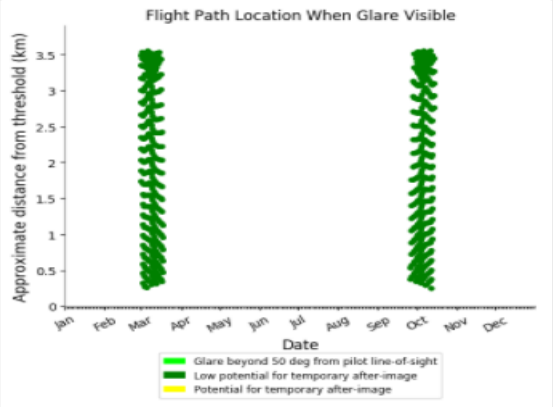
PV array is expected to produce the following glare for observers on this flight path:

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





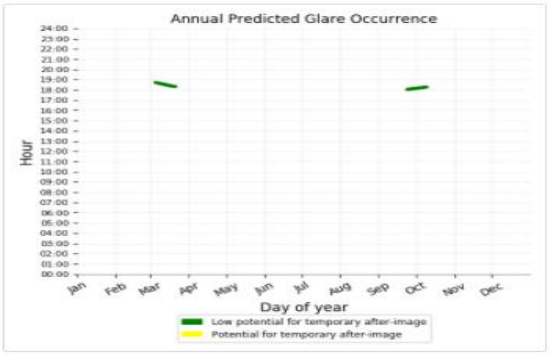


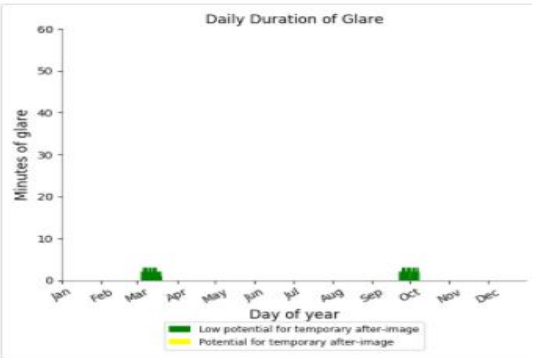


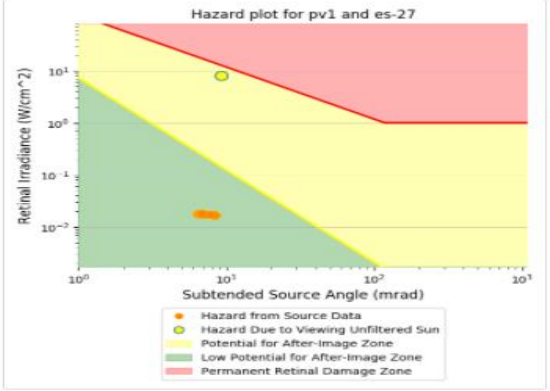
PV1 - Receptor (ES 27 5)

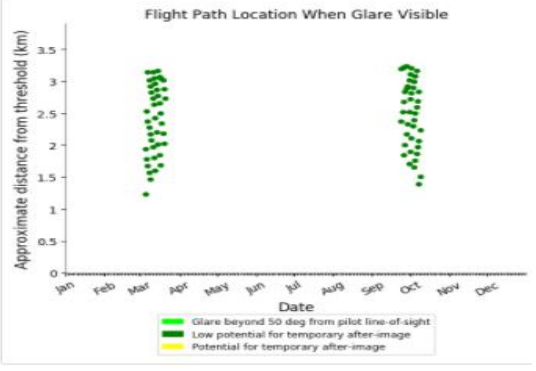
PV array is expected to produce the following glare for observers on this flight path:

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





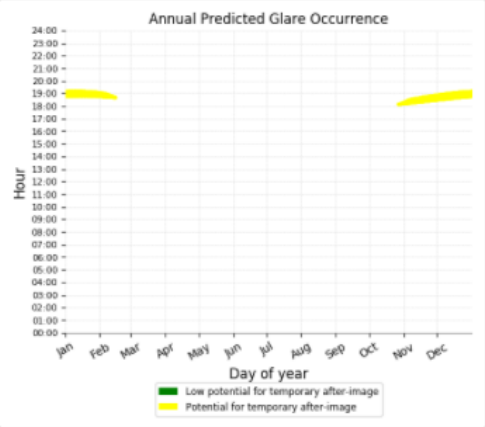


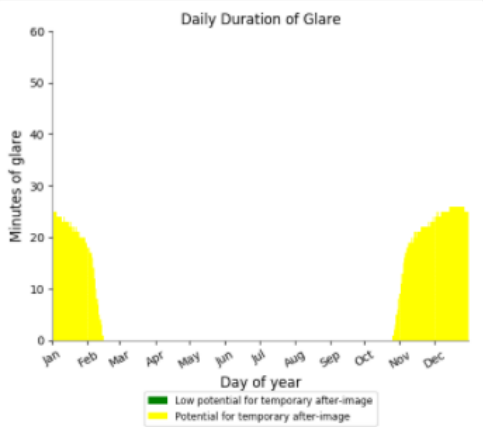


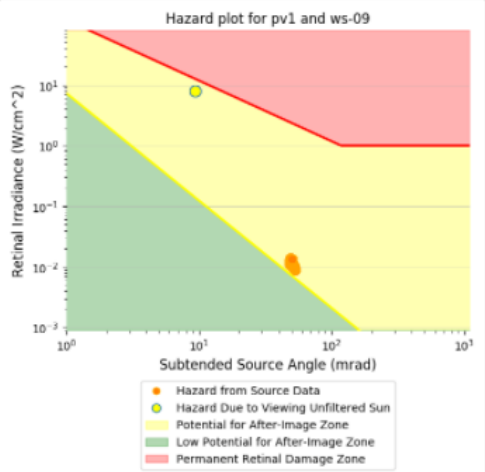
PV1 - Receptor (WS 09 E 10)

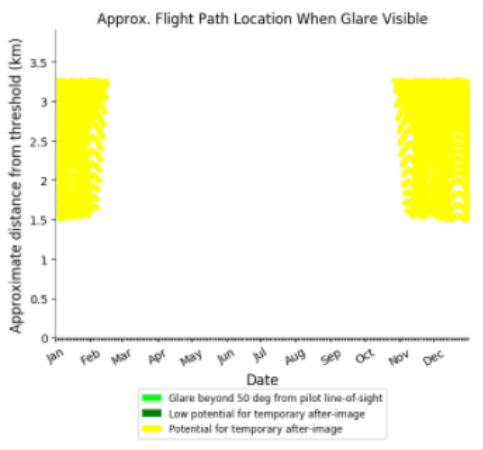
PV array is expected to produce the following glare for observers on this flight path:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,235 minutes of "yellow" glare with potential to cause temporary after-image.





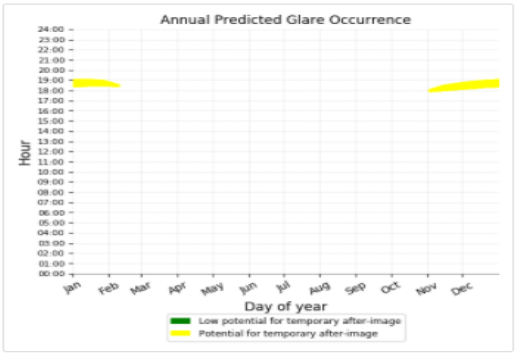


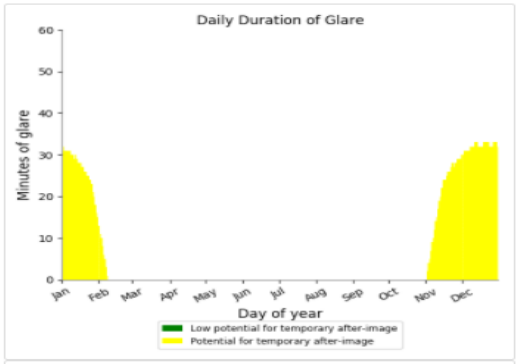


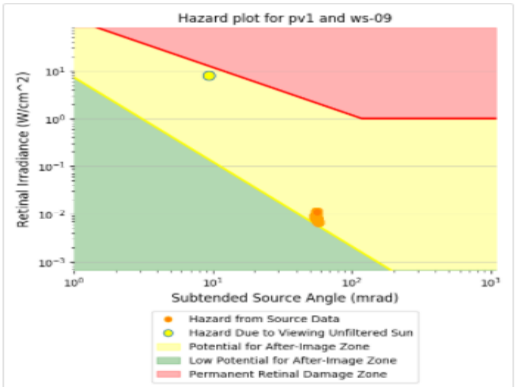
PV1 - Receptor (WS 09 E 15)

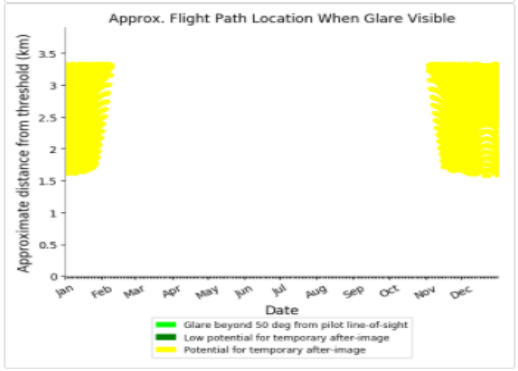
PV array is expected to produce the following glare for observers on this flight path:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,465 minutes of "yellow" glare with potential to cause temporary after-image.





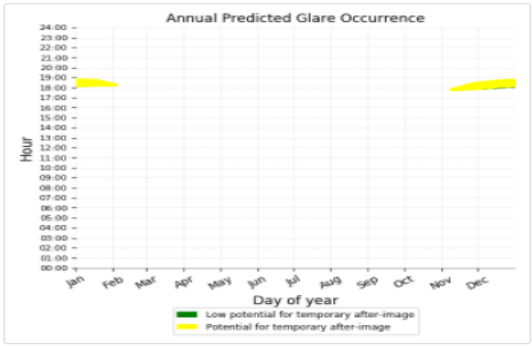


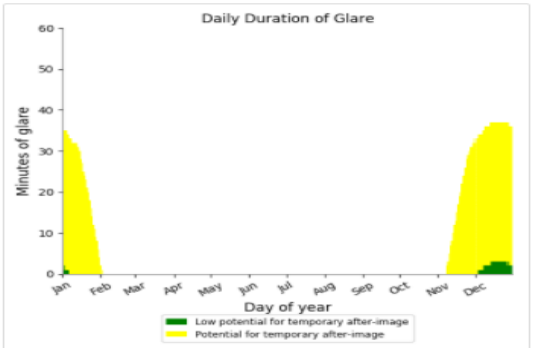


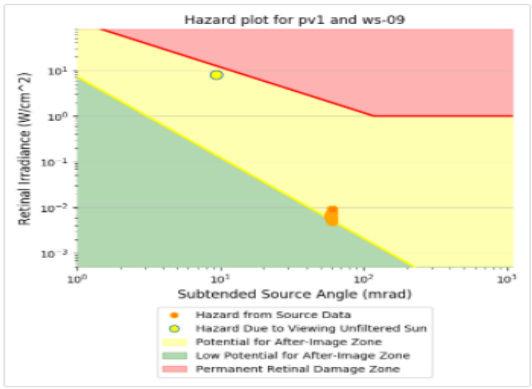
PV1 - Receptor (WS 09 E 20)

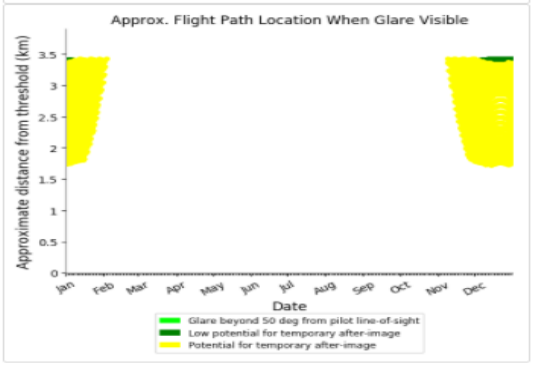
PV array is expected to produce the following glare for observers on this flight path:

- 74 minutes of "green" glare with low potential to cause temporary after-image.
- 2,245 minutes of "yellow" glare with potential to cause temporary after-image.





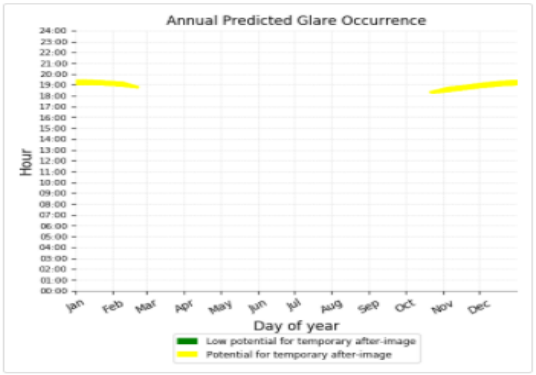


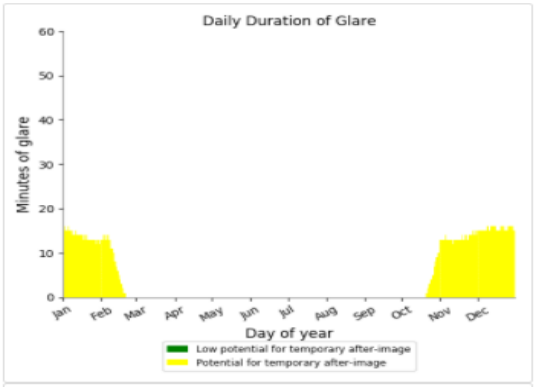


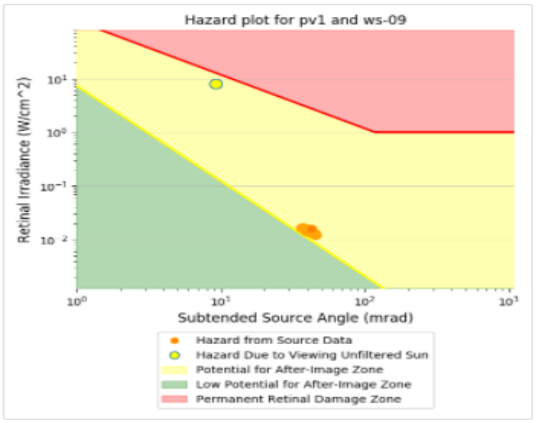
PV1 - Receptor (WS 09 E 5)

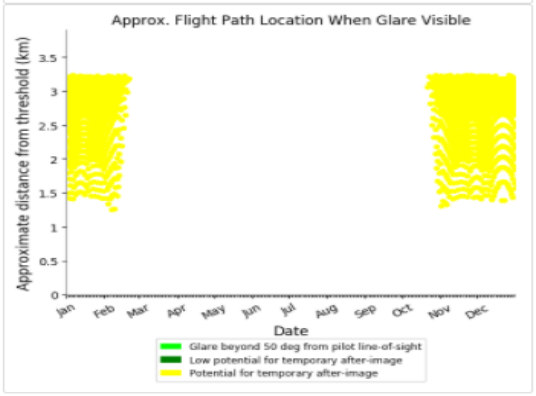
PV array is expected to produce the following glare for observers on this flight path:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,547 minutes of "yellow" glare with potential to cause temporary after-image.





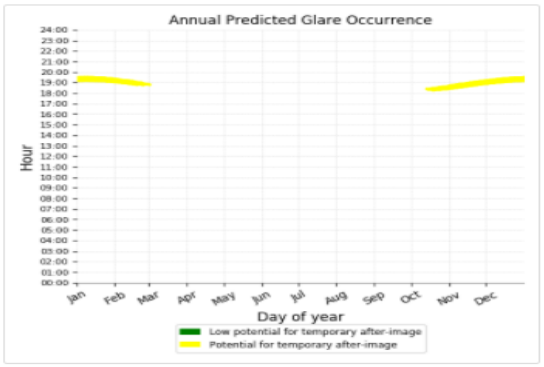


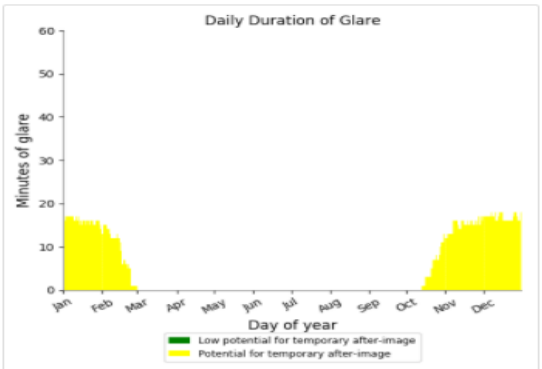


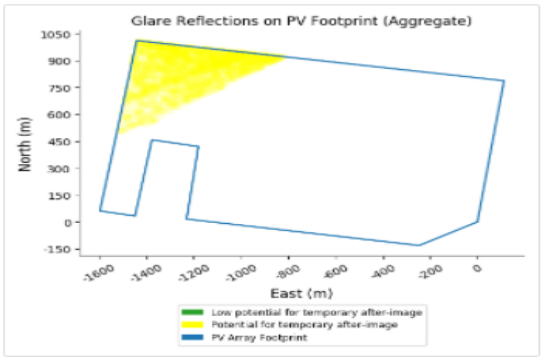
PV1 - OP Receptor (OP 1)

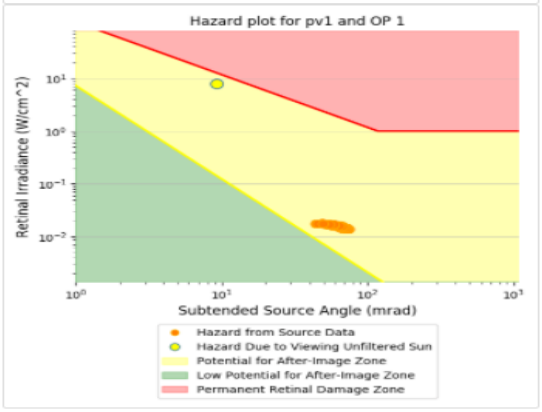
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,833 minutes of "yellow" glare with potential to cause temporary after-image.





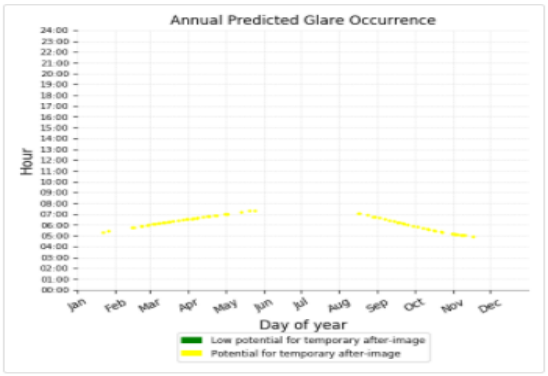


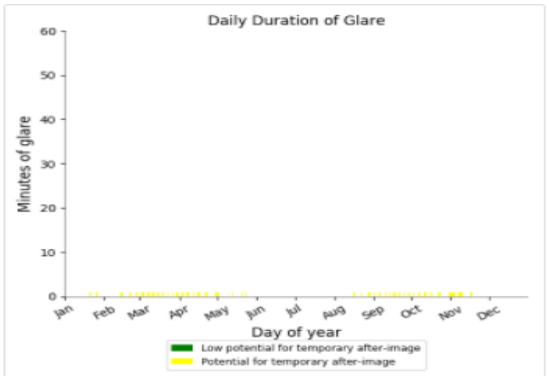


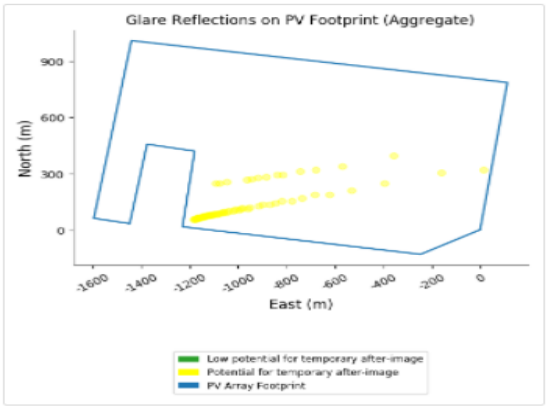
PV1 - OP Receptor (OP 5)

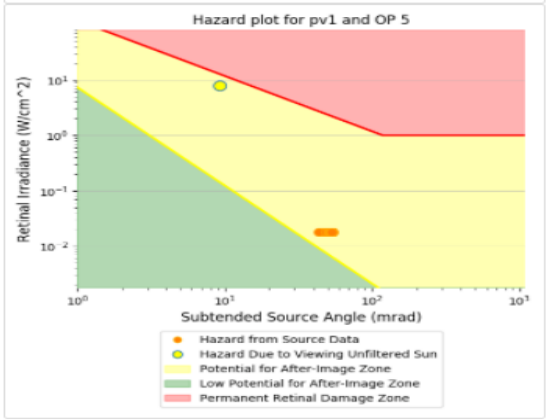
PV array is expected to produce the following glare for receptors at this location:

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





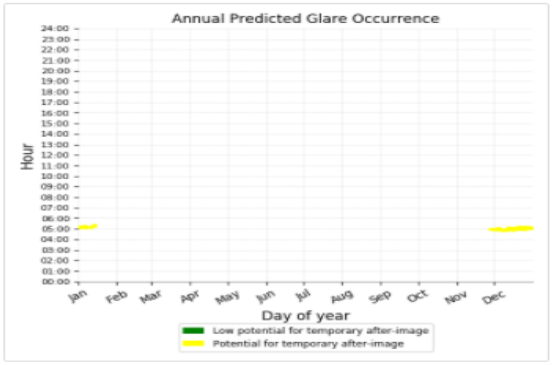


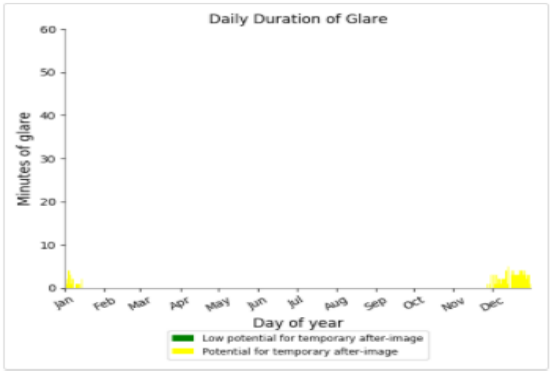


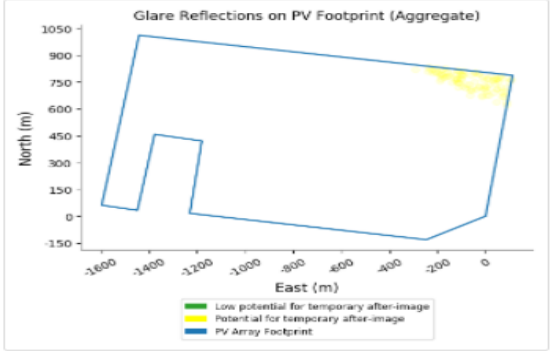
PV1 - OP Receptor (OP 6)

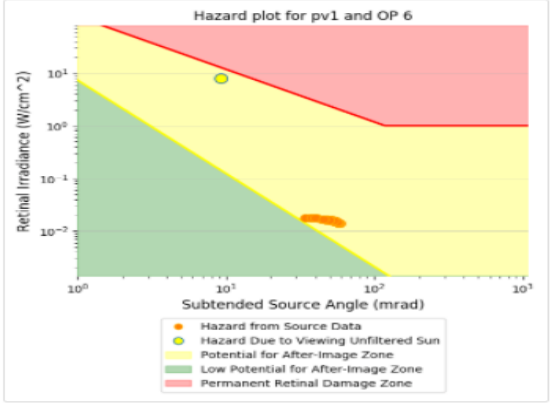
PV array is expected to produce the following glare for receptors at this location:

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





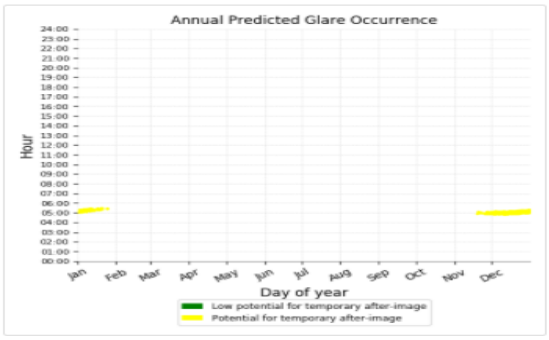


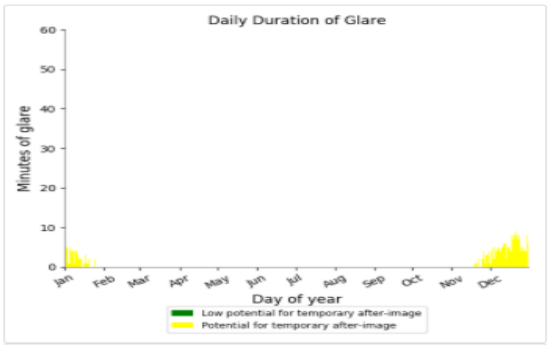


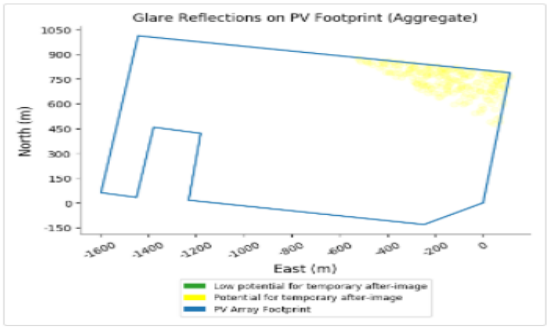
PV1 - OP Receptor (OP 7)

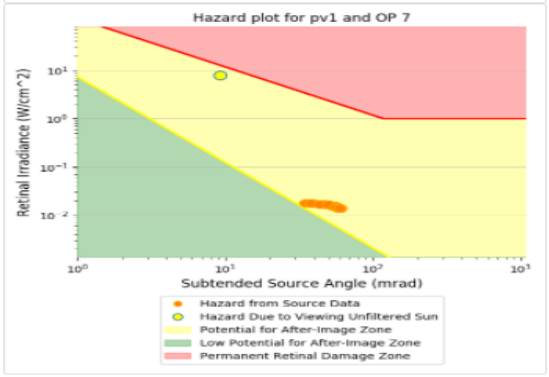
PV array is expected to produce the following glare for receptors at this location:

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





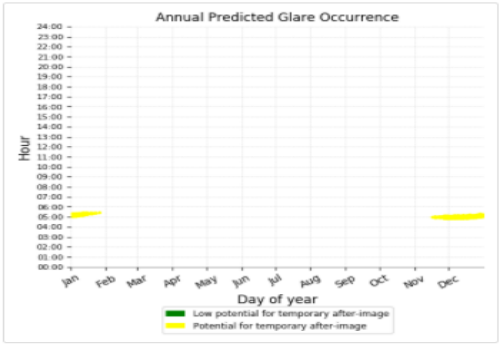


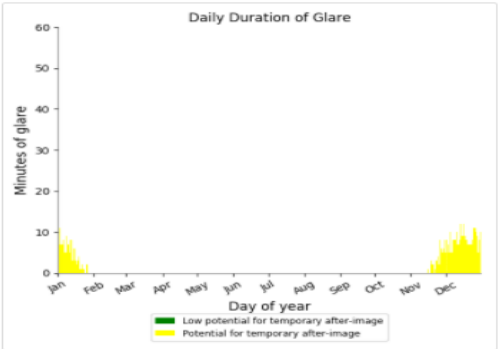


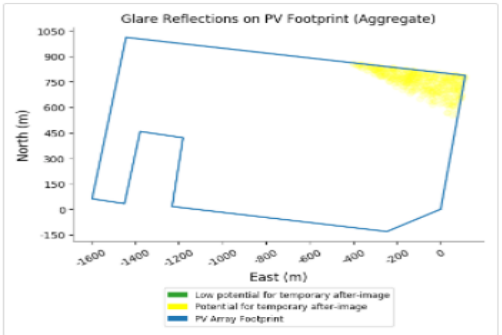
PV1 - OP Receptor (OP 8)

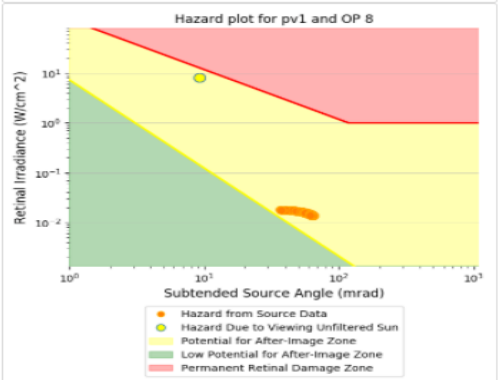
PV array is expected to produce the following glare for receptors at this location:

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





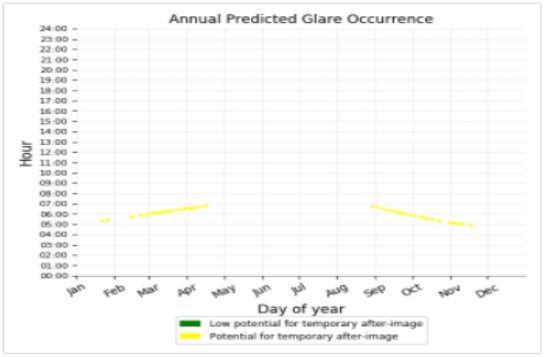


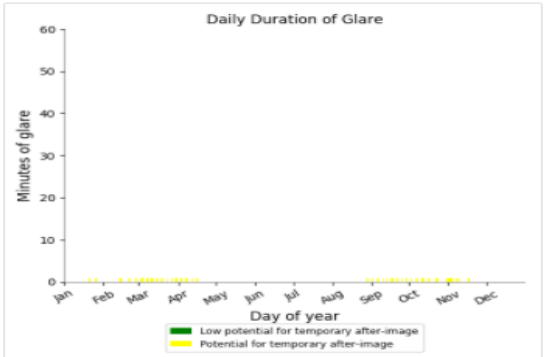


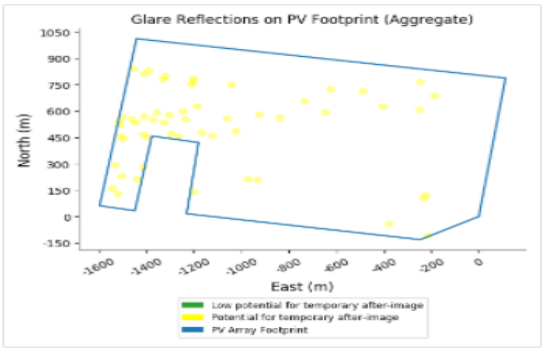
PV1 - OP Receptor (OP 9)

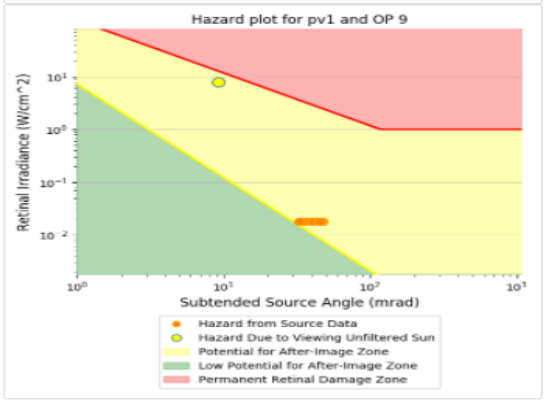
PV array is expected to produce the following glare for receptors at this location:

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





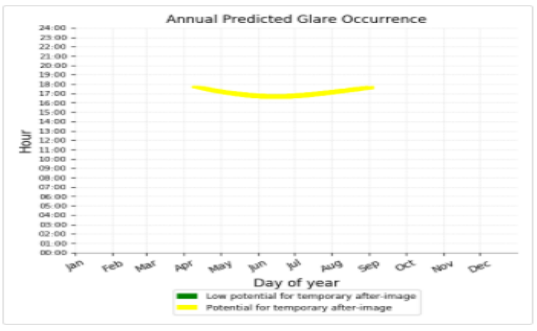


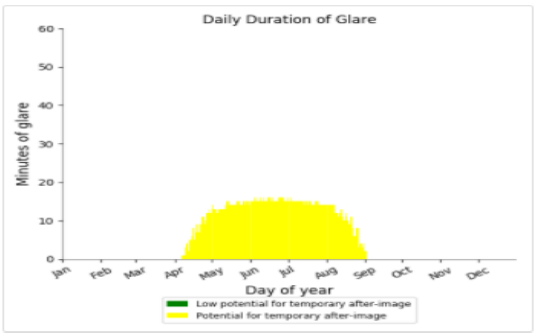


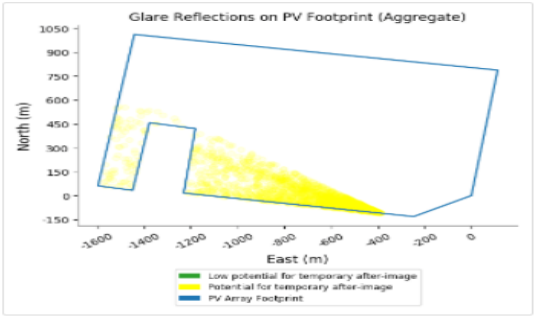
PV1 - OP Receptor (OP 10)

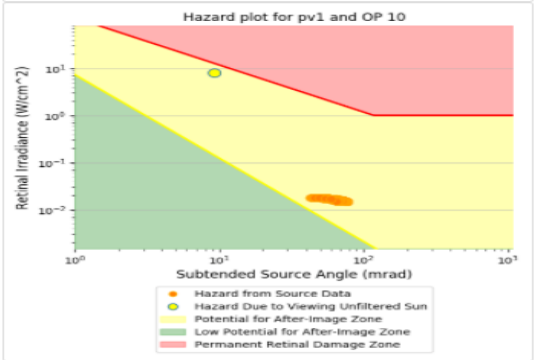
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,831 minutes of "yellow" glare with potential to cause temporary after-image.





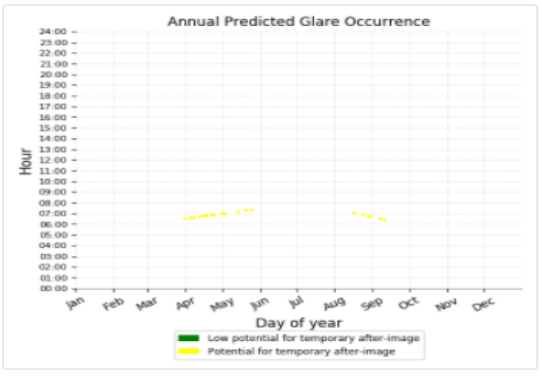


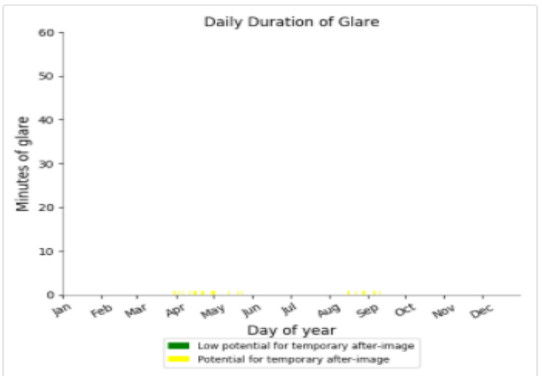


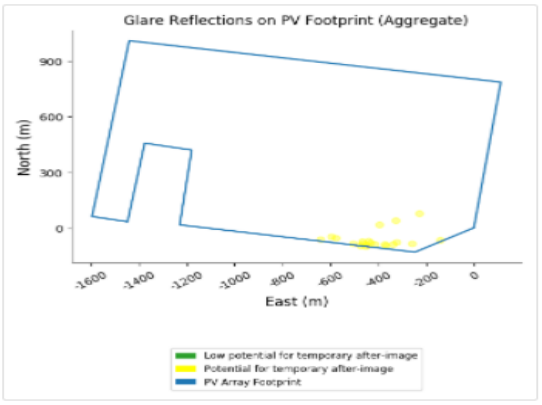
PV1 - OP Receptor (OP 11)

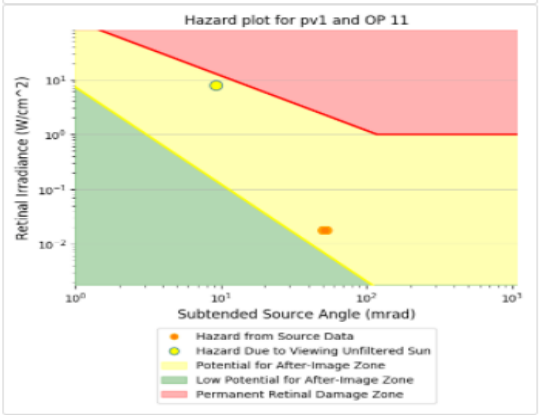
PV array is expected to produce the following glare for receptors at this location:

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





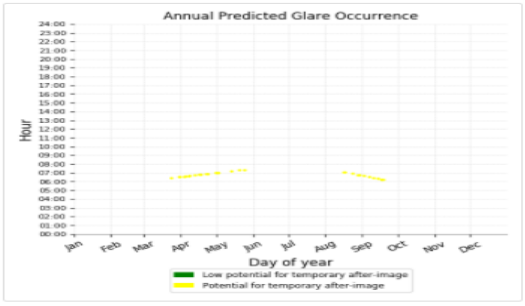


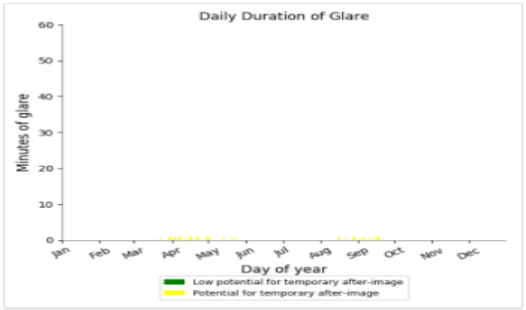


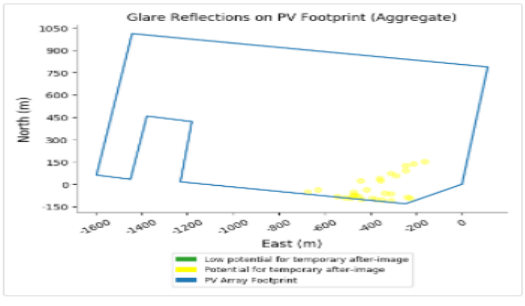
PV1 - OP Receptor (OP 12)

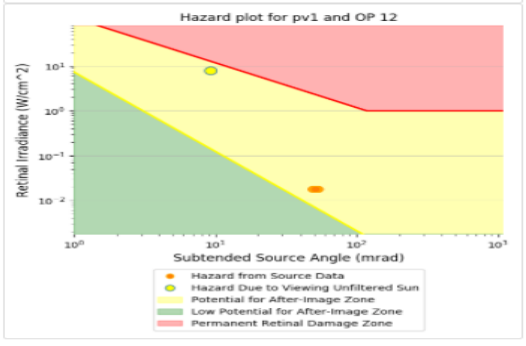
PV array is expected to produce the following glare for receptors at this location:

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





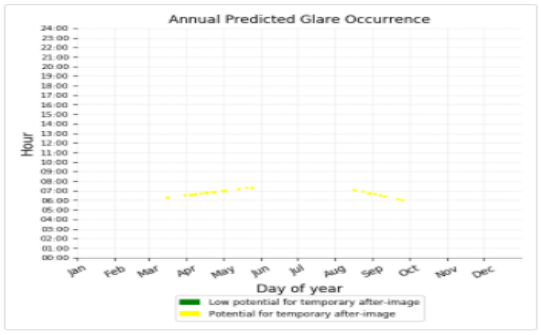


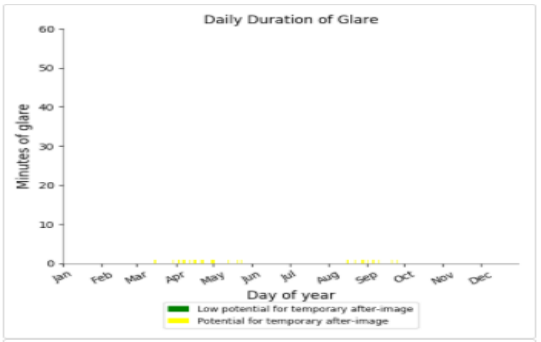


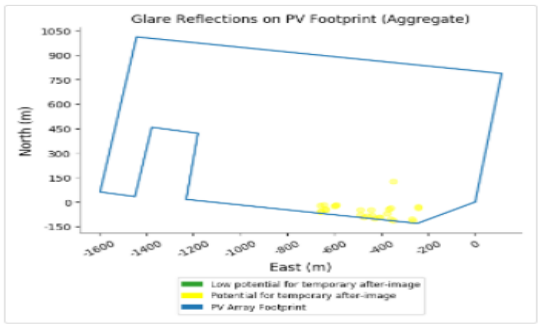
PV1 - OP Receptor (OP 13)

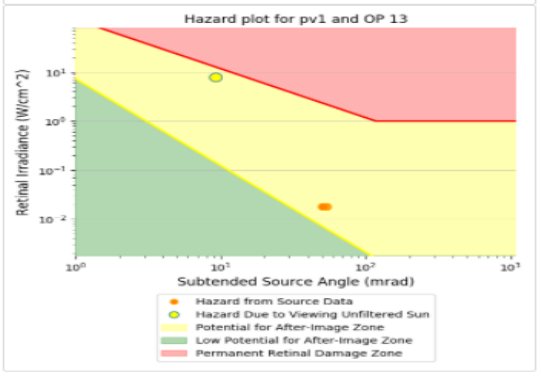
PV array is expected to produce the following glare for receptors at this location:

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





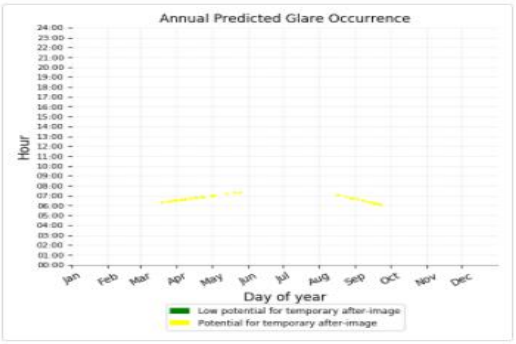


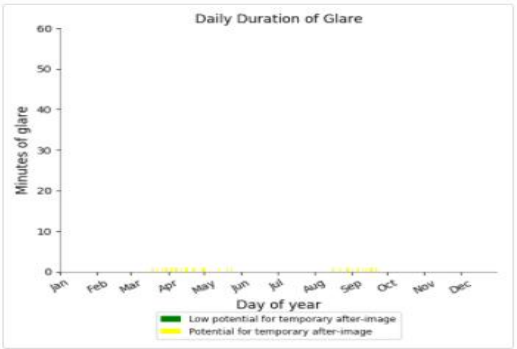


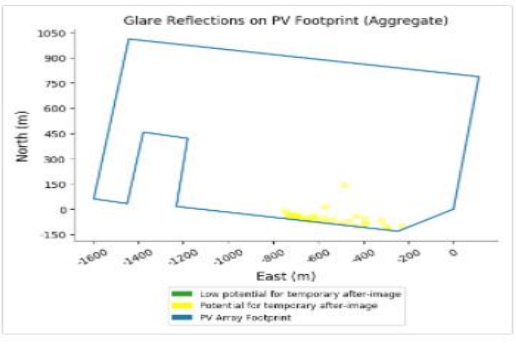
PV1 - OP Receptor (OP 14)

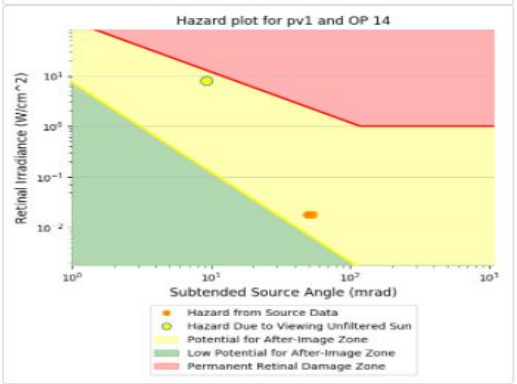
PV array is expected to produce the following glare for receptors at this location:

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





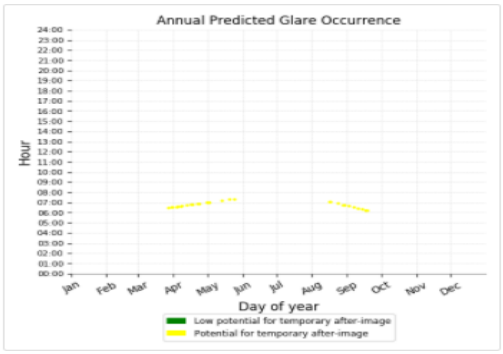


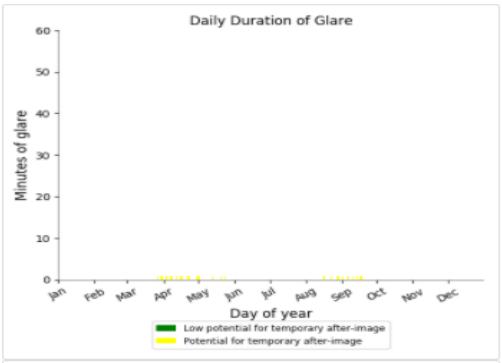


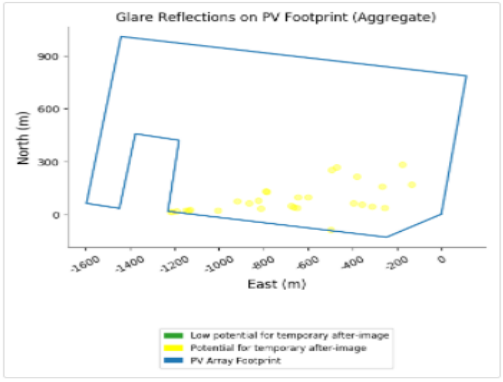
PV1 - OP Receptor (OP 15)

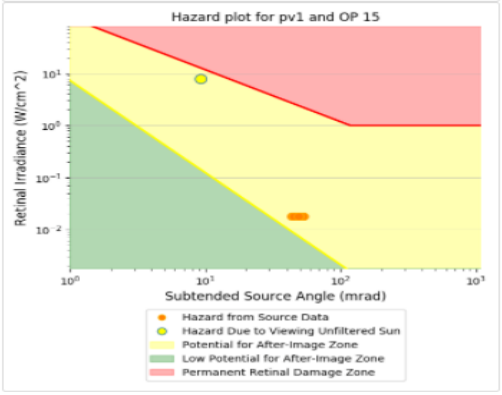
PV array is expected to produce the following glare for receptors at this location:

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





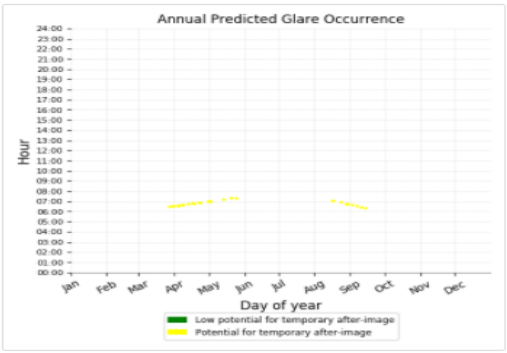


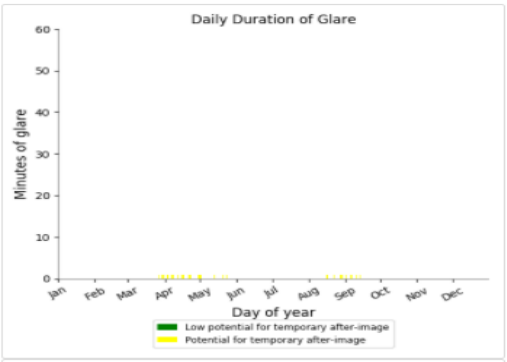


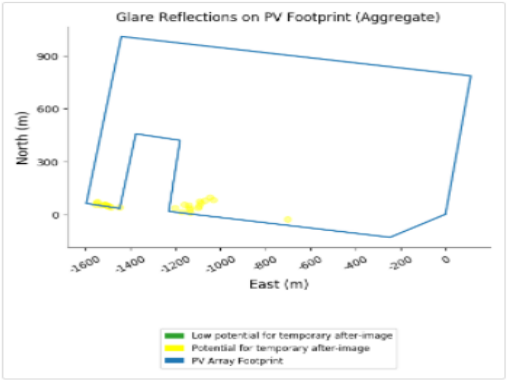
PV1 - OP Receptor (OP 16)

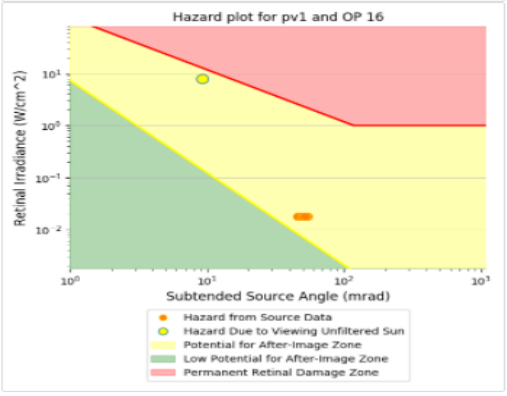
PV array is expected to produce the following glare for receptors at this location:

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





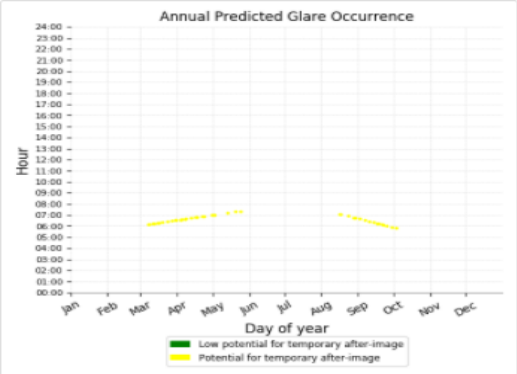


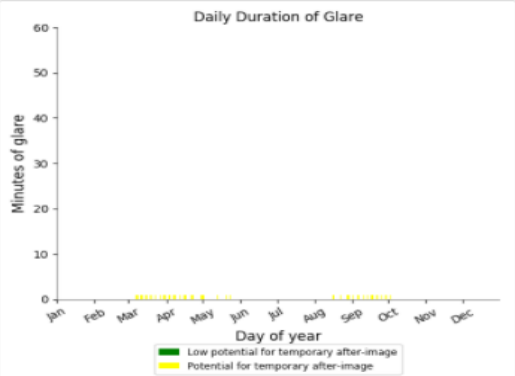


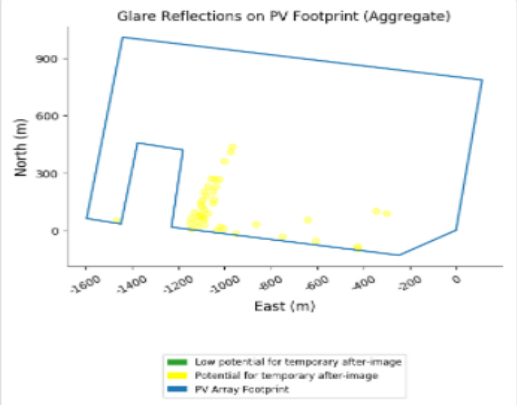
PV1 - OP Receptor (OP 17)

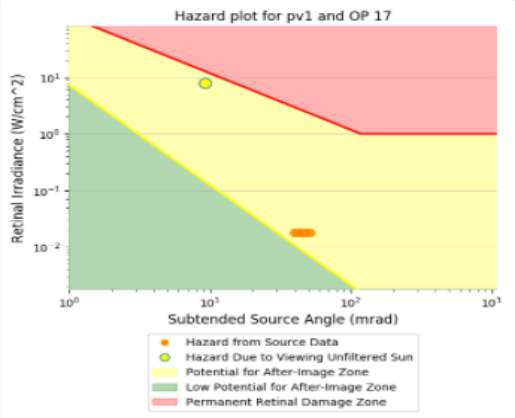
PV array is expected to produce the following glare for receptors at this location:

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





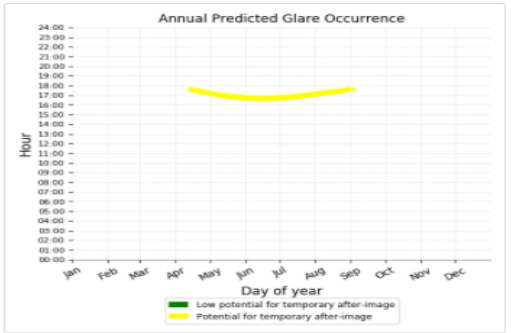


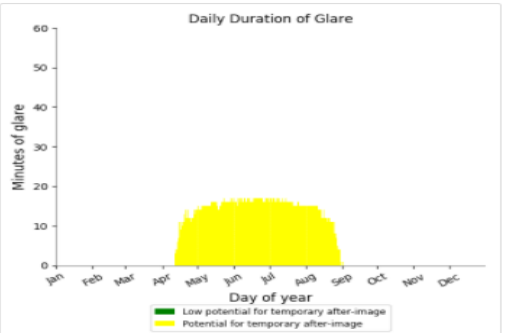


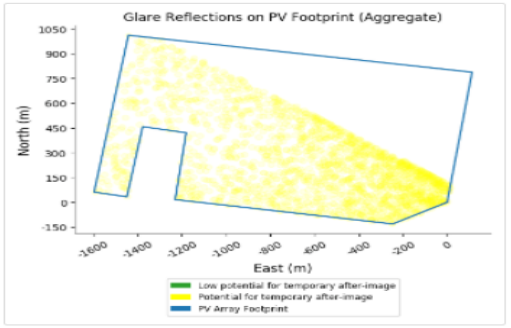
PV1 - OP Receptor (OP 19)

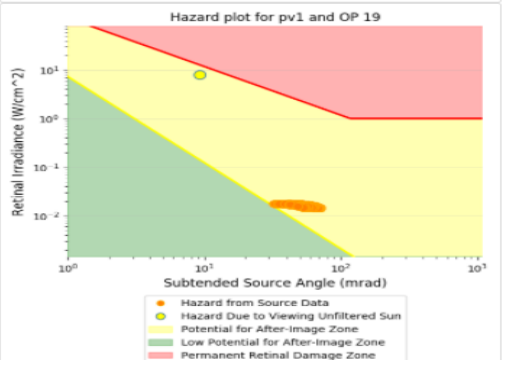
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,037 minutes of "yellow" glare with potential to cause temporary after-image.





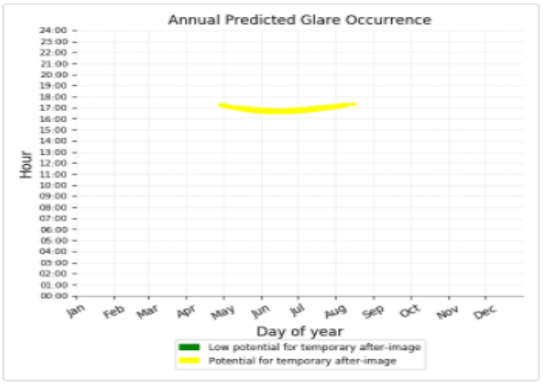


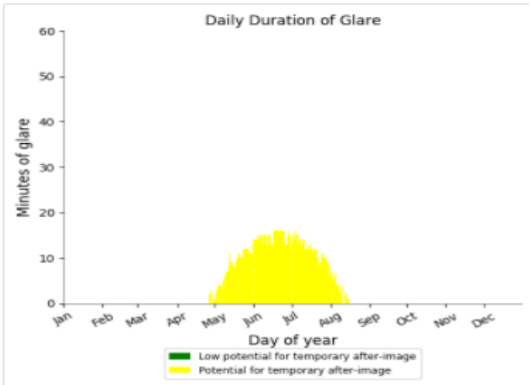


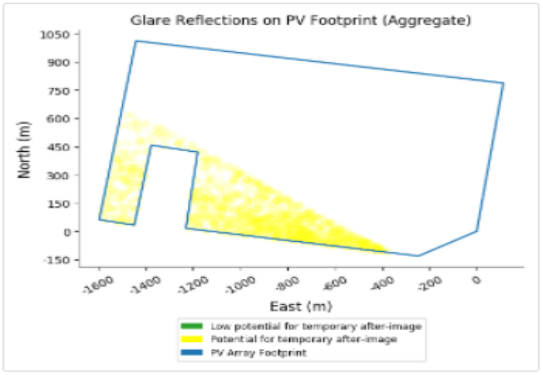
PV1 - OP Receptor (OP 20)

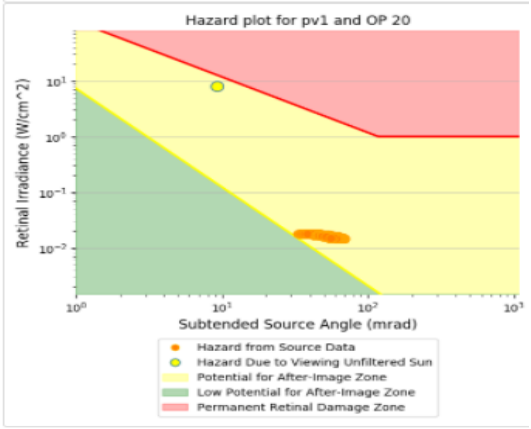
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,131 minutes of "yellow" glare with potential to cause temporary after-image.





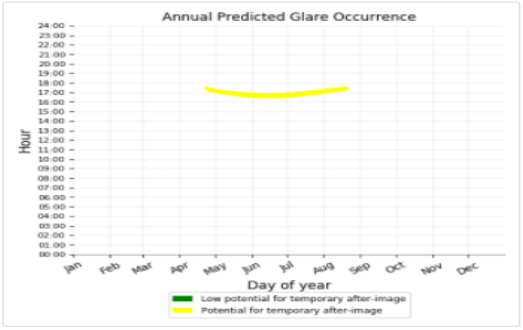


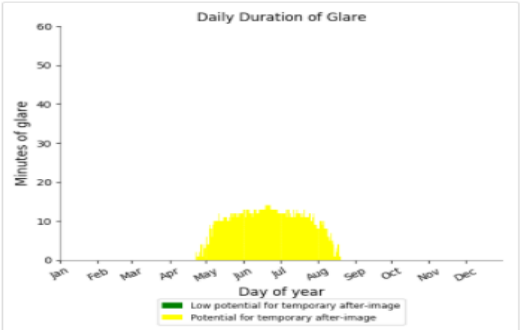


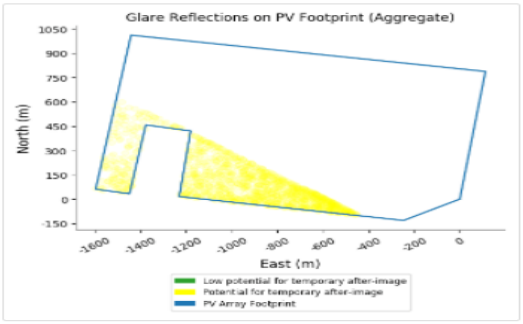
PV1 - OP Receptor (OP 21)

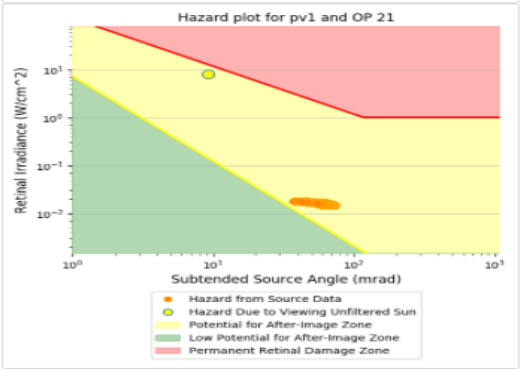
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,190 minutes of "yellow" glare with potential to cause temporary after-image.





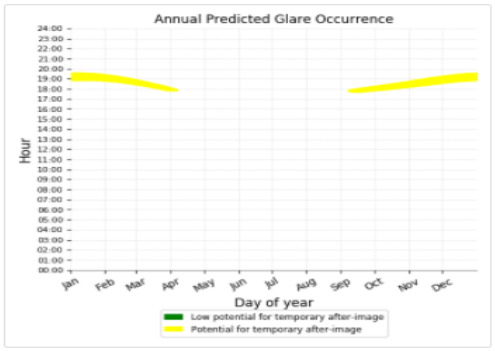


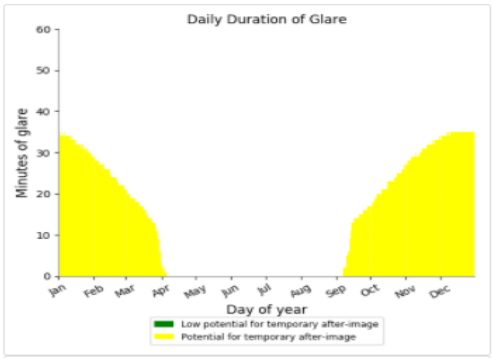


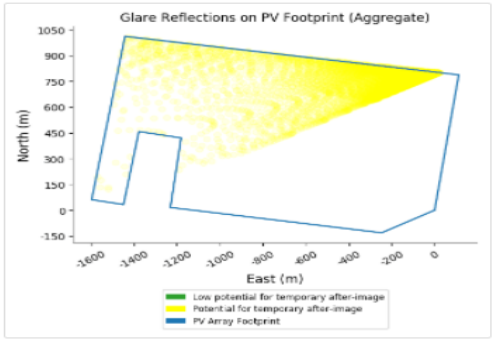
PV1 - OP Receptor (OP 22)

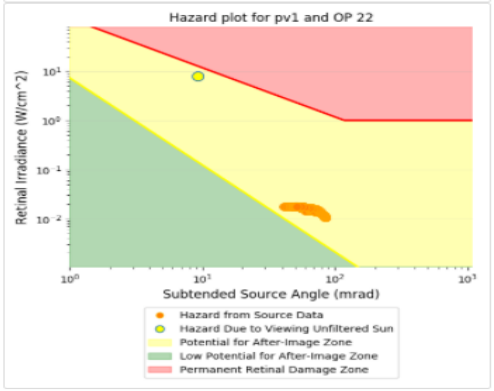
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 5,155 minutes of "yellow" glare with potential to cause temporary after-image.





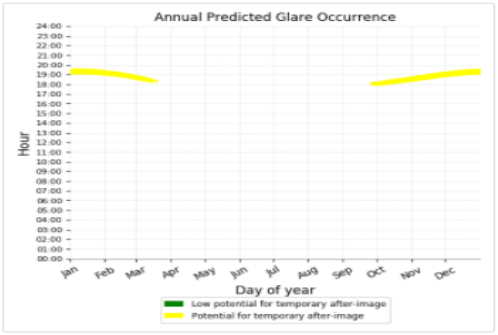


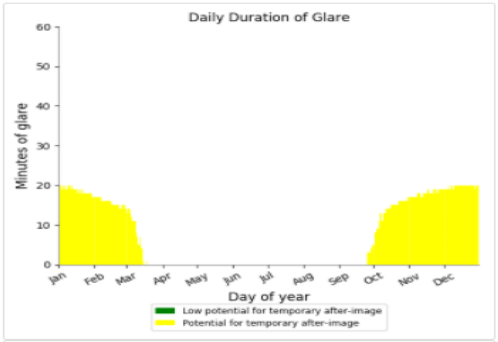


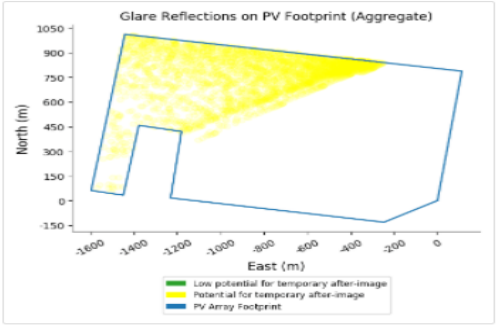
PV1 - OP Receptor (OP 23)

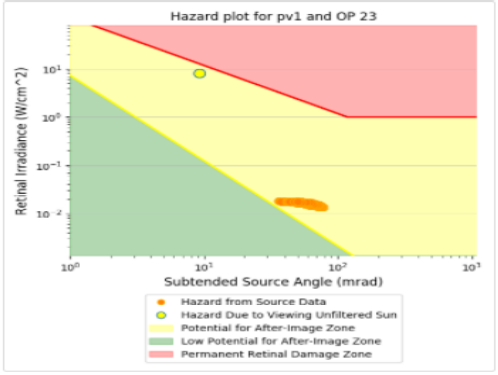
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,744 minutes of "yellow" glare with potential to cause temporary after-image.





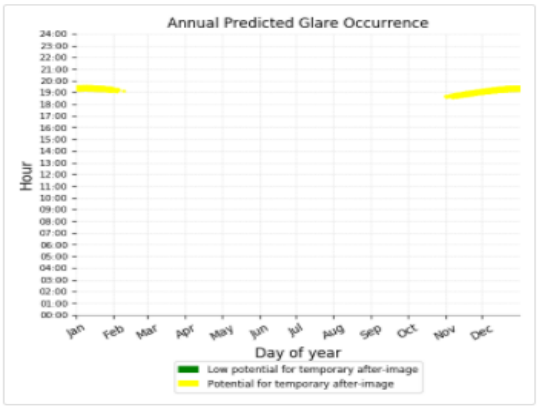


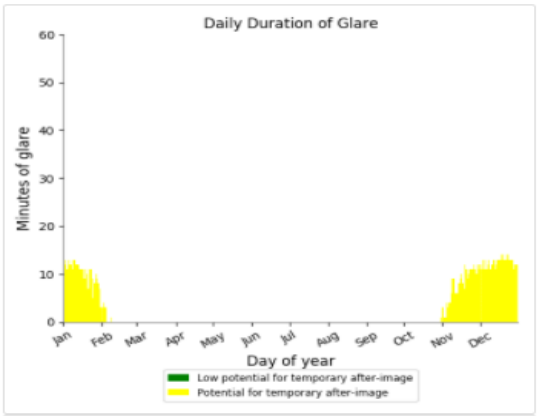


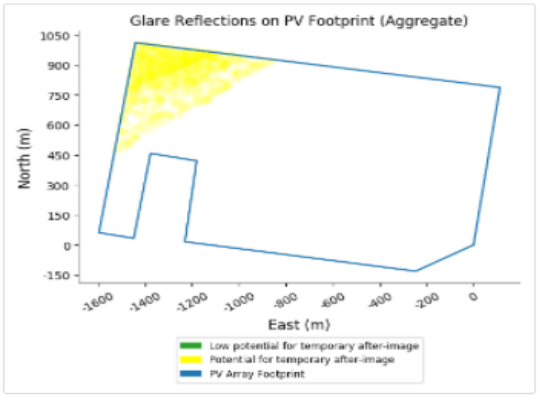
PV1 - OP Receptor (OP 24)

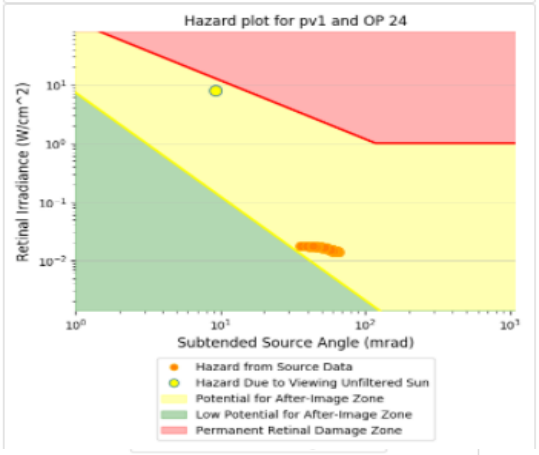
PV array is expected to produce the following glare for receptors at this location:

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





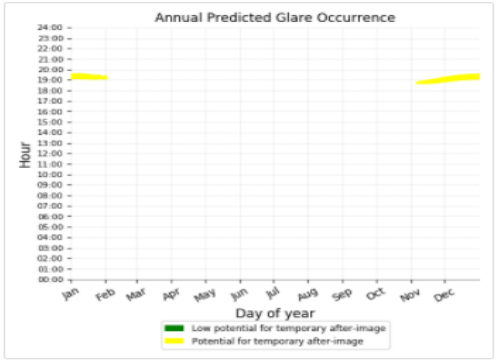


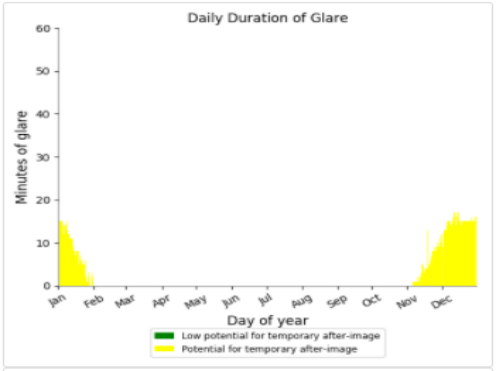


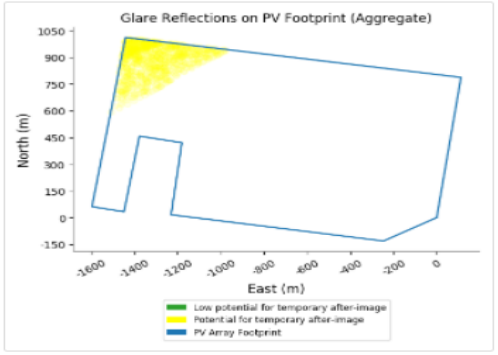
PV1 - OP Receptor (OP 25)

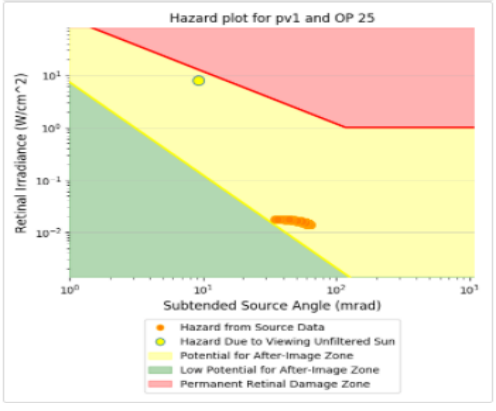
PV array is expected to produce the following glare for receptors at this location:

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





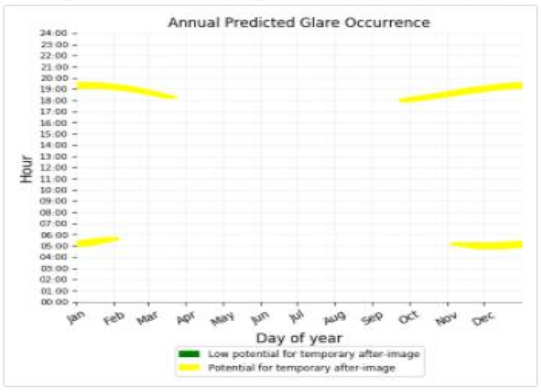


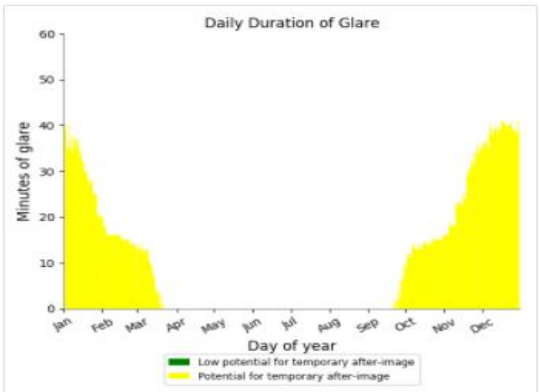


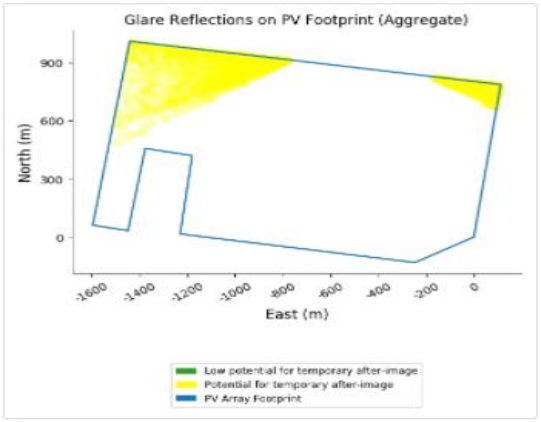
PV1 - OP Receptor (OP 26)

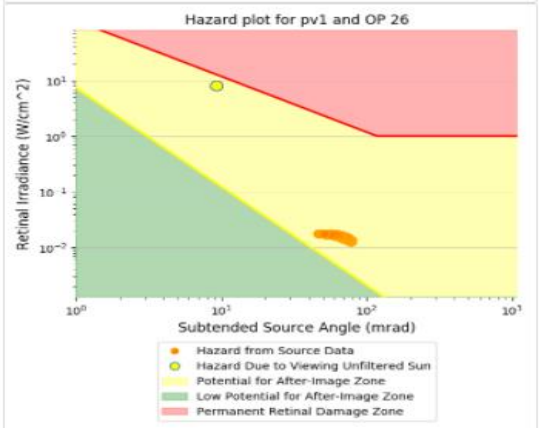
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,003 minutes of "yellow" glare with potential to cause temporary after-image.





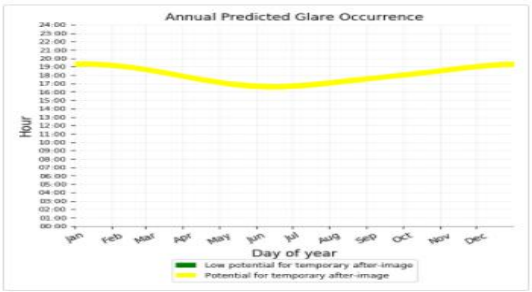


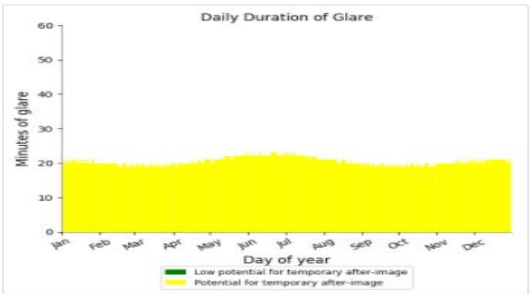


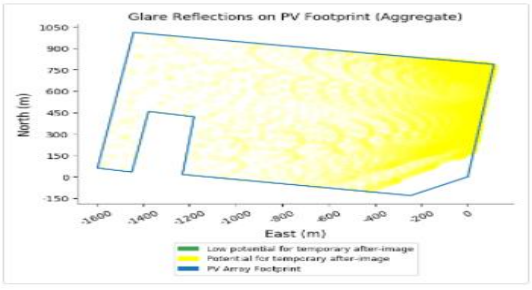
PV1 - OP Receptor (OP 27)

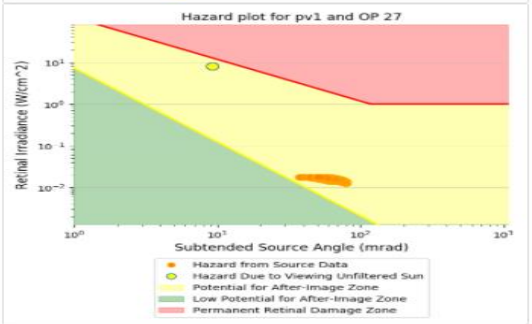
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 7,476 minutes of "yellow" glare with potential to cause temporary after-image.





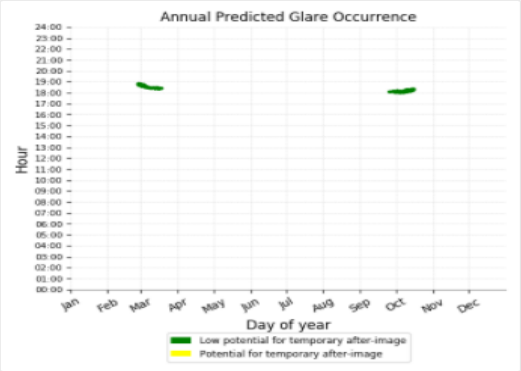


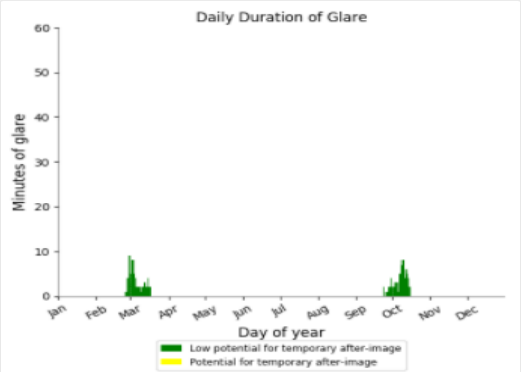


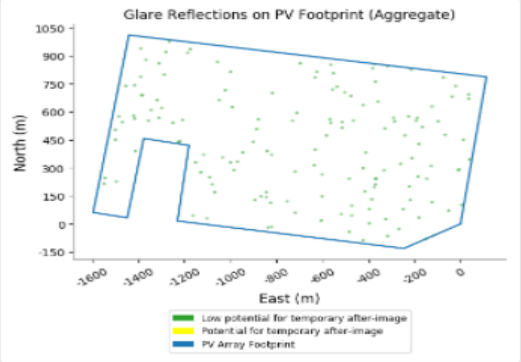
PV1 - OP Receptor (28-ATCT)

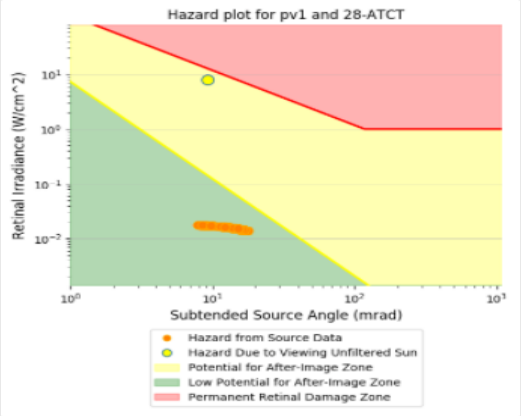
PV array is expected to produce the following glare for receptors at this location:

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





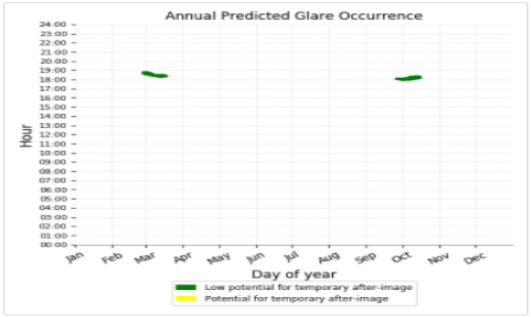


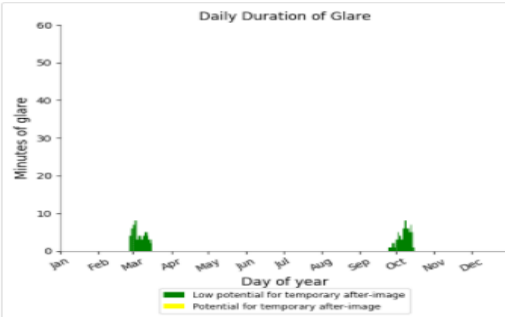


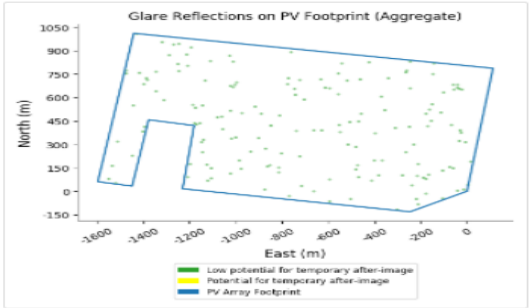
PV1 - OP Receptor (29-ATCT)

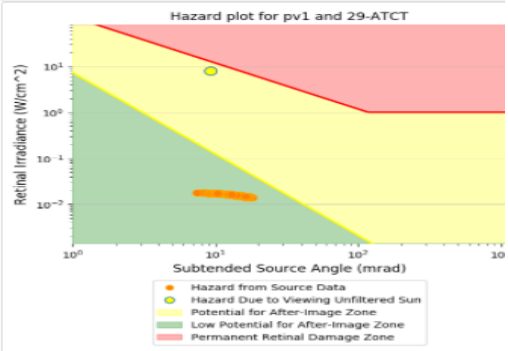
PV array is expected to produce the following glare for receptors at this location:

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





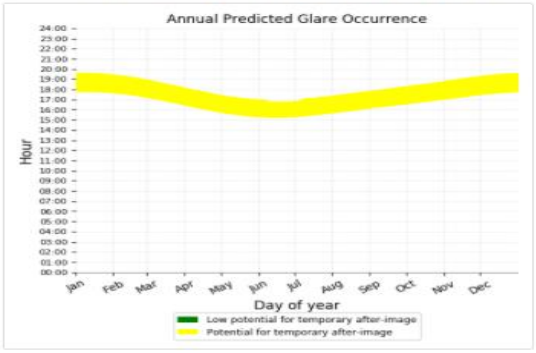


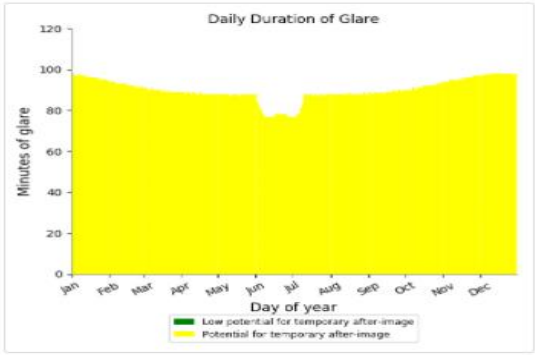


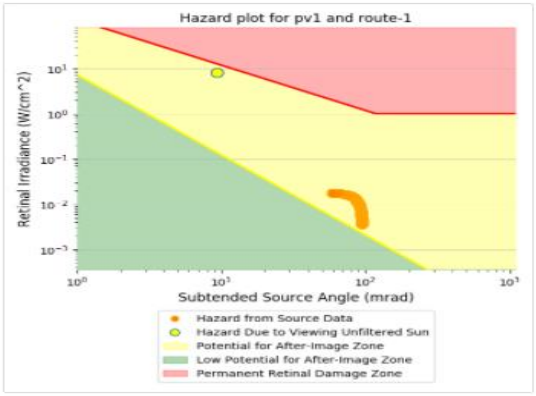
PV1 - Route Receptor (Route 1)

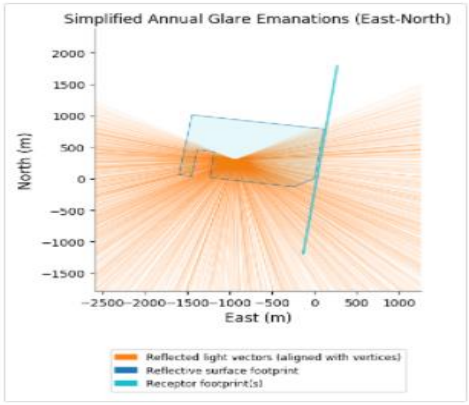
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 32,875 minutes of "yellow" glare with potential to cause temporary after-image.









A4 Receptors requiring mitigation strategies

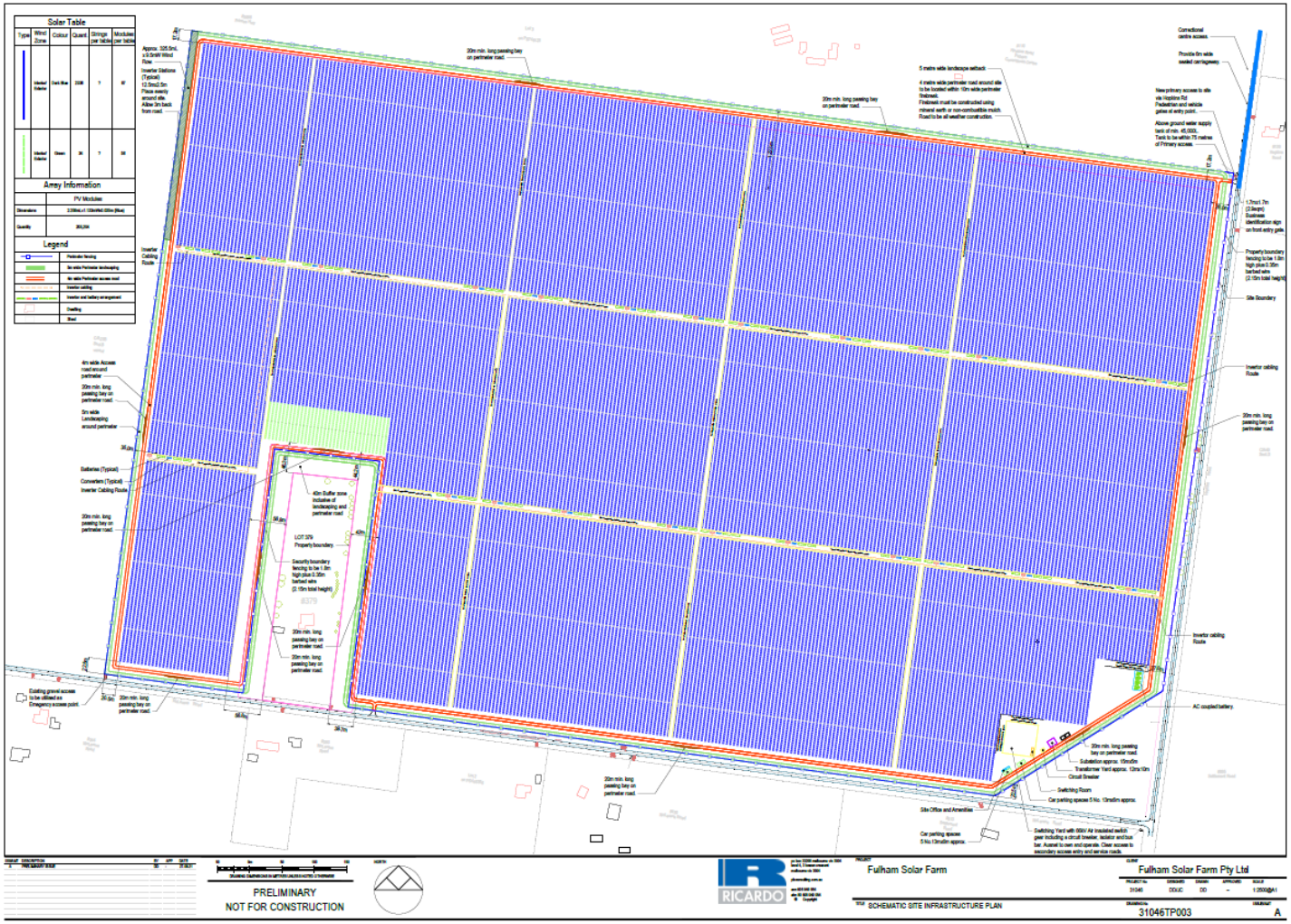
The following tables summarises and justifies receptors that are likely to require their own mitigation strategy.

Observation point	Subject to glare? (Y/N)	Mitigation requirement? (Y/N)	Details
OP 1	Y	Unlikely	Walls and vegetation surrounding the correctional facility
OP 2	N	N	
OP 3	N	N	
OP 4	N	N	
OP 5	Y	Likely	Next to site with broken vegetation
OP 6	Y	Likely	
OP 6	Y	Likely	Sporadic vegetation around site with tree
OP 7	Y	Likely	Sporadic vegetation around site with tree
OP 8	Y	Likely	No vegetation around site with tree
OP 9	Y	Likely	Sporadic vegetation that looks less dense/tall than the tree
OP 10	Y	Likely	Only a couple of trees surrounding receptor - potential for impact when panels rotate
OP 11	Y	Likely	Only a couple of trees surrounding receptor - potential for impact when panels rotate
OP 12	Y	Likely	Only a couple of trees surrounding receptor - potential for impact when panels rotate
OP 13	Y	Likely	Only a couple of trees surrounding receptor - potential for impact when panels rotate
OP 14	Y	Likely	Only a couple of trees surrounding receptor - potential for impact when panels rotate
OP 15	Y	Likely	Dense tree cover particularly to west of the property, however there is a break in tree cover to the east of the property
OP 16	Y	Likely	Lack of vegetation surrounding property
OP 17	Y	Unlikely	Multiple trees surrounding property with a
OP 18	N	N	
OP 19	Y	Potentially	Far away from the array with some tree coverage in
OP 20	Y	Unlikely	Dense tree coverage around the front and west of the property (i.e. the direction of the array)
OP 21	Y	Unlikely	Dense tree coverage around the front and west of the property (i.e. the direction of the array)

OP 22	Y	Likely	Some vegetation around site although large break to
OP 23	Y	Unlikely	Vegetation layer adjacent to the road and
OP 24	Y	Unlikely	Dense vegetation surrounding the property
OP 25	Y	Unlikely	Dense vegetation surrounding the property
OP 26	Y	Likely	Correctional centre - would recommend screening across whole of the southern border onto site to mitigate impact on buildings
OP 27	Y	Likely	Limited vegetation protecting site
OP 28 ATCT	Y	Unlikely	Far from site with multiple vegetation layers closer to the site thus obscuring the view
OP 29 ATCT	Y	Unlikely	Far from site with multiple vegetation layers closer to the site thus obscuring the view
RR 1	Y	Likely	Screening in place along site boundary where vegetation doesn't exist until native vegetation matures
RR 2	N	N	
RR 3	Y	Likely	Screening in place along site boundary where vegetation doesn't exist until native vegetation matures
RR 4	N	N	

A5 Revised site layout

Below indicates the final design of the solar PV scheme. The initial design assumed the entire area indicated was covered with PV modules at an orientation of 0° (north). This revised, detailed layout demonstrates the 8° orientation with the relevant landscape buffers and module row spacing.



A6 Landscape plan

The landscape plan below informs the final design of potential mitigation measures such as landscape and planting buffers around site.


RICARDO