Appendix H: Glint and Glare Assessment

Binn Farm Solar & BESS

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Basis of Report

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Acronyms and Abbreviations

ARP	Aerodrome Reference Point
BRE	Building Research Establishment
CAA	Civil Aviation Authority
CAST	Combined Aerodrome Safeguarding Team
FAA	Federal Aviation Administration
G&G	Glint and Glare
MW	Megawatt
NPF4	National Planning Framework 4
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
PV	Photovoltaic

1.0 Introduction

This report undertaken by SLR examines the potential glint and glare (G&G) effects arising from the installation of solar photovoltaic (PV) arrays on Binn Farm Solar Development (the 'Proposed Development') which is located on the land north-east of the Balvaird Castle and east of A912, in Perthshire County in Perth and Kinross council area, KY14 7SR, Scotland, United Kingdom. The National Grid reference for the site is NO 18029 12208.

The Proposed Development would have an export capacity of up to 30 MW of solar PV, covering a total area of approximately 41 hectares (ha).

This G&G assessment is informed by the latest design done by SLR and information provided by Trio Power Limited (herein "the Applicant"). **Graphic 1-1** shows the solar development footprint of the Proposed Development in the context of the surrounding land. The study considered four (4) PV areas for analysis in the G&G software.

Graphic 1-1: Solar development footprint of the Proposed Development and surroundings

1.1 PV Array Details

The Proposed Development has considered fixed PV module with a tilt angle of 20° and south orientation. **Table 1-1** illustrates the module specifications for the Proposed Development, summarising the parameters used within the report.

Table 1-1: Module Specifications

Parameter	Details
Mounting details	Fixed tilt (no tracking)
Module tilt	20°
Module orientation	180° (South)
Max Height	2.67 m

Parameter	Details
PV material category	Category 1. Defined as smooth glass with anti-reflective coating.
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.

1.2 Definitions

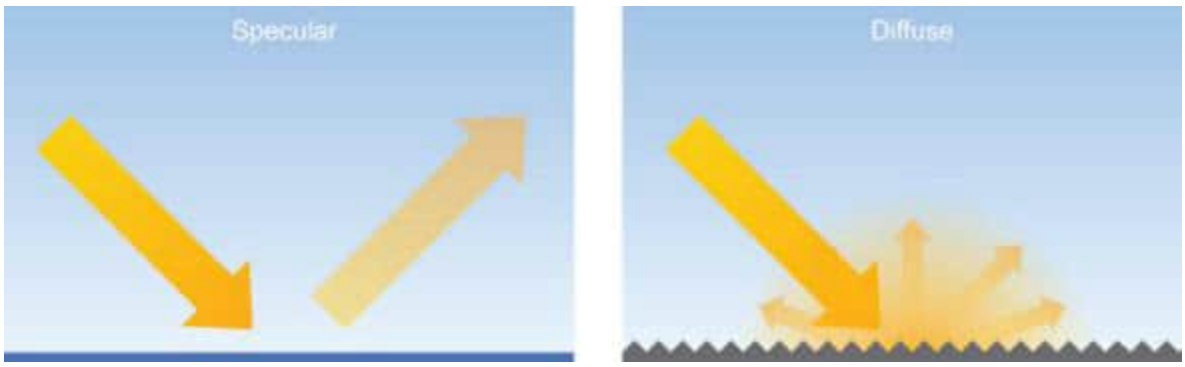
Glint, glare and dazzle are often used interchangeably but are defined in this report as described in **Table 1-2** below.

Table 1-2: Definition of Glint, Glare and Dazzle

Name	Description
Glint	Glint is a momentary flash of bright light.
Glare	Glare is a more continuous source of bright light.
Dazzle	This is an effect caused by intense G&G, which can cause distraction, and if strong enough reduce the ability of the receptor (pilot or driver, or otherwise) to distinguish details and objects.
Specular Reflections	Specular reflections are direct reflections of the sun's light off smooth surfaces, such as glass, steel, and calm water.
Diffuse Reflections	Diffuse reflections are scattered reflections of light produced from rougher surfaces such as concrete, tarmac, and vegetation.

It is noted that different organisations and agencies apply slightly different definitions to these terms, and some refer to the terms G&G interchangeably. In this report, in line with the Forge Solar modelling software, the term 'glare' is used as an umbrella term to cover G&G effects.

Graphic 1-2 shows the difference between specular reflection, produced as a direct reflection of the sun on to a smooth surface and diffused reflection, which is a scattered reflection of light.



Graphic 1-2: Types of Reflection: Specular (left) and Diffused (right).

The perceived intensity of glare will vary depending on the ambient light levels (influenced by the time of the day as well as weather patterns), orientation and inclination of the panels, and the distance to the receptor.

The ForgeSolar software output defines glare under a traffic light system, as 'green glare', 'yellow glare' and 'red glare'. This is explained in **Table 1-3** below.

Table 1-3: Types of glares

Name	Description
Green glare	'Green glare' is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Yellow glare	'Yellow glare' is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Red glare	'Red glare' has potential to cause retinal burn (permanent eye damage). Retinal burn is typically not possible for PV glare since the reflected light is not focused on a concentrated point.

Temporary after-image is the phenomenon whereby an image remains momentarily visible on the retina after looking away from a bright light source.

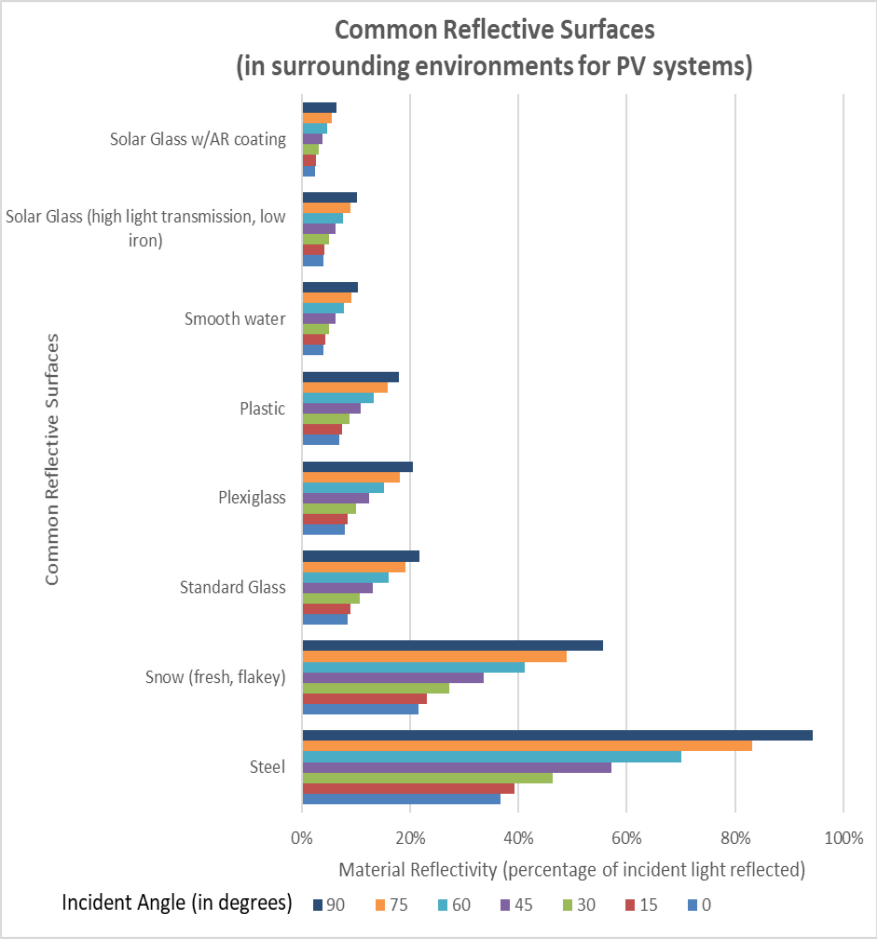
1.3 The Reflectivity of Solar Panels

Solar PV panels are designed to absorb sunlight and convert it into electricity; they are not designed to reflect light, although there may still be a small unavoidable reflective component present. The glass which forms the surface layer of solar panels is specifically designed with a low iron content to aid the absorption of daylight and thus has a much lower level of reflectivity than the glass typically seen in conventional windows.

For example, with a 75° angle of incidence, less than 9% of the total incident visible light is reflected, while normal glass reflects approximately 19% of light. If the panels have an anti-reflective coating applied reflectivity drops to about 5%. Thus, reflectance levels from a given solar site will be much lower than the reflectance generated by standard glass and other common reflective surfaces in the surrounding environment, although reflectance characteristics will also vary with the incidence angle, which changes as the sun moves across the sky.

Solar panels have a comparable reflectivity to calm water and are considerably less reflective that other natural materials such as snow. Any glare that may occur would be less intense than that seen when flying over a reservoir on a calm day or a snow-covered landscape on a bright day. As can be seen from **Graphic 1-3**, the reflectivity of light incident on solar glass is considerably less than light reflections from many other materials found in the built and natural environment, and approximately half that of standard glass.

As distance from the G&G source increases, the intensity of the event drops appreciably. This is due to a combination of factors including the diffraction of light after it reflects off the panel, atmospheric weather conditions such as the presence of particulates, haze, or low cloud, and the diminishing subtended viewing angle.



Graphic 1-3: Reflectivity of Common Materials at Varying Angles of Incidence.

(Based on data from SunPower Corporation, 2009)

1.4 Occurrence of Glint and Glare

G&G can only occur when direct sunlight can reach the solar panels. Diffused lighting, caused by weather conditions such as cloud, fog, and mist, cannot result in glint due to the low energy intensity of the light incident on the panels.

2.0 Planning Policy, Legislation & Guidance

Specific policy, legislation and guidance relating to assessing G&G effects from solar parks have been considered as part of this assessment and are summarised below.

2.1 National policy

UK National Policy Statements mentioning solar developments and/or G&G include:

- National Planning Policy Framework (NPPF)[1] – December 2024
- National Planning Practice Guidance (NPPG)[2] – August 2023
- Scotland's National Planning Framework 4 (NPF4)
- Overarching National Policy Statement for Energy (NPS EN-1) - November 2023
- National Policy Statement for Renewable Energy (NPS EN-3) – November 2023

The NPPF and NPPG notes that large scale solar farms 'could have a damaging effect on the landscape, particularly in undulating landscapes' and that the 'visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively' (Paragraph 007: ID 5-007-20140306 & Paragraph 013: ID 5-013-20150327). There is no explicit guidance on the proximity of receptors to the development that should be considered for assessment.

2.2 Local policy

Perth and Kinross Council's Renewable and Low Carbon Energy Planning Guidance - Consultation Draft 2025[3] sets out the key considerations in the development plan for renewable energy applications. These include considerations on socio-economic impacts, landscape and visual impact, impact on communities and dwellings, among others. The document has specified that the G&G assessments will be required where properties within 1 km to the east and west of the development have line of sight of the solar panels.

2.3 Guidance

In the UK, at the domestic level, the closest guidelines regarding glint are the Building Research Establishment (BRE) guidelines on 'Site layout planning for Daylight and Sunlight: A guide to good practice'. Other relevant guidance includes:

- Aviation Guidance from Civil Aviation Authority (CAA)
- The Combined Aerodrome Safeguarding Team (CAST) – July 2023
- Federal Aviation Administration (FAA)

BRE state that the sensitivities associated with G&G, and the landscape/visual impact and the potential impact on aircraft safety, should be a consideration. In some instances, it may be

[1] National Planning Policy Framework (2024) available at https://www.gov.uk/government/publications/national-planning-policy-framework--2

[2] National Planning Policy Framework- Planning practice guidance: Renewable and low carbon energy available at https://www.gov.uk/guidance/renewable-and-low-carbon-energy

[3] Perth and Kinross Council's Renewable and Low Carbon Energy Planning Guidance https://www.pkc.gov.uk/media/54347/Draft-Renewable-Low-Carbon-Energy-Planning-Guidance-2025/pdf/Renewables_Guidance_2025_Consultation_Draft.pdf?m=1756991924537

necessary to seek a G&G assessment as part of a planning application[4]. However, the BRE do not define a proximity to the development that receptors should be considered.

Both the NPPG and BRE guidance highlight the additional importance of a G&G study if solar tracking systems are used, whereby solar PV modules rotate to follow the suns path to maximise power generation. These can cause 'additional impacts'[4] such as 'differential diurnal and/or seasonal'[4] variations of G&G. The Department for Energy Security & Net Zero (DESNZ) also state that G&G studies may need to account for tracking panels as they may cause 'diurnal and/or seasonal impacts'[5]. This Project utilises a fixed mounting structure, rather than a tracking system whereby modules rotate in the direction of the suns path.

Regarding air-based receptors, the UK Civil Aviation Authority (CAA) states 'consideration of G&G should be made over a wider area' and indicate a range of up to 5 km from an Aerodrome Reference Point (ARP)[6] as an area of most concern. CAA also developed an interim guidance document published in 2010 and then retracted this in 2012. As a result, no formal copy exists.

[4] BRE (2013) *Planning guidance for the development of large-scale ground-mounted solar PV systems*. Available at https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

[5] Department for Energy Security & Net Zero (2023) *national Policy Statement for Renewable Energy Infrastructure (EN-3)*. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf

[6] UK CAA (2022) *CAST Guidance Note – Safeguarding Guidance to GA Aerodrome Managers and Operators*. Available at: https://www.caa.co.uk/search?query=glint

3.0 Methodology

3.1 Glint and Glare Analysis

A geometric analysis is conducted to study where and when G&G events may occur. This examines receptors present at ground level, such as dwellings, roads, national waymarked trails, and railway lines. Receptors are identified using available mapping, aerial photography, and street-level imagery.

The G&G analysis is completed in several stages using various methods, software models, and tools to progressively assess the potential for effects, while building an understanding of the local environmental conditions, either existing or proposed, that impact the potential for glare in the local area.

3.2 Assessment of Effects

The detailed geometric analysis uses a software model to make a prediction on the dates, times and durations of G&G effects at fixed positions over the course of a year. The software used is the GlareGauge tool that was originally developed in the United States by the Sandia National Laboratory and since improved upon and licensed to ForgeSolar. The times reported as to when G&G may occur are reported in Coordinated Universal Time (UTC) and thus any relevant daylight savings should be considered when observing the results.

The computer model predicts whether glare effects are possible at a 1-minute temporal resolution over the course of a full year. The model accounts for the maximum panel height, the area taken up by the panels and a fixed observer height. Any glare that is predicted is classified as either ‘green glare’ or ‘yellow glare’ or ‘red glare’, as described previously in **Table 1-3**.

3.2.1 Modelling Limitations

It is important to understand certain limitations within the model. The model calculates results based on the geometric relationship between the observation point at a fixed height, the reflective plane (panels) at a fixed height, and the position of the sun at each time interval as it progresses across the sky. It therefore takes no account of any screening features whatsoever. It does not account for surface features such as buildings, trees or intervening topography. The software also assumes it is sunny, at the maximum intensity possible, 365 days per year. Since the computer model indicates when glare ‘can’ happen, not when it ‘will’ happen, it considerably overstates the realistic glare duration, which is why further interpretation is essential.

- The geometry of the entire system is not considered, such as gaps between panels and heights of the mounting structures and individual panels. Therefore, a module height above of ground of 2.67m assumes this is the only elevation at which sunlight reflects from the module (i.e. the lower and higher portions of the array are not considered).
- The shape of surrounding obstacles and obstructions (such as trees, electricity poles and fences) are not fully considered. For example, a tree is considered as uniform in its circumference from its tip to the ground as opposed to thinner at the bottom from the trunk and widest in the middle. This can lead to an obstacle’s ability to shield a receptor from G&G being both under and overestimated. Further, the precise height of shading obstacles is not known, and estimates are therefore made.
- The model does not consider daily variations in weather conditions (e.g. cloud cover) and instead uses a typical clear day as a default. The software also assumes it is sunny, at the maximum intensity possible, 365 days per year. Since the computer

model indicates when glare 'can' happen, not when it 'will' happen, it considerably overstates the realistic glare duration, which is why further interpretation is essential. This also overestimates the impacts of G&G.

- Only twenty (20) obstructions can be modelled. As a result, many existing obstructions such as trees, hedgerows, and other buildings may not be present in the model. G&G is therefore overestimated in this instance.
- Only sixty (60) point receptors can be modelled. As a result, a single identified location is considered representative of multiple discrete receptors in close proximity.

The following steps were followed to assess the impacts of G&G arising from the Proposed Development:

- **Identify receptors required for the assessment**: Main roads, railway lines, ground-based receptors, and air-based receptors closest to the Proposed Development.
- **Input receptor and solar PV plant details**: Details such as location and area of coverage were entered into the Forge Solar modelling tool, as well as the three sets of modelling assumptions detailed in **Table 5-1**, **Table 5-2** and **Table 5-3** in **Section 5** below.
- **Assess the results**: The simulation results were analysed to assess the duration, intensity, and potential impact of G&G on all identified receptors. While the model has inherent limitations (e.g., the model does not consider objects such as trees and building), existing and planned screening measures - such as trees and hedgerows - were manually incorporated into the simulation. These were identified via Google Earth Pro, the Site Layout Plan (Figure 4.1 of the Supporting Environmental Information Report) and the Landscape Enhancement and Mitigation Plan (LEMP) (Annex D of Appendix C: Landscape and Visual Assessment). This allowed for a more realistic representation of the anticipated conditions.

4.0 Receptor Identification

The following section highlights the receptors considered for the assessment.

4.1 Ground-based Receptors

The study area is determined as a 2 km radius from the Proposed Development for buildings and a 5 km radius for other ground-based receptors (roads and trainline).

4.1.1 Fixed Ground Receptors

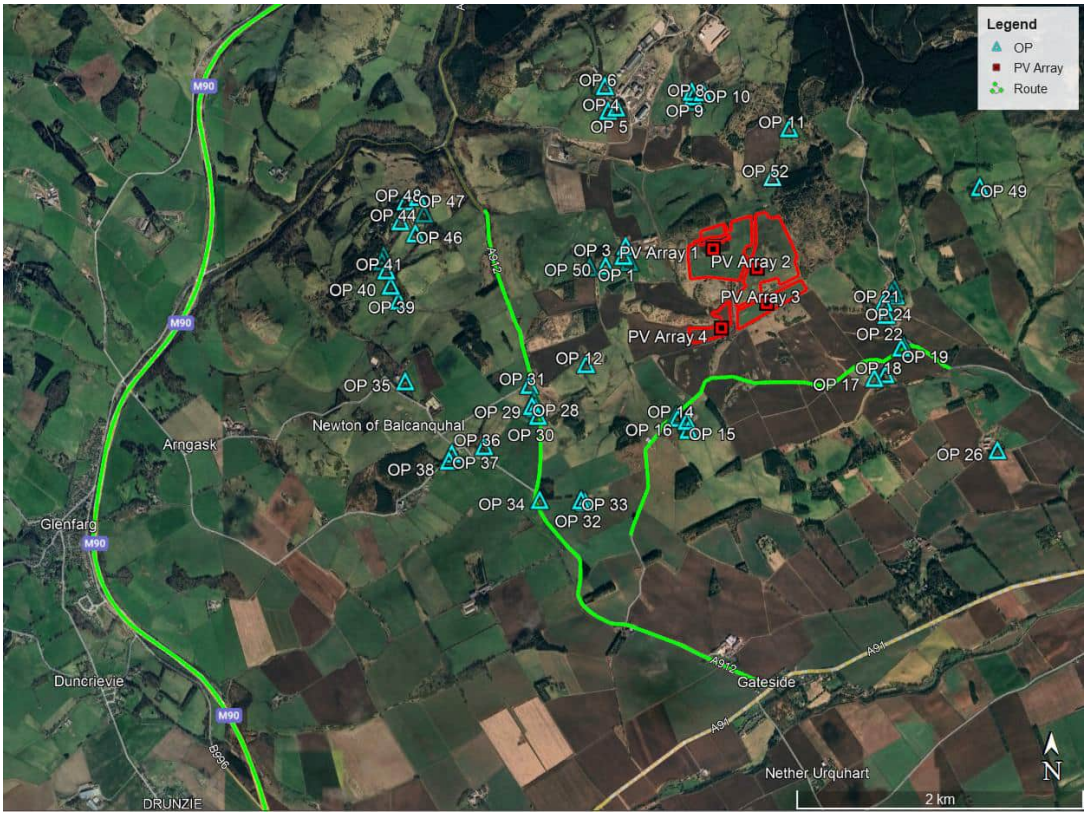
Several dwellings and farms are located within the study area. In some cases, a single identified location is considered representative of multiple discrete receptors in close proximity. A total of 51 ground-based observation points (OPs) in blue represent buildings within the study area (see **Graphic 4-1**). These include residential buildings to the east, west, north, and south of the Proposed Development. These receptors are all off-site residential properties of one or two storeys.

4.1.2 Roads and Trainline

Numerous roads and country lanes fall within the 5 km study area of the Proposed Development. The study has focused on the following key routes in green (see **Graphic 4-1**):

- Motorway, M90, west of the Proposed Development. It runs from Junction 1A of the M9 motorway to Perth
- Main Road, A912, west of the Proposed Development.
- Leden Urquhart Road, south of the Proposed Development.

There is no railway line within a 5 km radius of the Proposed Development, and therefore, no railway line has been considered in the study.



Graphic 4-1: The Proposed Development and identified ground-based receptors.

4.2 Air-based Receptors

There are no aviation receptors within 5 km of the Proposed Development, with the closest being Balado Airfield, located approximately 14.5 km south-west.

5.0 G&G Assessment

5.1 Modelling Input

Four different solar PV areas have been identified and modelled in the software to estimate the G&G effects.

There are a total of three sets of modelling assumptions required for the simulation, detailed in **Table 5-1**, **Table 5-2** and **Table 5-3** below.

Table 5-1: 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

Table 5-2: PV array parameters

Parameter	Details
Mounting details	Fixed tilt (no tracking).
Module tilt	20°
Module orientation	180° (South)
PV material category	Category 1. Defined as smooth glass with anti-reflective coating.
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.

Table 5-3: Receptor parameters

Parameter	Details
Route receptors	Three routes: M90, A912 and Leden Urquhart Road
Residential Dwellings - Observation points	51 OPs, all of them offsite
Obstructions	Range of trees and buildings scattered around site: a total of 20 screenings

5.2 Simulation Results

The following section details the results of the G&G simulation, along with implications for the site and limitations of the study. Note that further details can be found in the following G&G simulation reports:

- **Annex A:** Forge Solar Analysis – Binn Farm Solar.pdf

Table 5-4 highlights the total duration and magnitude of G&G experienced by all affected receptors across the day and year. It is worth noting that the remaining receptors are not impacted by G&G from the PV array.

Table 5-4: Duration and diurnal/seasonal patterns of G&G

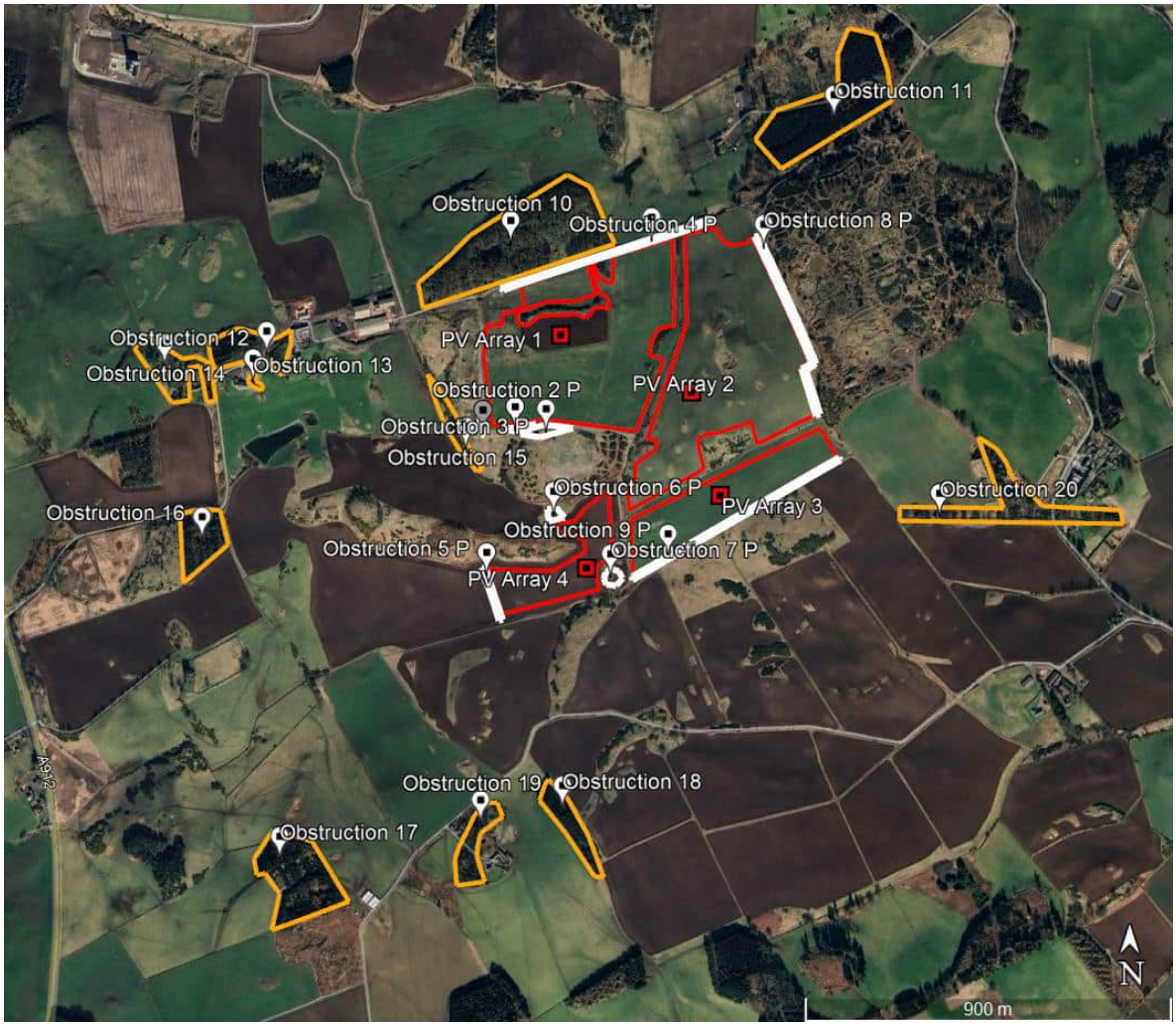
Receptor	G&G Hazard Summary	PV Area	Cumulative Time and Daily G&G Duration
Route 1	Green	PV Area: 1, 2, 3, 4	During mid-Mar to mid-July, Aug to mid-Sep, between 05:00 and 06:30, for up to 23 minutes per day
Route 3	Mostly Green	PV Area: 3, 4	During mid-Mar to mid-Sep, between 18:00 and 19:30, for up to 28 minutes per day (6,189 minutes over the whole year) Up to 29 mins of yellow glare from May to mid-Aug, between 18:00 and 19:30 (total 241 minutes over the whole year)
OP 1	Green	PV Area: 1, 2	During Apr to mid-May and Aug to mid-Sep, between 05:30 and 06:30 and 18:00 and 19:00, for up to 28 minutes per day
OP 2	Yellow	PV Area: 1, 2	During mid-Apr to mid-May and mid-Jul to Aug, between 05:00 and 06:30, for up to 31 minutes per day (1,197 minutes over the whole year) Up to 29 minutes of green glare from mid-Mar to mid-Sep, between 05:00 and 06:30 (total 3,515 minutes over the whole year)
OP 12	Green	PV Area: 2, 3	During mid-Apr to mid-Aug, between 05:30 and 06:30, for up to 21 minutes per day
OP 17	Green	PV Area: 3, 4	During mid-Apr to Aug, between 18:00 and 19:00, for up to 19 minutes per day
OP 18	Green	PV Area: 3, 4	During Apr to mid-Sep, between 18:00 and 19:00, for up to 20 minutes per day
OP 19	Green	PV Area: 3, 4	During Apr to mid-Sep, between 18:00 and 19:00, for up to 20 minutes per day
OP 20	Green	PV Area: 3	During Apr to mid-Sep, between 18:00 and 19:30, for up to 19 minutes per day
OP 26	Green	PV Area: 3, 4	During May to mid-Aug, between 18:00 and 19:30, for up to 12 minutes per day

Receptor	G&G Hazard Summary	PV Area	Cumulative Time and Daily G&G Duration
OP 27	Green	PV Area: 2, 4	During mid-May to mid-Jul, between 05:00 and 06:00, for up to 20 minutes per day
OP 28	Green	PV Area: 4	During mid-May to mid-Jul, between 05:00 and 06:30, for up to 21 minutes per day
OP 29	Green	PV Area: 4	During mid-May to mid-Jul, between 05:00 and 06:00, for up to 20 minutes per day
OP 30	Green	PV Area: 4	During mid-May to mid-Jul, between 05:00 and 06:00, for up to 22 minutes per day
OP 31	Green	PV Area:1, 2, 3, 4	During May to mid-Aug, between 05:00 and 06:30, for up to 23 minutes per day
OP 35	Green	PV Area: 1, 2, 3, 4	During Apr to Aug, between 05:00 and 06:30, for up to 23 minutes per day
OP 36	Green	PV Area: 3, 4	During Jun to mid-Jul, between 05:00 and 06:30, for up to 26 minutes per day
OP 37	Green	PV Area: 3, 4	During mid-May to mid-Jul, between 05:00 and 06:30, for up to 29 minutes per day
OP 38	Green	PV Area: 3, 4	During Jun to mid-Jul, between 05:00 and 06:30, for up to 29 minutes per day
OP 39	Green	PV Area: 1, 2	During mid-Mar to Apr and mid-Aug to Sep, between 05:30 and 06:30, for up to 18 minutes per day
OP 40	Green	PV Area: 1	During mid-Mar to mid-Apr and Sep, between 05:30 and 06:30, for up to 10 minutes per day

5.3 Discussion and Implication of Results

It is to be noted that existing screening measures, such as trees, hedgerows, have been incorporated into the simulation as illustrated in orange in **Graphic 5-1**. These screenings are based on information available in Google Earth Pro and the LMP.

In addition, vegetation proposals outlined in the Landscape and Management Plan (LMP) have been included in the simulation as “P” and are shown in white in **Graphic 5-1**. These proposed screenings include either native woodland of 3 m height and hedgerows of 1.5 m to fill gaps around the Site boundary.



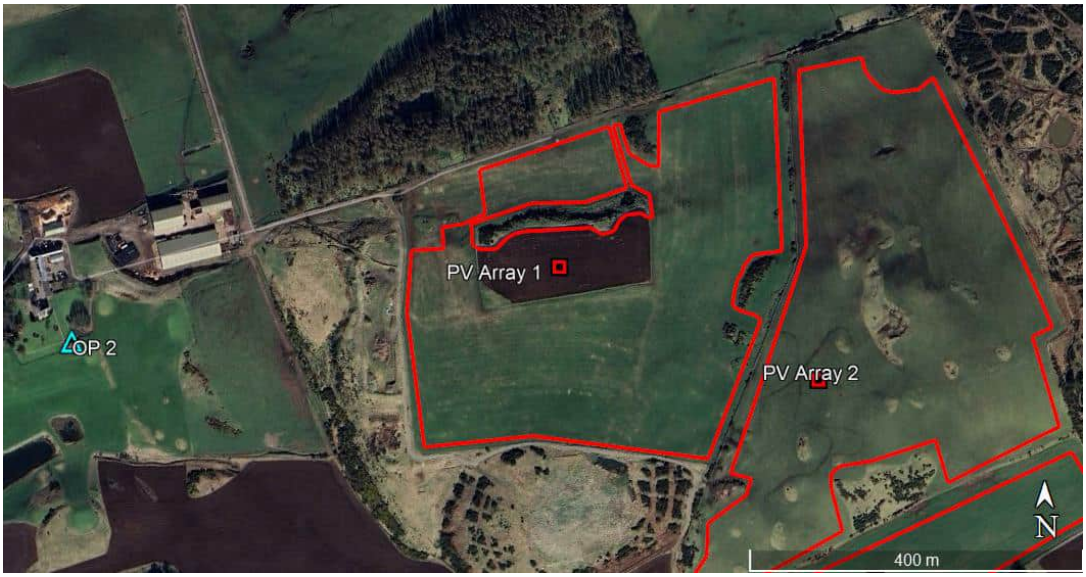
Graphic 5-1:Existing (orange) and proposed screenings (white) included in the simulation.

5.3.1 Fixed Ground Receptors

Out of the 51 identified ground-based fixed receptors, 19 receptors are potentially affected by G&G from the Proposed Development from PV Areas 1, 2, 3 and 4, as indicated in **Table 5-4**.

Among these 19 receptors, only OP 2 is expected to potentially experience yellow glare from the Proposed Development, while remaining fixed receptors experience only green glare.

Receptor OP 2, which is the landowner's house, is located on Milden Road and west of the Proposed Development, as illustrated in **Graphic 5-2**. It is potentially affected by yellow glare from PV Area 1.

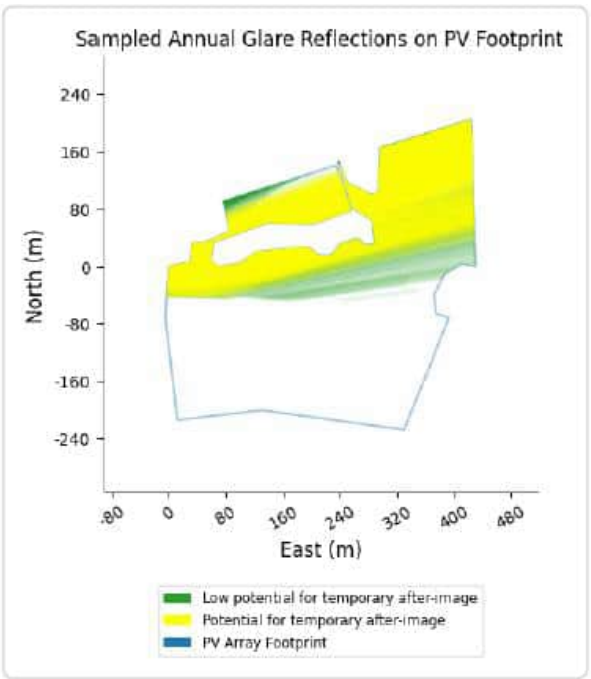


Graphic 5-2: Location of OP 2 (blue) and PV Areas (red).

Graphic 5-3 below illustrates the areas of PV area 1 from which the yellow glare emanates to the fixed receptor OP 2.

According to the ForgeSolar analysis, OP 2 could receive up to 31 minutes per day of yellow glare during mid-Apr to mid-May and mid-Jul to Aug, in the early mornings (05:00 and 06:30) and up to 29 mins per day of green glare from mid-March to mid-September, in the early mornings (05:00 to 06:30). This is attributed to the sun rising in the east and reflecting westwards towards the receptor.

PV Array 1 to OP 2



Graphic 5-3: Areas of PV Array 1 from where yellow glare emanates to OP 2.

However, in real-life conditions, the potential impact is expected to be less significant due to intervening topography between the area of PV array 1 where glare emanates and the

receptor OP 2. The intervening topography, which is not accounted for in the simulation, will screen the glare from PV array 1 to OP 2.

The intervening topography is illustrated below in **Graphic 5-4** using an elevation profile generated in Google Earth. As shown, OP 2 is located at an elevation of approximately 209 m, while the area of PV Array 1 from which glare originates, lies at elevations above 225 m. The red arrow in the figure marks the point where the PV area begins; this location also represents the highest point along the topographic profile. To the left of this point, the terrain slopes downward toward OP 2, while to the right, the elevation decreases slightly across the extent of the PV panels. This indicates that a local topographic high between OP 2 and the PV area acts as a natural visual barrier, potentially preventing direct visibility of the panels from OP 2.

Additionally, as outlined in the Modelling Limitations section, the software assumes clear, sunny conditions 365 days a year, an unrealistic assumption for the Scottish climate, likely resulting in an overestimation of potential effects. Therefore, considering the intervening topography and unrealistic assumption in the simulation, the residual glare effect at OP 2 is expected to be **minimal**.

Graphic 5-4: Elevation profile between OP 2 and PV Array 1 where glare emanates.

The remaining receptors are predicted to experience potential glare of green magnitude from PV Areas 1, 2, 3 and 4. These are located southeast (OP 17, OP 18, OP 19, OP 20, OP 26), southwest (OP 27, OP 28, OP 29, OP 30, OP 31, OP 36, OP 37 and OP 38) and west (OP 1, OP 12, OP 35, OP 39, and OP 40) of the Proposed Development.

The simulation has accounted for the existing as well as planned screening vegetation, specifically native woodland of 3 m height and hedgerows of 1.5 m in height. The proposed/ planned screening measures included in simulation are depicted below in **Graphic 5-5**.

Graphic 5-5: Planned screening measures (white) included in the simulation.

Despite this mitigation, some residual glare is still predicted which has been discussed above in **Table 5-4**. In the worst-case scenario, this could result in up to 29 minutes of glare per day for OP 37 and OP 38 during the morning hours (05:00 to 06:30) when the sun is low in the sky and reflects westwards during sunrise, with no occurrence outside of the mid-March to September timeframe.

The predicted glare is of green magnitude, which is lower in intensity than reflections from windows or bodies of water and does **not pose a risk** to health or safety. Furthermore, as noted in the Modelling Limitations section, the software does not account for intervening topography or obstructions and assumes 365 days of clear, sunny conditions per year.

As such, under real-life conditions, the potential impact on these receptors is considered **negligible**.

5.3.2 Roads

The G&G assessment evaluated three routes that include roads: M90, A912, and Leden Urquhart Road. Existing screening measures, such as trees and hedgerows, as well as planned vegetation (discussed above in **Section 5.3.1**), have been incorporated in the simulation. However, due to modelling limitations, it was not possible to include all the screening vegetation, obstructions, and intervening topography in the model. As a result, the predicted outcomes may represent a conservative scenario, and the actual level of impact in real-life conditions is likely to be lower once all mitigation measures are in place.

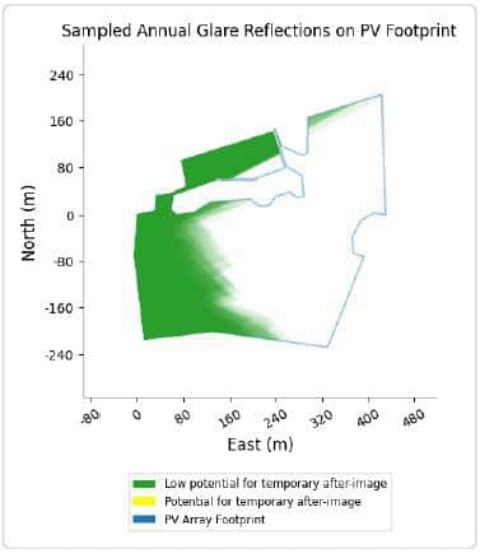
According to the Forge Solar Analysis (**Annex A**), Route 1 (M90) and Route 3 (Leden Urquhart Road) are expected to be potentially affected by mostly green glare as follows:

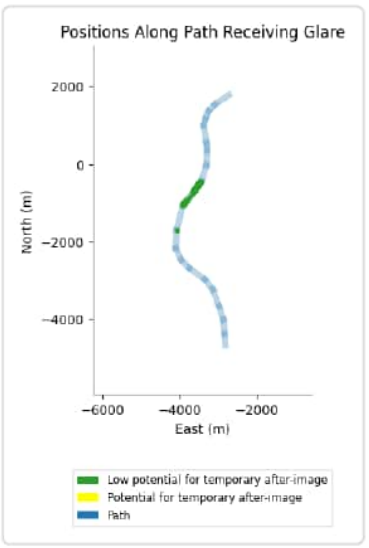
- Route 1 (M90) is potentially impacted by green glare only up to 23 minutes per day during mid-March to mid-July and August to mid-September, in the morning hours (05:00 to 06:30) due to the low angle of the sun at that time of the day. Route 1 is affected by all four PV Areas 1, 2, 3, and 4.

- Route 3 is potentially affected by both green and yellow glare, but mainly green glare. Green glare is expected for up to 28 mins per day during mid-March to mid-September during the evening hours (18:00 and 19:30), again due to the low angle of the sun at that time of the day. It may be subjected to yellow glare for up to 29 minutes per day from May to mid-August, during the evening hours (18:00 to 19.30). Route 3 is affected by 241 mins of yellow glare and 6,189 mins of green glare in total over the whole year. PV Areas 3 & 4 affect the Route 3.

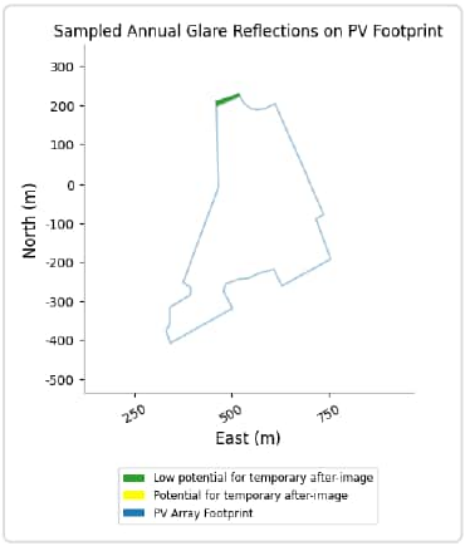
Additionally, **Graphic 5-6** and **Graphic 5-7** illustrate where the G&G emanates from, and which part of the route is affected by it.

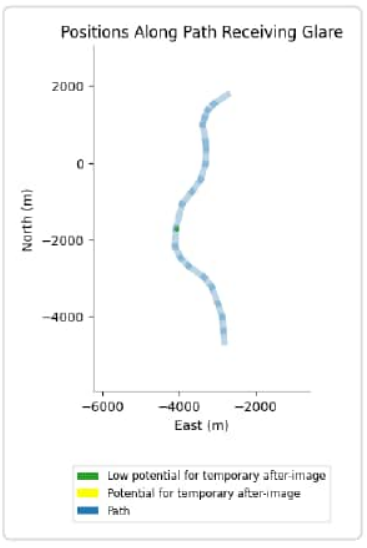
PV Area 1



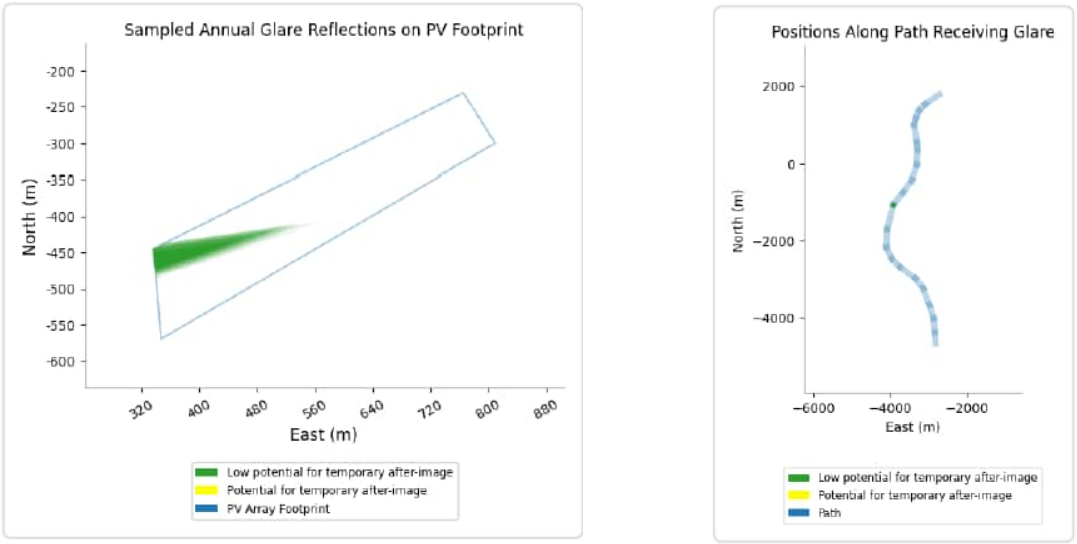


PV Area 2

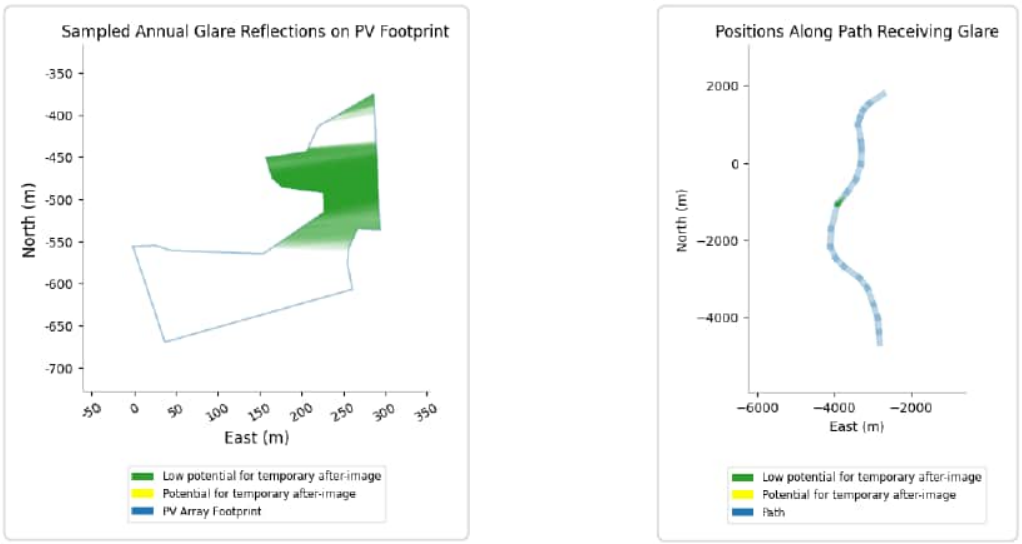




PV Area 3

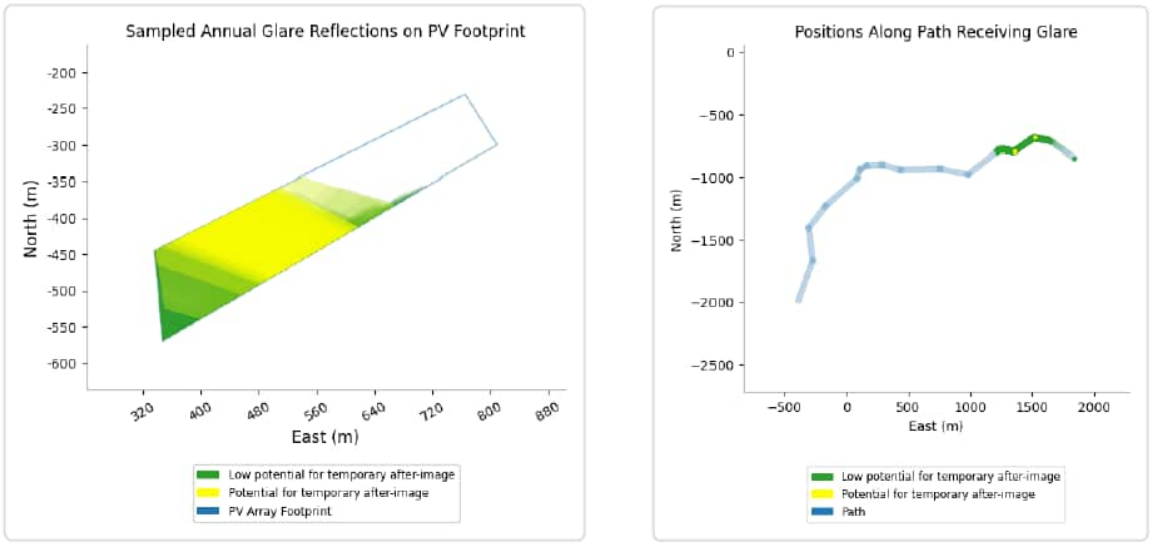


PV Area 4

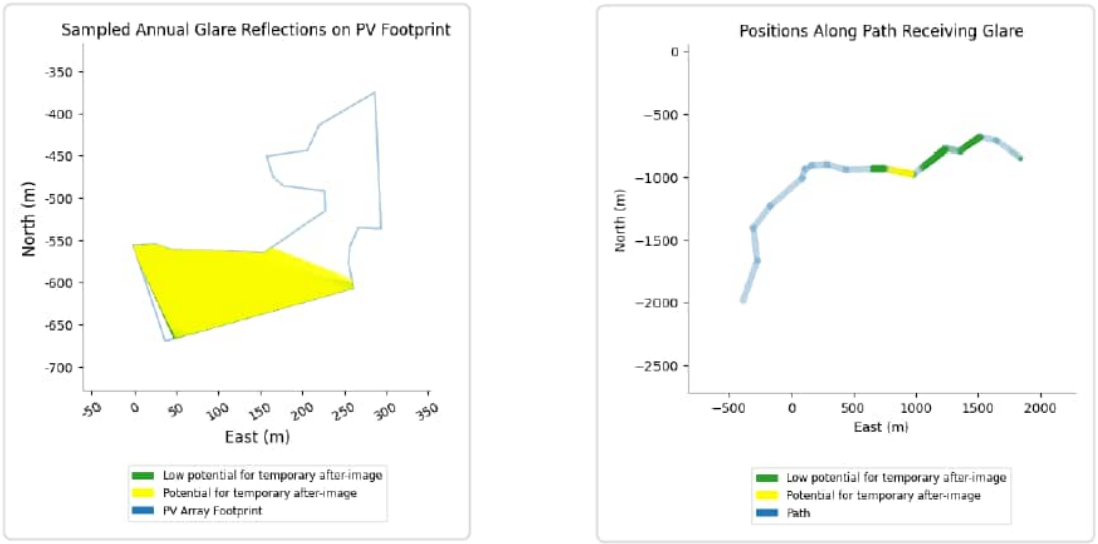


Graphic 5-6: Glare emanating from PV Areas (left) and impacting on sections of Route 1 (right).

PV Area 3



PV Area 4



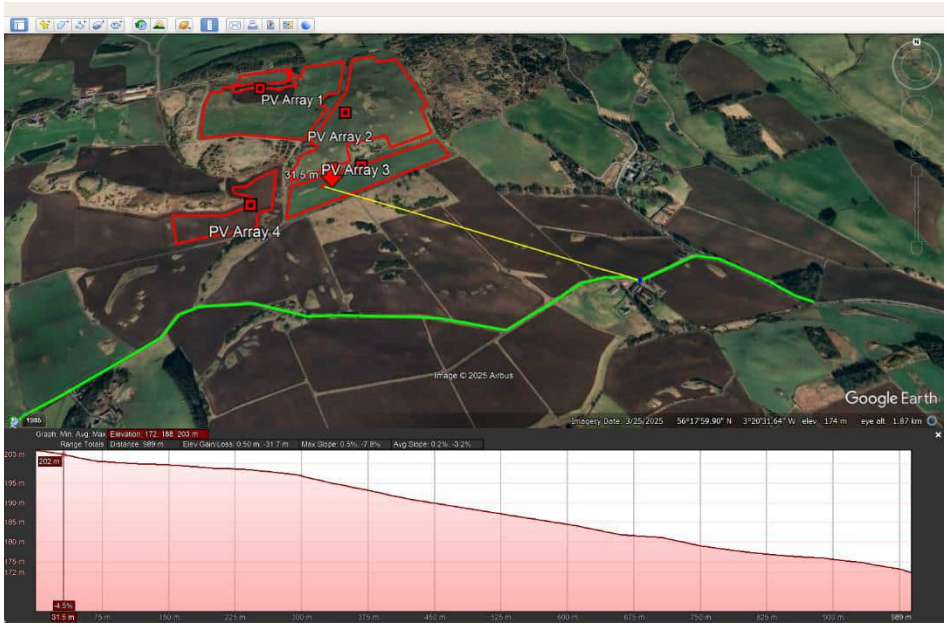
Graphic 5-7: Glare emanating from PV Areas (left) and impacting on sections of Route 3 (right).

While there are already existing and proposed screenings in place, additionally there are several existing screenings such as trees and hedgerows along the sections of routes 1 and 3 affected by glare, which would obstruct the glare under real-life conditions. However, these obstructions (see **Graphic 5-8** and **Graphic 5-9**) could not be included in the assessment due to software limitations.

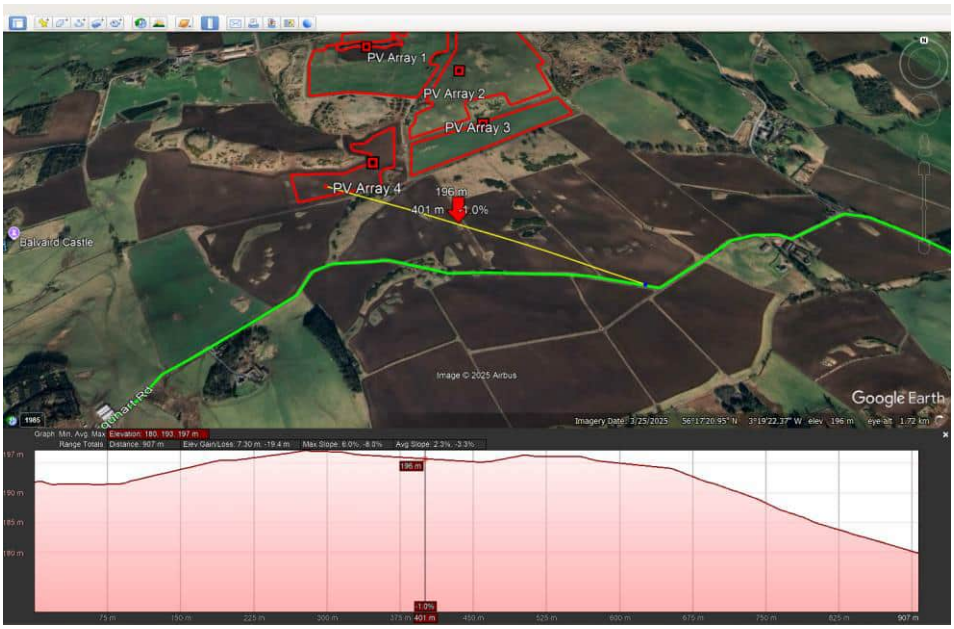
Graphic 5-8: Existing screenings along Route 1 not included in the simulation.

Graphic 5-9: Existing screenings along Route 3 not included in the simulation.

Additionally, there is intervening topography between the area of PV arrays 3 and 4 where glare emanates and Route 3, which is not accounted for in the simulation. In real-life conditions, this will screen the glare from PV array 3 & 4 to Route 3 and thus the potential impact is expected to be less significant. The intervening topography is illustrated below in **Graphic 5-10** with the help of the elevation profile from Google Earth Pro. As it can be seen from the figure, sections of Route 3 which is affected by yellow glare is located at an approximate elevation of 170-180 m whereas the areas of PV array 3 and 4 where glare emanates are at approximately 190 m and above.



Elevation profile from PV Array 3 to Route 3



Elevation profile from PV Array 4 to Route 3

Graphic 5-10: Elevation profile between Route 3 and PV areas 3 and 4 from where yellow glare emanates.

In conclusion, the combination of short exposure durations (50 hours for Route 1 and 103 hours for Route 3), limited occurrence of yellow glare, presence of existing and proposed mitigation measures, as well as intervening topography means that the potential G&G impact on Routes 1 & 3 is **negligible** and unlikely to pose a risk to health or safety.

Furthermore, the impact occurs when the sun is low in the sky, and the angle may limit direct visibility depending on vehicle orientation. As such, the risk to vehicle movement on roads is assessed to be **low**.

6.0 Conclusion

The purpose of this G&G assessment is to consider the effects of G&G arising from the Proposed Development on receptors around the site. For glare to occur there must be viable weather conditions, the geometrical alignment for glint (i.e. reflected light must physically arrive at the receptor, given the relative position of the sun in the sky and the panels), and there must be visibility of the panels (i.e. no intervening landform, or surface features (buildings, trees, hedgerows etc).

The software used for the simulation (GlareGauge tool by ForgeSolar) has some limitations (which are discussed in the report) such as treating the circumference of trees at ground and tip height as uniform, despite the trunk of tree being much smaller than the body of the tree. Additionally, G&G can only occur under sunny conditions, which the software does not explicitly account for, potentially leading to overestimations of its occurrence and impact. This can also affect the assessment of how obstacles mitigate G&G on sensitive receptors.

The G&G assessment identified low potential impacts on fixed receptors and transport routes, surrounding the Proposed Development. Of the 51 assessed fixed ground receptors, only one (OP2) is predicted to experience potentially significant effects (yellow glare). However, these impacts are likely overestimated due to conservative modelling assumptions and the presence of intervening topography between the receptor and the PV area that will block the glare. Other fixed receptors are expected to experience low-intensity (green) glare with no health or safety implications.

For transport routes, Route 3 is only expected to be potentially affected by yellow glare for a limited period only. The study has included existing as well as proposed vegetations in the simulation, however, there are several existing screenings along Route 3 and an intervening topography between PV areas where glare emanates and Route 3 that have not been included due to software limitations. Existing screening measures, intervening topography and conservative modelling assumptions, indicate that these impacts are overstated and unlikely to cause any significant impacts. Route 1 is expected to experience low-intensity (green) glare with no health or safety implications, and Route 2 is not expected to experience any glare.

Overall, the study provides a conservative assessment of potential glare impacts, incorporating worst-case assumptions such as daily sunny conditions, and real-world impacts are expected to be lower.

Annex A Forge Solar Analysis

Appendix H: Glint and Glare Assessment

Binn Farm Solar & BESS

TRIO Power Limited

SLR Project No.: 405.065788.00001

16 December 2025

FORGESOLAR GLARE ANALYSIS

Project: **Binn Farm Solar**
Site configuration: **Binn Farm Solar v2**

Client: Trio Power

Created 22 Oct, 2025
Updated 22 Oct, 2025
Time-step 1 minute
Timezone offset UTC0
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 10 MW to 100 MW
Site ID 162430.26877

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

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	20.0	180.0	10,119	168.7	1,196	19.9	-
PV array 2	20.0	180.0	5,920	98.7	0	0.0	-
PV array 3	20.0	180.0	12,468	207.8	99	1.6	-
PV array 4	20.0	180.0	18,622	310.4	123	2.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	3,031	50.5	0	0.0
Route 2	0	0.0	0	0.0
Route 3	6,213	103.5	222	3.7
OP 1	2,019	33.6	0	0.0
OP 2	3,500	58.3	1,196	19.9
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	3,582	59.7	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	2,874	47.9	0	0.0
OP 18	3,027	50.5	0	0.0
OP 19	2,411	40.2	0	0.0
OP 20	1,974	32.9	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	1,686	28.1	0	0.0
OP 27	1,060	17.7	0	0.0
OP 28	760	12.7	0	0.0
OP 29	636	10.6	0	0.0
OP 30	951	15.8	0	0.0
OP 31	3,725	62.1	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	4,231	70.5	0	0.0
OP 36	1,273	21.2	0	0.0
OP 37	1,778	29.6	0	0.0
OP 38	1,541	25.7	0	0.0
OP 39	644	10.7	0	0.0
OP 40	213	3.5	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 20.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.296198	-3.331368	234.00	2.67	236.67
2	56.295558	-3.331443	232.05	2.67	234.72
3	56.294266	-3.331170	221.12	2.67	223.79
4	56.294388	-3.329254	224.74	2.67	227.41
5	56.294145	-3.326043	223.55	2.67	226.22
6	56.295550	-3.325024	228.79	2.67	231.46
7	56.295604	-3.325314	228.23	2.67	230.90
8	56.295842	-3.325356	228.16	2.67	230.83
9	56.296104	-3.325120	228.82	2.67	231.49
10	56.296229	-3.324745	229.67	2.67	232.34
11	56.296199	-3.324423	231.10	2.67	233.77
12	56.298045	-3.324530	223.71	2.67	226.38
13	56.297687	-3.326590	224.79	2.67	227.46
14	56.297122	-3.326612	226.58	2.67	229.25
15	56.297104	-3.326794	226.80	2.67	229.47
16	56.297241	-3.327331	227.95	2.67	230.62
17	56.297509	-3.327524	227.92	2.67	230.59
18	56.296931	-3.327213	228.51	2.67	231.18
19	56.296783	-3.326762	227.74	2.67	230.41
20	56.296479	-3.326698	228.00	2.67	230.67
21	56.296467	-3.326934	228.39	2.67	231.06
22	56.296550	-3.327095	228.85	2.67	231.52
23	56.296479	-3.327502	230.02	2.67	232.69
24	56.296336	-3.327695	230.31	2.67	232.98
25	56.296336	-3.327964	230.69	2.67	233.36
26	56.296443	-3.328210	231.08	2.67	233.75
27	56.296390	-3.329337	233.23	2.67	235.90
28	56.296235	-3.329777	233.56	2.67	236.23
29	56.296199	-3.330270	234.00	2.67	236.67
30	56.296277	-3.330420	234.00	2.67	236.67
31	56.296503	-3.330367	234.00	2.67	236.67
32	56.296741	-3.329154	232.92	2.67	235.59
33	56.296729	-3.328103	230.84	2.67	233.51
34	56.296902	-3.327245	228.68	2.67	231.35
35	56.297467	-3.327577	228.16	2.67	230.83
36	56.297015	-3.330142	235.27	2.67	237.94
37	56.296640	-3.329981	233.97	2.67	236.64
38	56.296509	-3.330496	234.00	2.67	236.67
39	56.296497	-3.330839	234.00	2.67	236.67
40	56.296259	-3.330871	234.00	2.67	236.67

Name: PV array 2
Axis tracking: Fixed (no rotation)
Tilt: 20.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.298086	-3.323930	225.44	2.67	228.11
2	56.298223	-3.323178	227.79	2.67	230.46
3	56.298259	-3.323007	227.91	2.67	230.58
4	56.298063	-3.322803	230.66	2.67	233.33
5	56.297932	-3.322535	232.28	2.67	234.95
6	56.297896	-3.322245	233.74	2.67	236.41
7	56.297926	-3.321891	235.26	2.67	237.93
8	56.298039	-3.321494	236.36	2.67	239.03
9	56.295509	-3.319477	244.76	2.67	247.43
10	56.295395	-3.319788	243.64	2.67	246.31
11	56.294479	-3.319177	226.88	2.67	229.55
12	56.293853	-3.321194	217.45	2.67	220.12
13	56.294240	-3.321548	224.63	2.67	227.30
14	56.294145	-3.322159	223.38	2.67	226.05
15	56.294026	-3.322610	222.04	2.67	224.71
16	56.294008	-3.322985	221.81	2.67	224.48
17	56.293895	-3.323554	220.33	2.67	223.00
18	56.293722	-3.323629	217.77	2.67	220.44
19	56.293335	-3.323254	211.30	2.67	213.97
20	56.292532	-3.325850	210.46	2.67	213.13
21	56.292823	-3.326022	214.18	2.67	216.85
22	56.292960	-3.325871	215.10	2.67	217.77
23	56.293359	-3.325861	218.91	2.67	221.58
24	56.293645	-3.325013	219.33	2.67	222.00
25	56.293812	-3.324981	220.76	2.67	223.43
26	56.293931	-3.325314	221.88	2.67	224.55
27	56.296128	-3.323844	233.80	2.67	236.47

Name: PV array 3
Axis tracking: Fixed (no rotation)
Tilt: 20.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.292204	-3.325936	207.60	2.67	210.27
2	56.291085	-3.325764	198.57	2.67	201.24
3	56.293502	-3.318297	208.54	2.67	211.21
4	56.294127	-3.319005	219.51	2.67	222.18

Name: PV array 4
Axis tracking: Fixed (no rotation)
Tilt: 20.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.291207	-3.331388	191.13	2.67	193.80
2	56.290182	-3.330776	183.02	2.67	185.69
3	56.290748	-3.327150	196.71	2.67	199.38
4	56.291016	-3.327246	198.62	2.67	201.29
5	56.291189	-3.327225	199.93	2.67	202.60
6	56.291397	-3.327053	202.27	2.67	204.94
7	56.291385	-3.326624	201.62	2.67	204.29
8	56.292826	-3.326742	216.46	2.67	219.13
9	56.292481	-3.327815	216.84	2.67	219.51
10	56.292207	-3.328040	213.97	2.67	216.64
11	56.292141	-3.328824	213.58	2.67	216.25
12	56.291945	-3.328716	211.39	2.67	214.06
13	56.291844	-3.328512	209.77	2.67	212.44
14	56.291784	-3.327708	207.90	2.67	210.57
15	56.291576	-3.327697	205.17	2.67	207.84
16	56.291129	-3.328877	198.19	2.67	200.86
17	56.291165	-3.330669	193.86	2.67	196.53
18	56.291218	-3.330948	193.23	2.67	195.90

Route Receptors

Name: Route 1
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.312050	-3.375414	131.38	1.50	132.88
2	56.309860	-3.381379	147.58	1.50	149.08
3	56.308337	-3.383997	162.64	1.50	164.14
4	56.306575	-3.385327	166.40	1.50	167.90
5	56.305004	-3.386057	163.23	1.50	164.73
6	56.300980	-3.384898	153.86	1.50	155.36
7	56.299233	-3.384590	153.99	1.50	155.49
8	56.296042	-3.384890	148.39	1.50	149.89
9	56.292303	-3.387036	133.97	1.50	135.47
10	56.289485	-3.390609	142.12	1.50	143.62
11	56.286603	-3.394772	139.71	1.50	141.21
12	56.280942	-3.397306	145.33	1.50	146.83
13	56.276701	-3.397692	152.21	1.50	153.71
14	56.273985	-3.395417	150.70	1.50	152.20
15	56.272078	-3.392070	148.81	1.50	150.31
16	56.269362	-3.385547	142.55	1.50	144.05
17	56.267074	-3.382285	143.43	1.50	144.93
18	56.263165	-3.379624	135.72	1.50	137.22
19	56.260100	-3.377795	144.98	1.50	146.48
20	56.256787	-3.377152	152.77	1.50	154.27
21	56.254165	-3.376851	152.79	1.50	154.29

Name: Route 2
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.298479	-3.353767	121.09	1.50	122.59
2	56.296562	-3.353488	123.86	1.50	125.36
3	56.292847	-3.351471	137.45	1.50	138.95
4	56.290834	-3.349947	144.18	1.50	145.68
5	56.290048	-3.349776	147.57	1.50	149.07
6	56.286926	-3.348128	152.35	1.50	153.85
7	56.286394	-3.347944	152.80	1.50	154.30
8	56.284530	-3.347665	156.38	1.50	157.88
9	56.281883	-3.347888	159.46	1.50	160.96
10	56.280615	-3.348350	155.83	1.50	157.33
11	56.280152	-3.348135	151.64	1.50	153.14
12	56.279151	-3.347159	145.98	1.50	147.48
13	56.276810	-3.343307	135.27	1.50	136.77
14	56.275367	-3.343280	132.86	1.50	134.36
15	56.274592	-3.343516	131.11	1.50	132.61
16	56.274044	-3.343215	128.11	1.50	129.61
17	56.273353	-3.341885	123.01	1.50	124.51
18	56.272734	-3.339675	118.67	1.50	120.17
19	56.272638	-3.337529	115.68	1.50	117.18
20	56.268829	-3.321843	93.31	1.50	94.81

Name: Route 3
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	56.288621	-3.301744	136.55	1.50	138.05
2	56.289812	-3.304813	144.96	1.50	146.46
3	56.290074	-3.306873	157.13	1.50	158.63
4	56.289061	-3.309512	172.36	1.50	173.86
5	56.289228	-3.311336	176.06	1.50	177.56
6	56.287442	-3.315520	177.45	1.50	178.95
7	56.287847	-3.319168	189.15	1.50	190.65
8	56.287774	-3.324263	201.28	1.50	202.78
9	56.288137	-3.326719	199.91	1.50	201.41
10	56.288065	-3.328704	196.80	1.50	198.30
11	56.287815	-3.329573	193.96	1.50	195.46
12	56.287160	-3.329960	193.74	1.50	195.24
13	56.285177	-3.334079	190.16	1.50	191.66
14	56.283593	-3.336257	192.02	1.50	193.52
15	56.281242	-3.335745	169.93	1.50	171.43
16	56.278383	-3.337569	149.33	1.50	150.83

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	56.295610	-3.338590	211.20	4.50
OP 2	2	56.295195	-3.337954	208.69	4.50
OP 3	3	56.296216	-3.338356	212.85	4.50
OP 4	4	56.304609	-3.340237	194.84	4.50
OP 5	5	56.304806	-3.339352	196.45	4.50
OP 6	6	56.306110	-3.340651	206.85	4.50
OP 7	7	56.305131	-3.330568	208.80	4.50
OP 8	8	56.305460	-3.330847	210.87	4.50
OP 9	9	56.305753	-3.330997	212.65	4.50
OP 10	10	56.305713	-3.329763	212.71	4.50
OP 11	11	56.303471	-3.320226	224.54	4.50
OP 12	12	56.288938	-3.342657	175.74	4.50
OP 13	13	56.285736	-3.332651	192.83	4.50
OP 14	14	56.285614	-3.332468	193.72	4.50
OP 15	15	56.284869	-3.331312	197.27	4.50
OP 16	16	56.285424	-3.331495	197.86	4.50
OP 17	17	56.288083	-3.310409	170.23	4.50
OP 18	18	56.288318	-3.309162	169.44	4.50
OP 19	19	56.289957	-3.307325	160.17	4.50
OP 20	20	56.290074	-3.307051	158.11	4.50
OP 21	21	56.292764	-3.309371	172.51	4.50
OP 22	22	56.291993	-3.309033	167.80	4.50
OP 23	23	56.293353	-3.308486	172.68	4.50
OP 24	24	56.293202	-3.308009	169.04	4.50
OP 25	25	56.293597	-3.308164	172.70	4.50
OP 26	26	56.283569	-3.296085	101.13	4.50
OP 27	27	56.286634	-3.348426	153.66	4.50
OP 28	28	56.286336	-3.348652	154.82	4.50
OP 29	29	56.286220	-3.348276	154.25	4.50
OP 30	30	56.285726	-3.347992	155.63	4.50
OP 31	31	56.287649	-3.348947	152.86	4.50
OP 32	32	56.280372	-3.342717	158.46	4.50
OP 33	33	56.280482	-3.343168	158.78	4.50
OP 34	34	56.280500	-3.347792	155.97	4.50
OP 35	35	56.287866	-3.362879	212.15	4.50
OP 36	36	56.283853	-3.354051	180.98	4.50
OP 37	37	56.283388	-3.357669	191.79	4.50
OP 38	38	56.282962	-3.357986	191.71	4.50
OP 39	39	56.292854	-3.363619	199.94	4.50
OP 40	40	56.293769	-3.364494	208.60	4.50
OP 41	41	56.294720	-3.364990	206.30	4.50
OP 42	42	56.295273	-3.365467	206.25	4.50
OP 43	43	56.295639	-3.365296	203.50	4.50
OP 44	44	56.297780	-3.363414	187.87	4.50
OP 45	45	56.298274	-3.360759	169.85	4.50
OP 46	46	56.297042	-3.361740	176.71	4.50
OP 47	47	56.299306	-3.361449	167.80	4.50
OP 48	48	56.299027	-3.362838	174.13	4.50
OP 49	49	56.299886	-3.298775	191.83	4.50
OP 50	50	56.295010	-3.340562	206.26	4.50
OP 51	51	56.294909	-3.342363	205.54	4.50

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 52	52	56.300075	-3.322689	204.75	4.50

Obstruction Components

Name: Obstruction 10
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.297121	-3.334000	221.19
2	56.296576	-3.333882	223.52
3	56.297904	-3.326693	224.32
4	56.299136	-3.327509	210.72
5	56.299303	-3.328442	208.71
6	56.298005	-3.332058	227.04
7	56.297469	-3.333120	226.03
8	56.297121	-3.334000	221.19

Name: Obstruction 11
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.300621	-3.320756	209.00
2	56.300079	-3.321400	210.30
3	56.299478	-3.320316	227.44
4	56.300823	-3.316325	227.20
5	56.302359	-3.316862	221.45
6	56.302472	-3.317838	219.32
7	56.300984	-3.318396	218.71
8	56.300621	-3.320756	209.00

Name: Obstruction 12
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.296095	-3.338765	212.39
2	56.295884	-3.338636	212.25
3	56.295139	-3.339066	208.18
4	56.295610	-3.339978	210.14
5	56.295389	-3.341732	206.25
6	56.296038	-3.341882	205.98
7	56.296279	-3.341179	206.31
8	56.295934	-3.339371	211.50
9	56.296095	-3.338765	212.39

Name: Obstruction 13
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.295266	-3.340123	209.17
2	56.295049	-3.340303	206.99
3	56.294897	-3.339935	206.20
4	56.295003	-3.339841	207.21
5	56.295094	-3.340144	207.57
6	56.295266	-3.340123	209.17

Name: Obstruction 14
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.294731	-3.342792	205.97
2	56.295451	-3.342491	207.38
3	56.295496	-3.342212	206.66
4	56.294629	-3.341960	203.14
5	56.294662	-3.341547	203.14
6	56.295406	-3.341783	206.18
7	56.295671	-3.342486	206.83
8	56.295993	-3.344170	207.32
9	56.294600	-3.343221	206.47
10	56.294731	-3.342792	205.97

Name: Obstruction 15
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.295359	-3.333816	217.85
2	56.293981	-3.332867	208.13
3	56.293117	-3.331735	208.27
4	56.293231	-3.331606	208.90
5	56.294347	-3.332529	214.38
6	56.295359	-3.333816	217.85

Name: Obstruction 16
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.292295	-3.343145	181.90
2	56.290866	-3.342909	183.34
3	56.291688	-3.341170	185.76
4	56.292414	-3.341621	184.34
5	56.292295	-3.343145	181.90

Name: Obstruction 17
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.285408	-3.339682	181.83
2	56.284551	-3.340175	183.39
3	56.283610	-3.339102	188.07
4	56.284134	-3.336656	192.55
5	56.285361	-3.337879	189.59
6	56.285408	-3.339531	182.58
7	56.285408	-3.339682	181.83

Name: Obstruction 18
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.286724	-3.328931	196.94
2	56.286224	-3.329414	197.70
3	56.285158	-3.327805	196.60
4	56.284735	-3.327333	191.43
5	56.284694	-3.326914	189.93
6	56.286254	-3.328298	199.87
7	56.286724	-3.328931	196.94

Name: Obstruction 19
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.286236	-3.331614	193.10
2	56.285313	-3.332461	194.52
3	56.284455	-3.332558	193.02
4	56.284503	-3.331420	194.20
5	56.285361	-3.331850	196.93
6	56.286063	-3.330777	196.24
7	56.286236	-3.331614	193.10

Name: Obstruction 1 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.294615	-3.331738	223.68
2	56.294596	-3.331593	224.63
3	56.293959	-3.331523	217.29
4	56.293965	-3.331674	216.69
5	56.294615	-3.331738	223.68

Name: Obstruction 20
Top height: 7.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.294060	-3.313056	200.48
2	56.292352	-3.311619	179.47
3	56.292369	-3.315760	191.92
4	56.292054	-3.315749	190.52
5	56.292024	-3.306855	152.64
6	56.292346	-3.306962	155.29
7	56.292316	-3.309956	173.70
8	56.294060	-3.313056	200.48

Name: Obstruction 2 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.294105	-3.330743	220.18
2	56.294185	-3.329592	223.36
3	56.294020	-3.330308	221.13
4	56.294105	-3.330743	220.18

Name: Obstruction 3 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.293960	-3.330185	221.14
2	56.294105	-3.329761	222.59
3	56.294170	-3.329246	223.60
4	56.294114	-3.328275	224.36
5	56.294033	-3.328814	223.43
6	56.293919	-3.329421	222.14
7	56.293960	-3.330185	221.14

Name: Obstruction 4 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.296991	-3.330974	235.30
2	56.296934	-3.330738	235.04
3	56.298336	-3.323045	226.90
4	56.298452	-3.322965	226.02
5	56.296991	-3.330974	235.30

Name: Obstruction 5 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.291220	-3.331450	191.04
2	56.291235	-3.331573	190.70
3	56.290017	-3.330876	182.41
4	56.290041	-3.330747	182.88
5	56.291220	-3.331450	191.04

Name: Obstruction 6 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.292393	-3.329073	215.83
2	56.292199	-3.329030	213.96
3	56.292247	-3.328671	214.73
4	56.292426	-3.328794	216.61
5	56.292393	-3.329073	215.83

Name: Obstruction 7 P Native Woodland
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.291113	-3.326354	198.92
2	56.291187	-3.326681	199.78
3	56.291074	-3.326890	199.20
4	56.290919	-3.326906	198.24
5	56.290755	-3.326740	197.41
6	56.290806	-3.326413	197.49
7	56.291008	-3.326203	198.27
8	56.291113	-3.326354	198.92

Name: Obstruction 8 P Hedgerow
Top height: 1.5 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.298087	-3.321264	237.11
2	56.298063	-3.321371	236.75
3	56.295475	-3.319322	244.59
4	56.295359	-3.319678	243.35
5	56.294474	-3.319096	226.65
6	56.294494	-3.319037	227.04
7	56.295329	-3.319601	243.10
8	56.295459	-3.319202	244.53
9	56.298087	-3.321264	237.11

Name: Obstruction 9 P Hedgerow
Top height: 1.5 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	56.291062	-3.325635	198.54
2	56.291019	-3.325589	198.42
3	56.293420	-3.318228	207.27
4	56.293453	-3.318284	207.81
5	56.291062	-3.325635	198.54

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	20.0	180.0	10,119	168.7	1,196	19.9	-
PV array 2	20.0	180.0	5,920	98.7	0	0.0	-
PV array 3	20.0	180.0	12,468	207.8	99	1.6	-
PV array 4	20.0	180.0	18,622	310.4	123	2.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	3,031	50.5	0	0.0
Route 2	0	0.0	0	0.0
Route 3	6,213	103.5	222	3.7
OP 1	2,019	33.6	0	0.0
OP 2	3,500	58.3	1,196	19.9
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	3,582	59.7	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	2,874	47.9	0	0.0
OP 18	3,027	50.5	0	0.0
OP 19	2,411	40.2	0	0.0
OP 20	1,974	32.9	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	1,686	28.1	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 27	1,060	17.7	0	0.0
OP 28	760	12.7	0	0.0
OP 29	636	10.6	0	0.0
OP 30	951	15.8	0	0.0
OP 31	3,725	62.1	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	4,231	70.5	0	0.0
OP 36	1,273	21.2	0	0.0
OP 37	1,778	29.6	0	0.0
OP 38	1,541	25.7	0	0.0
OP 39	644	10.7	0	0.0
OP 40	213	3.5	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

PV: PV array 1 potential temporary after-image

Receptor results ordered by category of glare

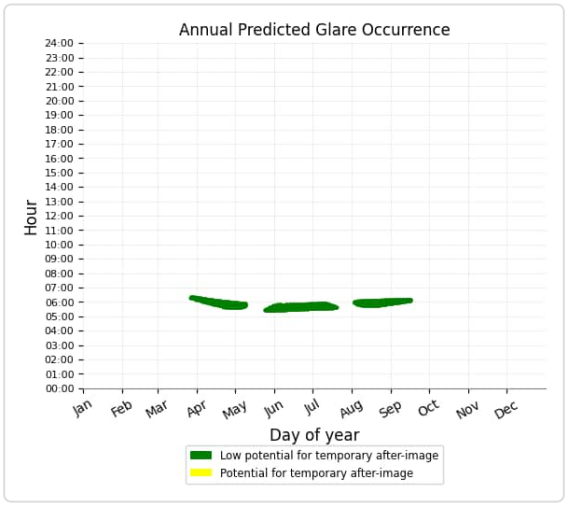
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	2,454	40.9	0	0.0
Route 2	0	0.0	0	0.0
Route 3	0	0.0	0	0.0
OP 2	2,630	43.8	1,196	19.9
OP 1	1,702	28.4	0	0.0
OP 31	838	14.0	0	0.0
OP 35	1,713	28.6	0	0.0
OP 39	569	9.5	0	0.0
OP 40	213	3.5	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0

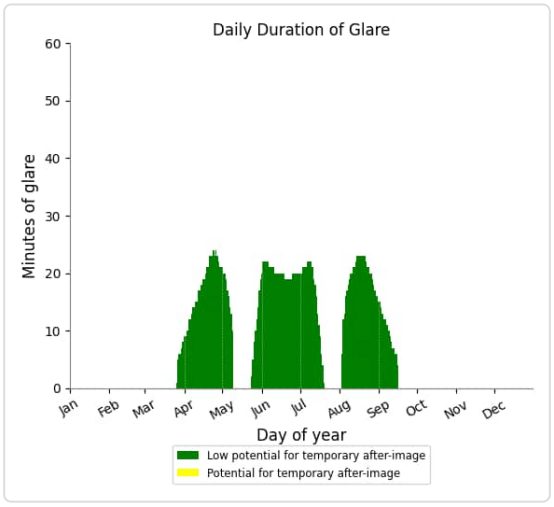
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

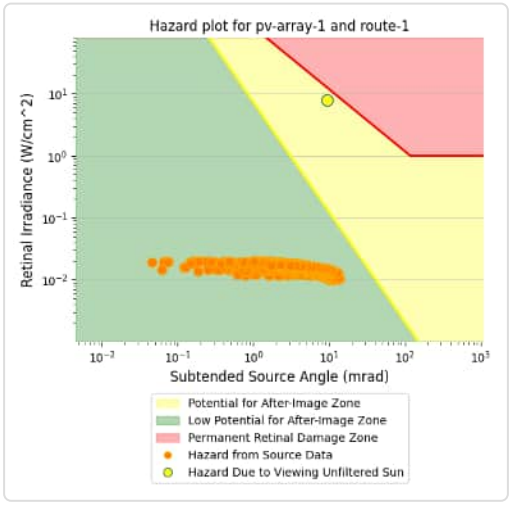
PV array 1 and Route: Route 1

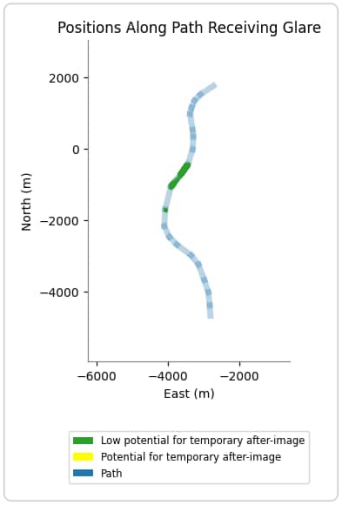
Yellow glare: none

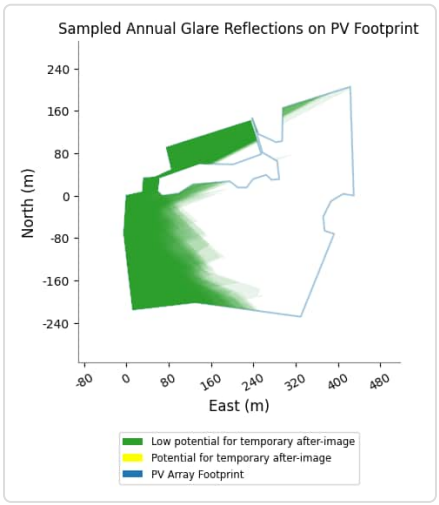
Green glare: 2,454 min.











PV array 1 and Route: Route 2

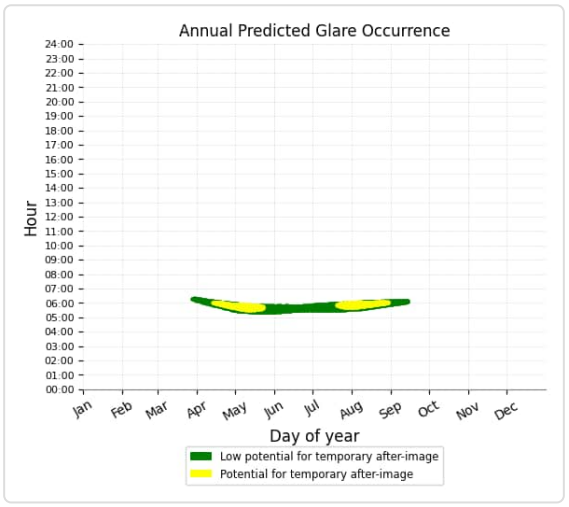
No glare found

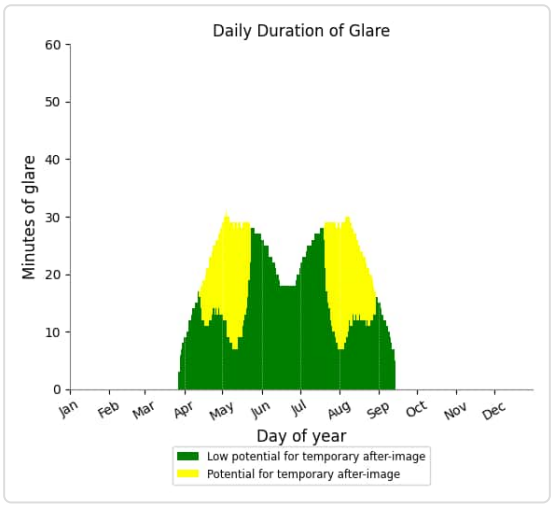
PV array 1 and Route: Route 3

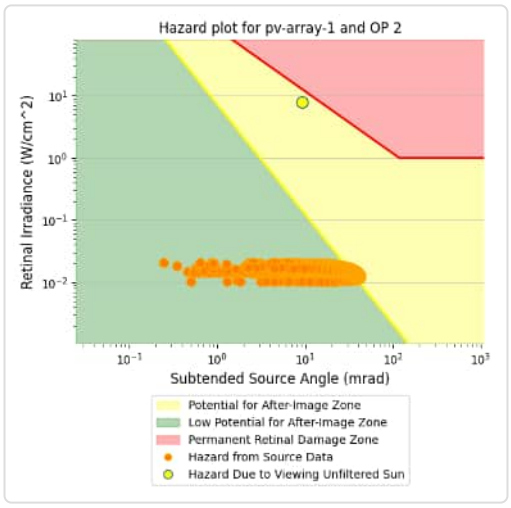
No glare found

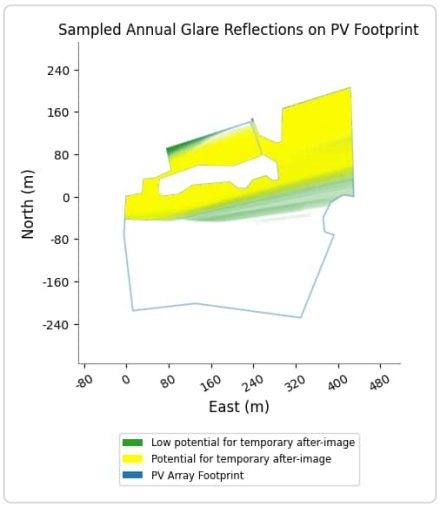
PV array 1 and OP 2

Yellow glare: 1,196 min.
Green glare: 2,630 min.





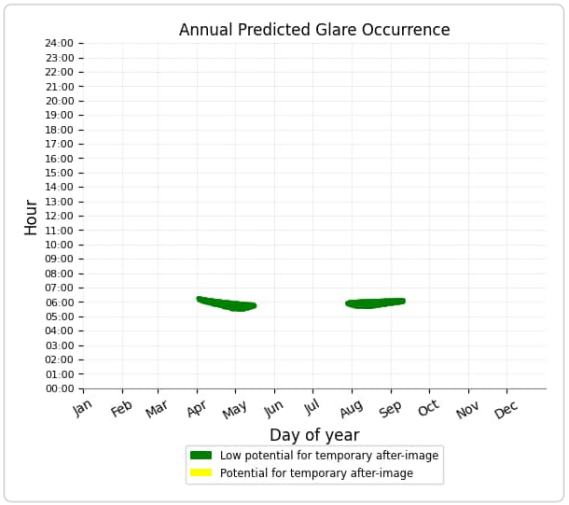


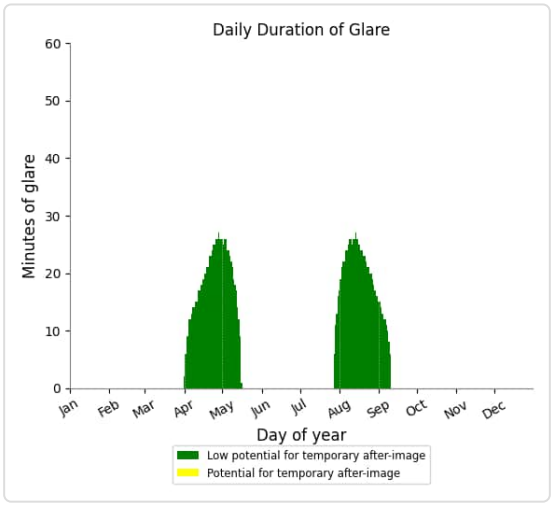


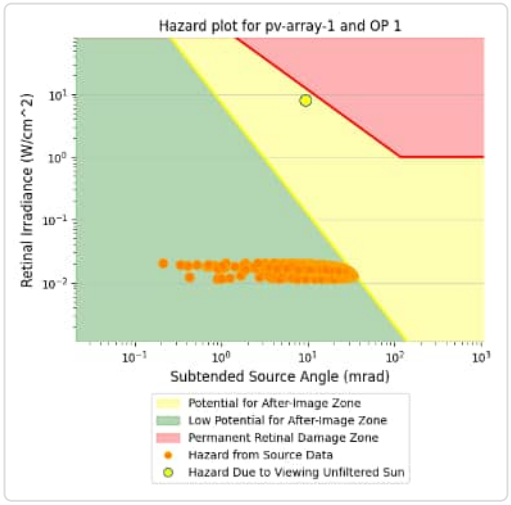
PV array 1 and OP 1

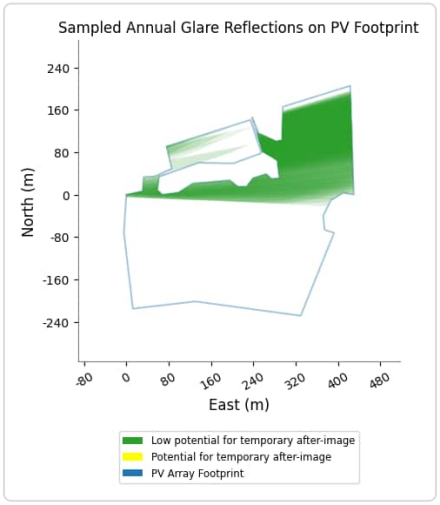
Yellow glare: none

Green glare: 1,702 min.





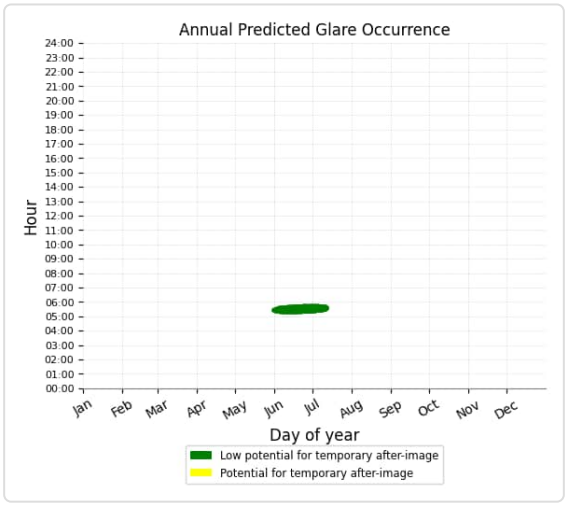


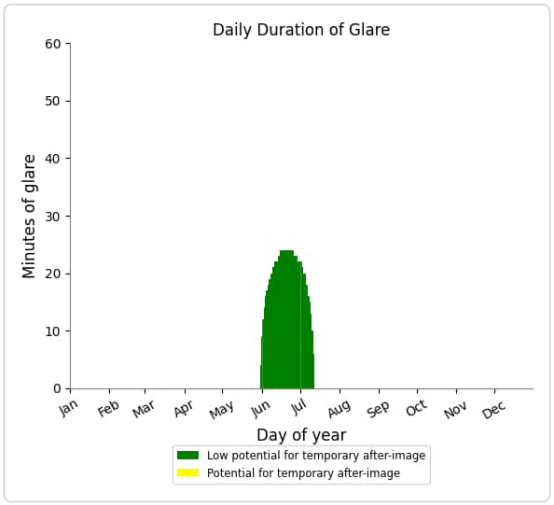


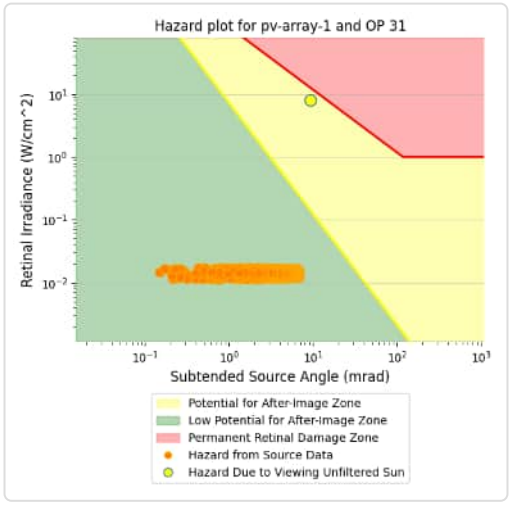
PV array 1 and OP 31

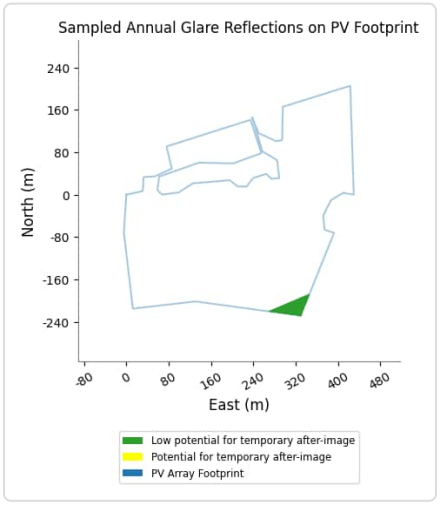
Yellow glare: none

Green glare: 838 min.





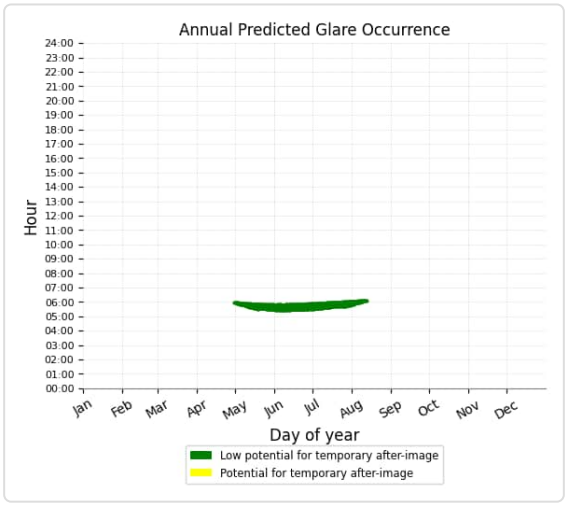


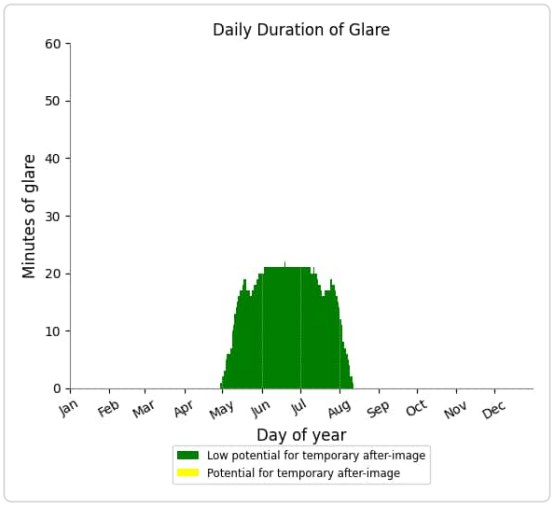


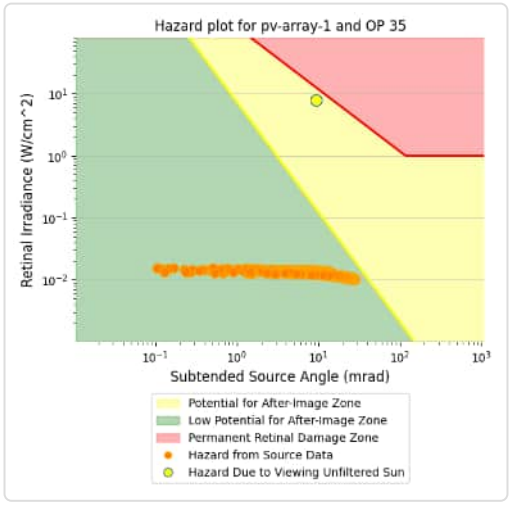
PV array 1 and OP 35

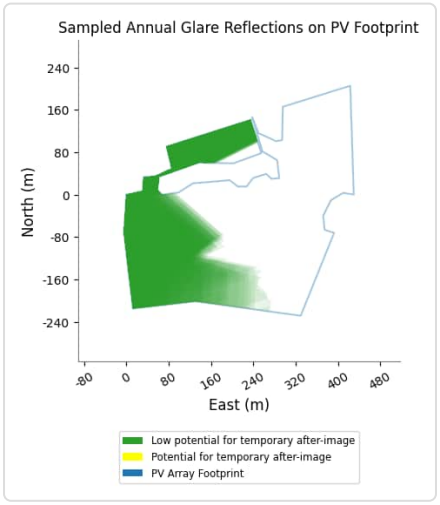
Yellow glare: none

Green glare: 1,713 min.





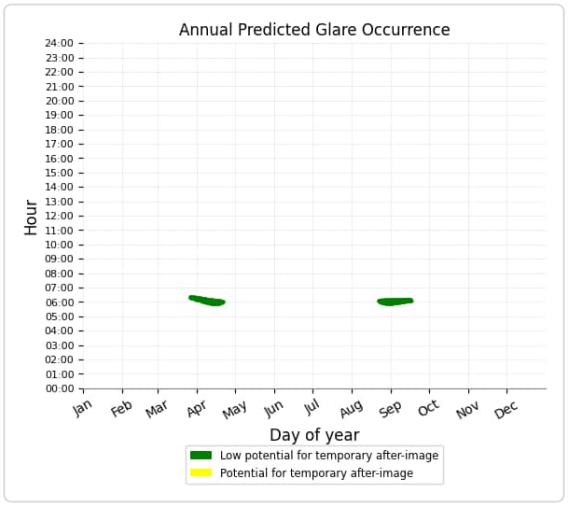


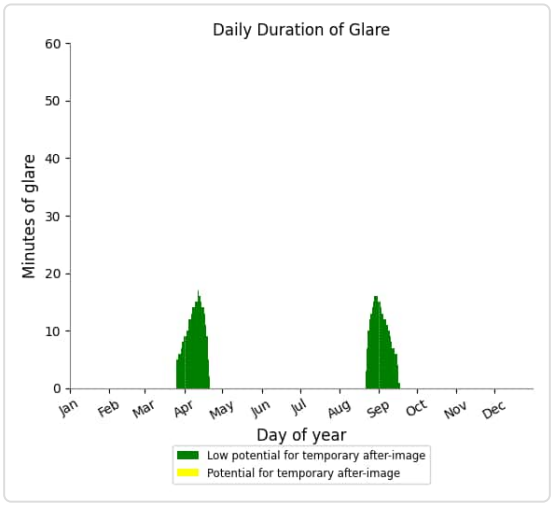


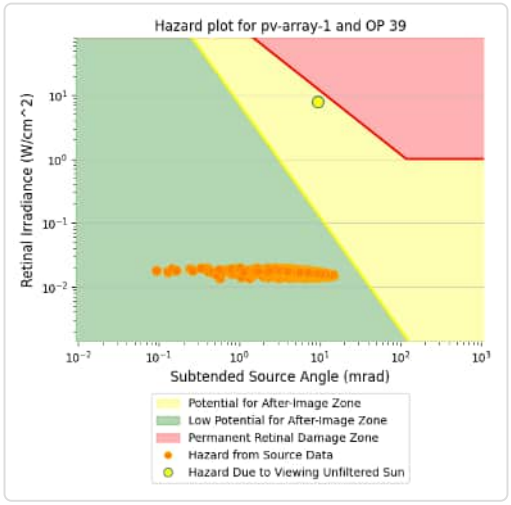
PV array 1 and OP 39

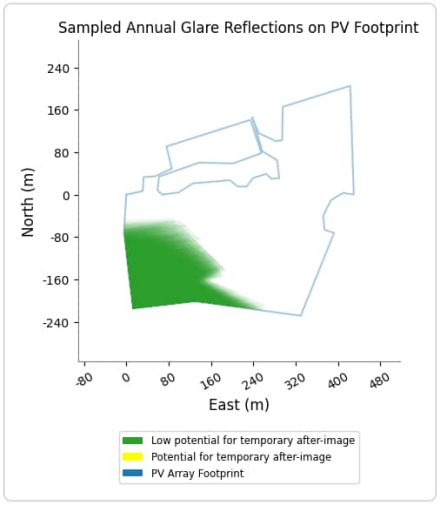
Yellow glare: none

Green glare: 569 min.



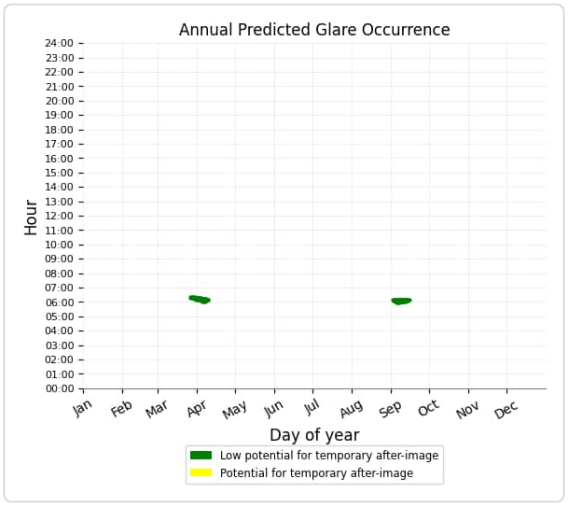


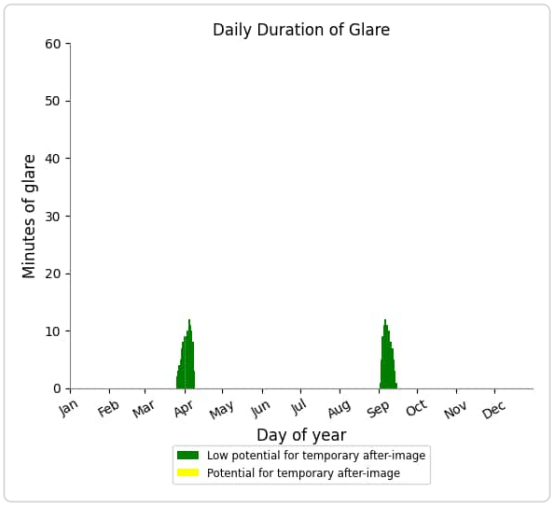


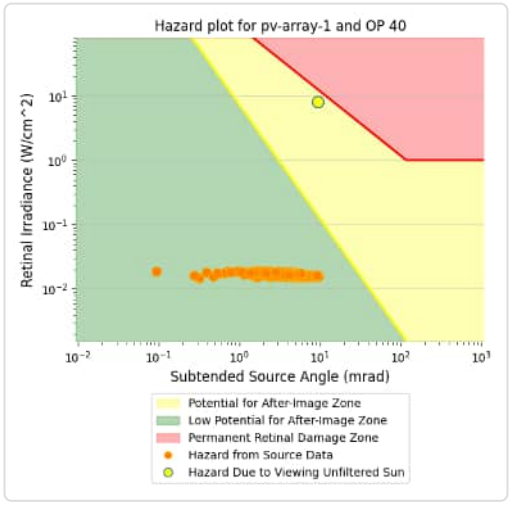


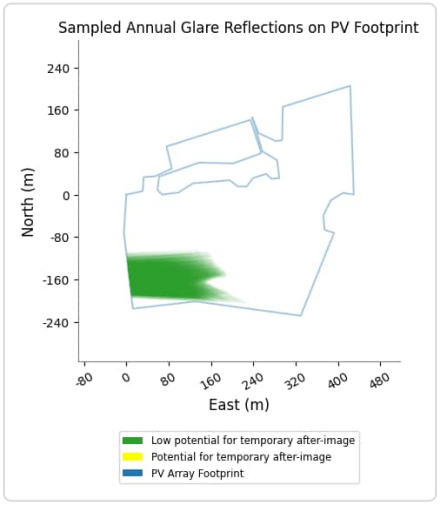
PV array 1 and OP 40

Yellow glare: none
Green glare: 213 min.









PV array 1 and OP 3

No glare found

PV array 1 and OP 4

No glare found

PV array 1 and OP 5

No glare found

PV array 1 and OP 6

No glare found

PV array 1 and OP 7

No glare found

PV array 1 and OP 8

No glare found

PV array 1 and OP 9

No glare found

PV array 1 and OP 10

No glare found

PV array 1 and OP 11

No glare found

PV array 1 and OP 12

No glare found

PV array 1 and OP 13

No glare found

PV array 1 and OP 14

No glare found

PV array 1 and OP 15

No glare found

PV array 1 and OP 16

No glare found

PV array 1 and OP 17

No glare found

PV array 1 and OP 18

No glare found

PV array 1 and OP 19

No glare found

PV array 1 and OP 20

No glare found

PV array 1 and OP 21

No glare found

PV array 1 and OP 22

No glare found

PV array 1 and OP 23

No glare found

PV array 1 and OP 24

No glare found

PV array 1 and OP 25

No glare found

PV array 1 and OP 26

No glare found

PV array 1 and OP 27

No glare found

PV array 1 and OP 28

No glare found

PV array 1 and OP 29

No glare found

PV array 1 and OP 30

No glare found

PV array 1 and OP 32

No glare found

PV array 1 and OP 33

No glare found

PV array 1 and OP 34

No glare found

PV array 1 and OP 36

No glare found

PV array 1 and OP 37

No glare found

PV array 1 and OP 38

No glare found

PV array 1 and OP 41

No glare found

PV array 1 and OP 42

No glare found

PV array 1 and OP 43

No glare found

PV array 1 and OP 44

No glare found

PV array 1 and OP 45

No glare found

PV array 1 and OP 46

No glare found

PV array 1 and OP 47

No glare found

PV array 1 and OP 48

No glare found

PV array 1 and OP 49

No glare found

PV array 1 and OP 50

No glare found

PV array 1 and OP 51

No glare found

PV array 1 and OP 52

No glare found

PV: PV array 2 low potential for temporary after-image

Receptor results ordered by category of glare

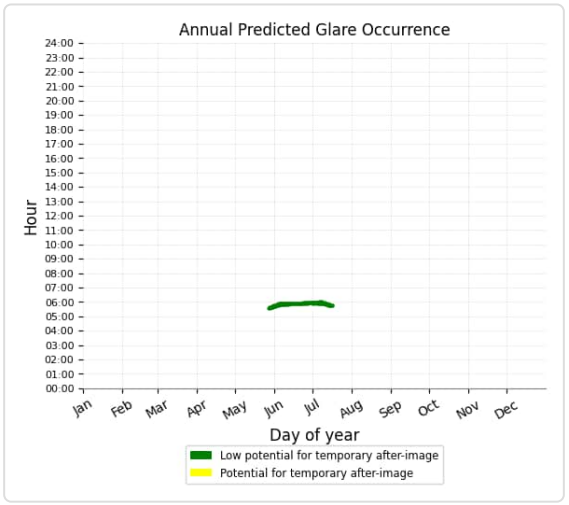
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	190	3.2	0	0.0
Route 2	0	0.0	0	0.0
Route 3	0	0.0	0	0.0
OP 1	317	5.3	0	0.0
OP 2	870	14.5	0	0.0
OP 12	1,664	27.7	0	0.0
OP 27	136	2.3	0	0.0
OP 31	1,452	24.2	0	0.0
OP 35	1,216	20.3	0	0.0
OP 39	75	1.2	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0

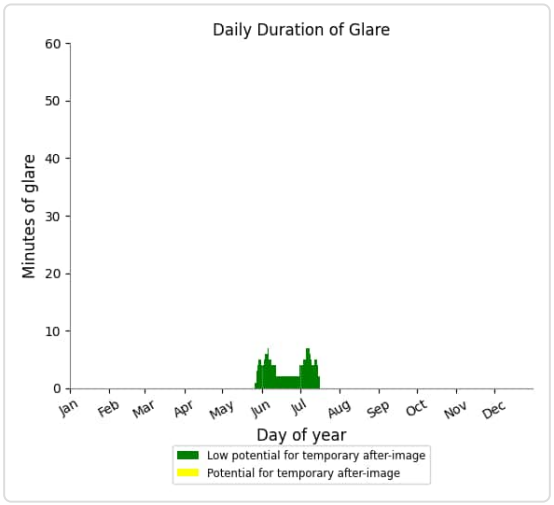
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

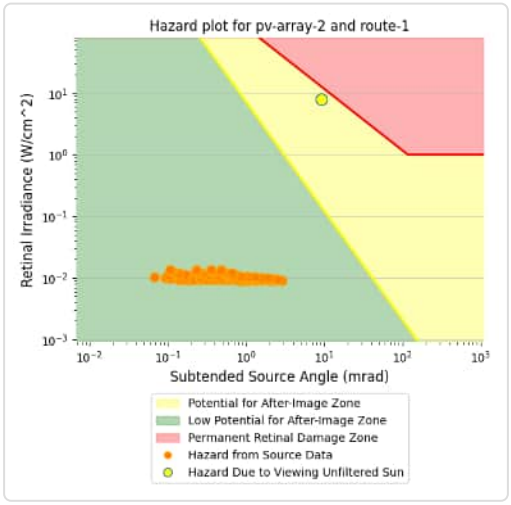
PV array 2 and Route: Route 1

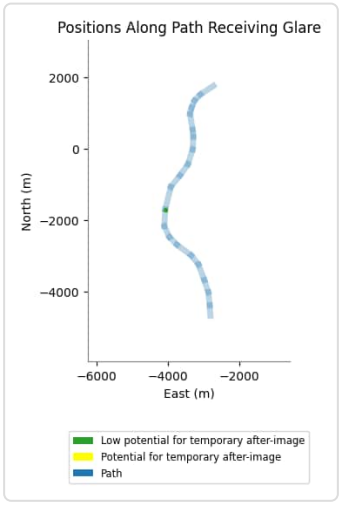
Yellow glare: none

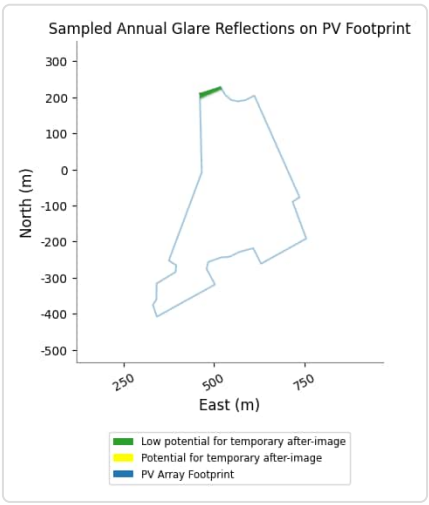
Green glare: 190 min.











PV array 2 and Route: Route 2

No glare found

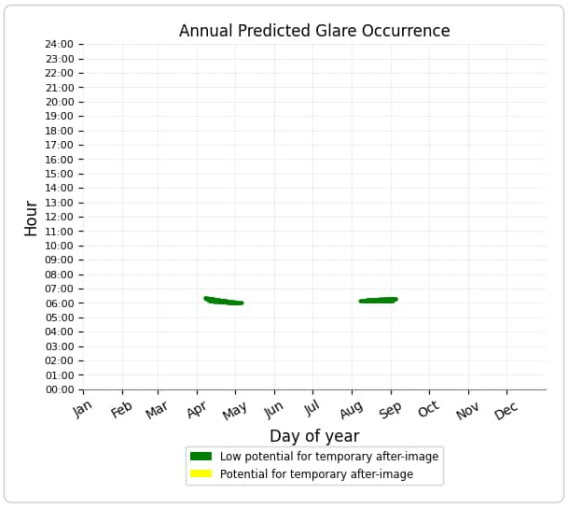
PV array 2 and Route: Route 3

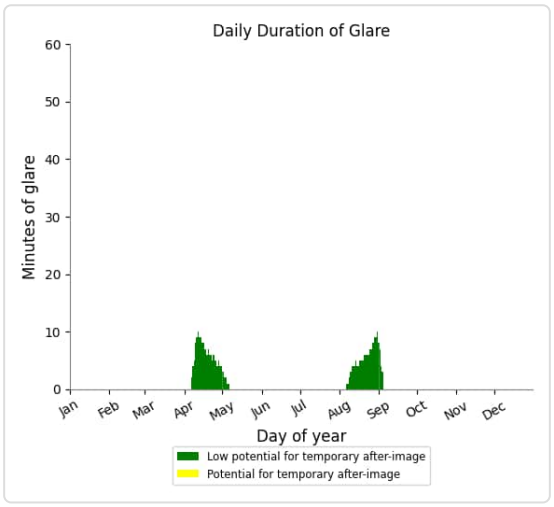
No glare found

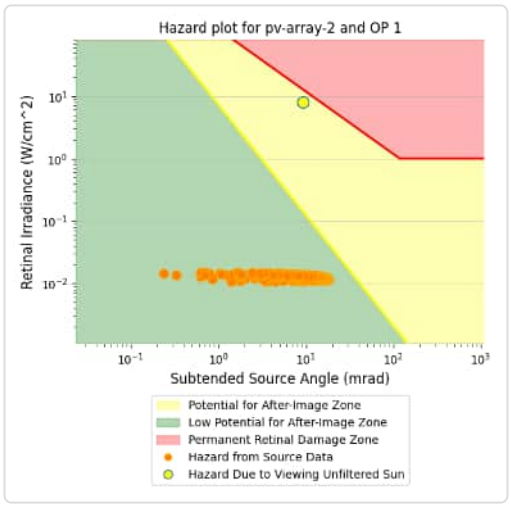
PV array 2 and OP 1

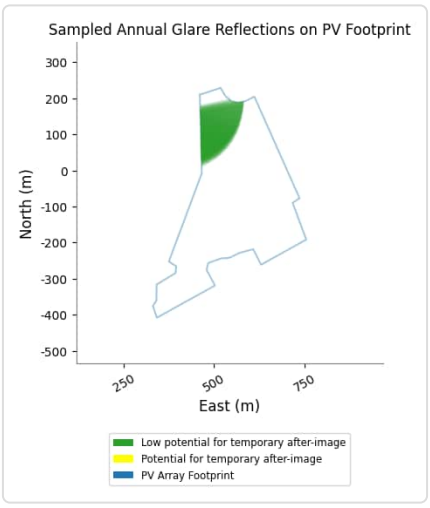
Yellow glare: none

Green glare: 317 min.





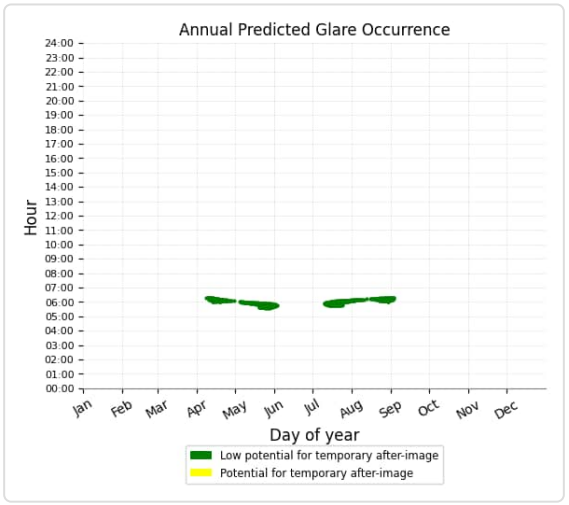


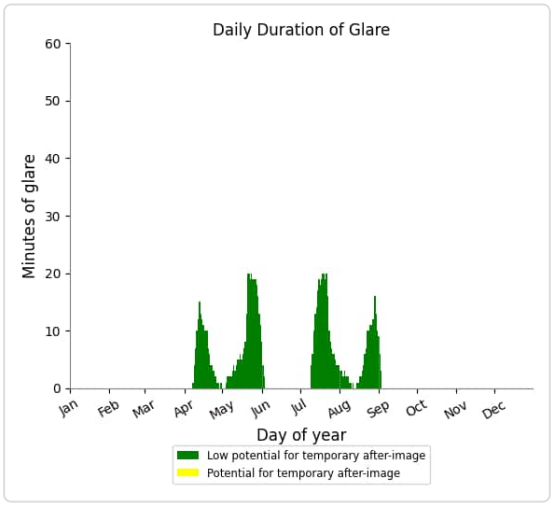


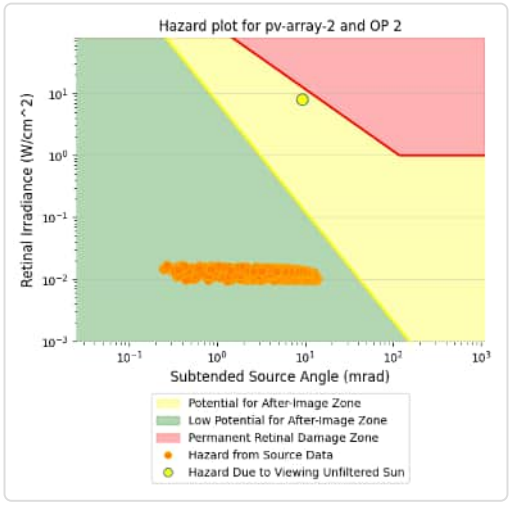
PV array 2 and OP 2

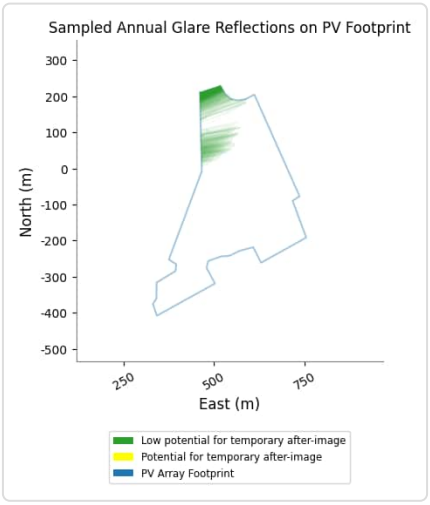
Yellow glare: none

Green glare: 870 min.





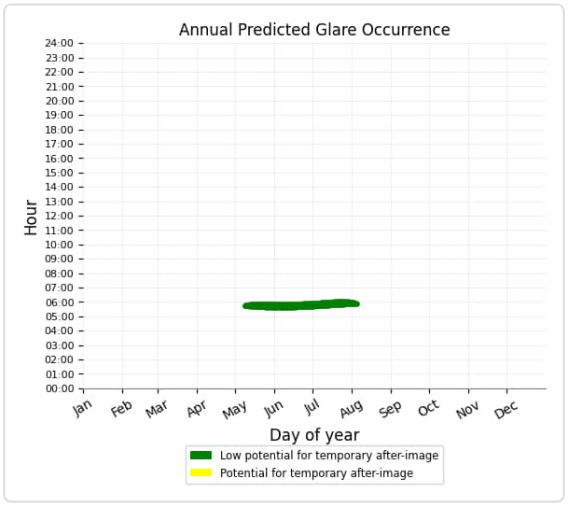


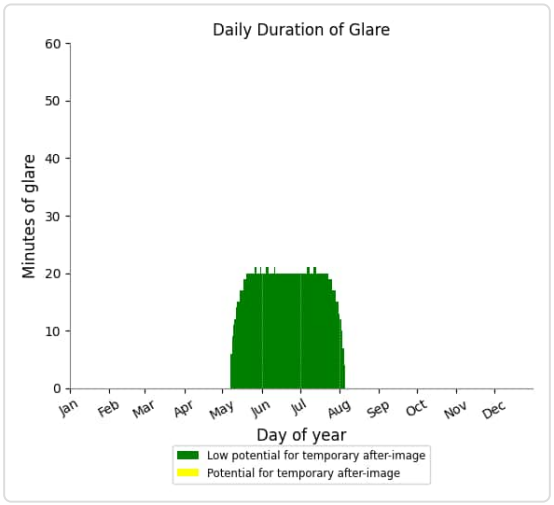


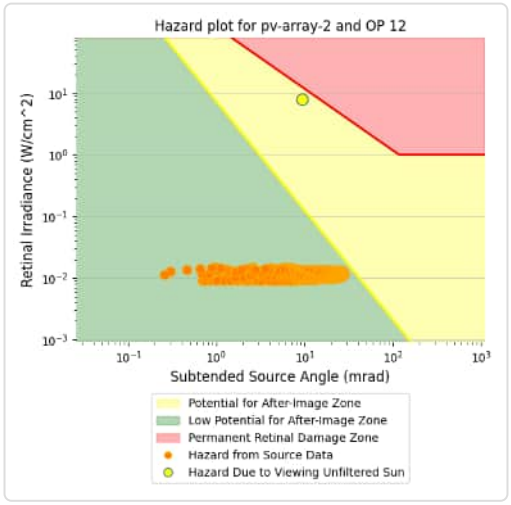
PV array 2 and OP 12

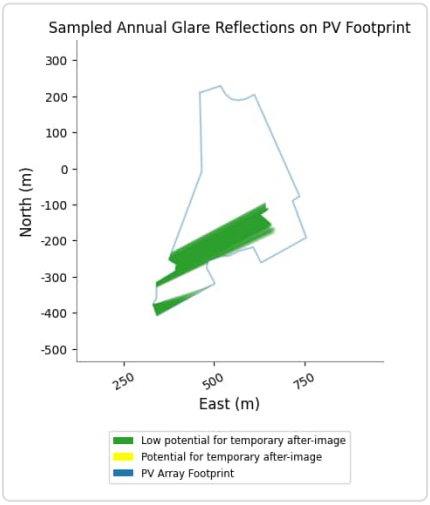
Yellow glare: none

Green glare: 1,664 min.





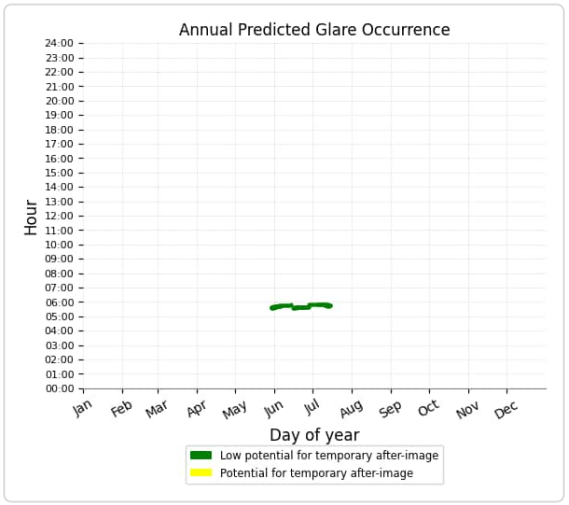


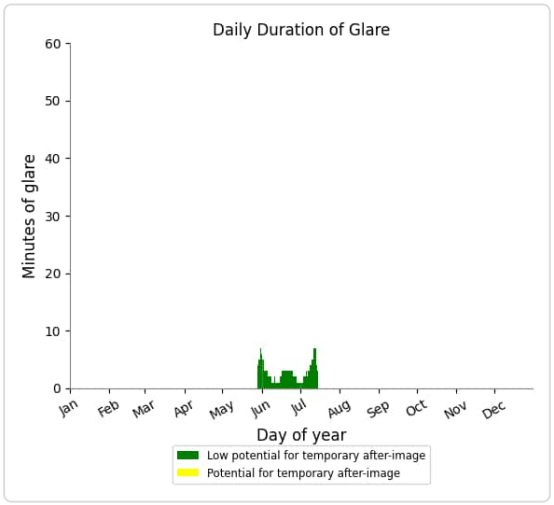


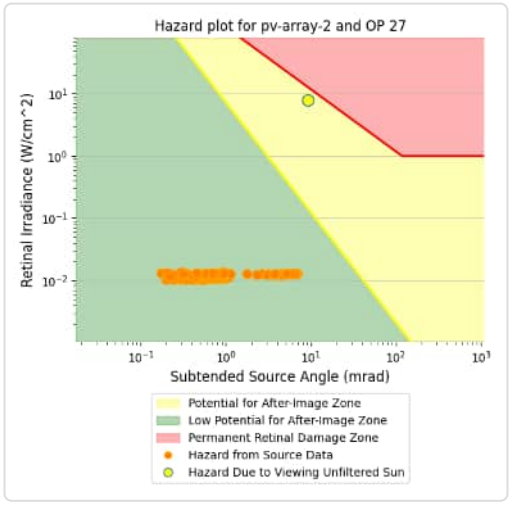
PV array 2 and OP 27

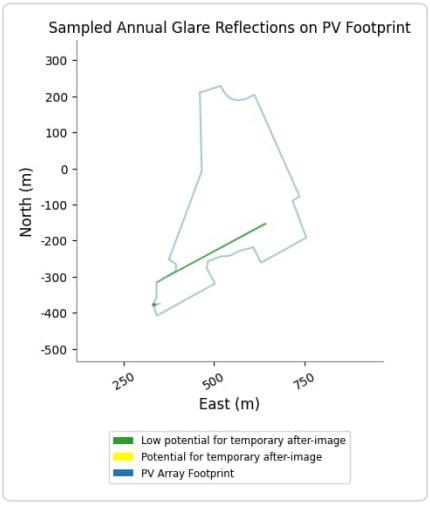
Yellow glare: none

Green glare: 136 min.





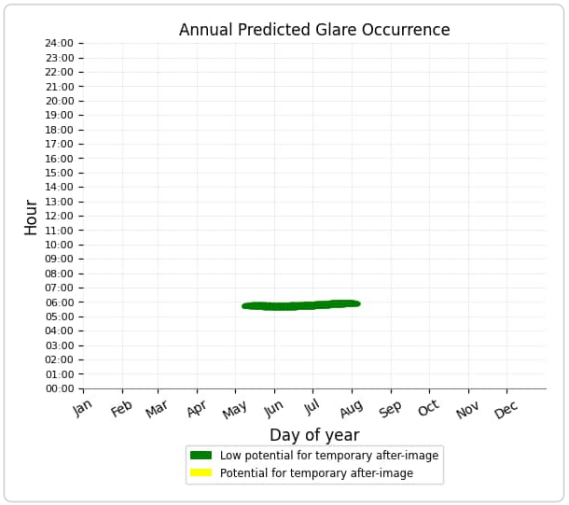


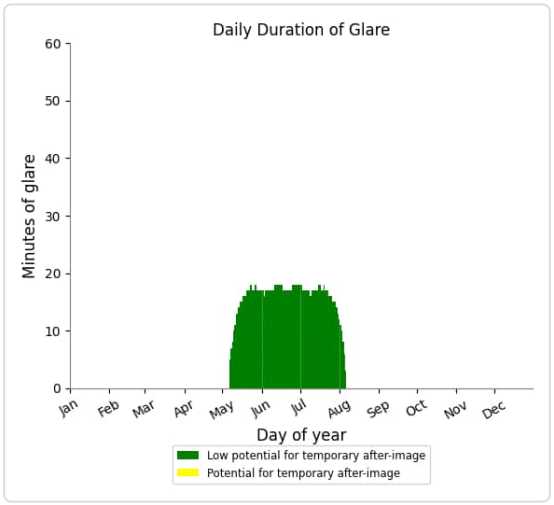


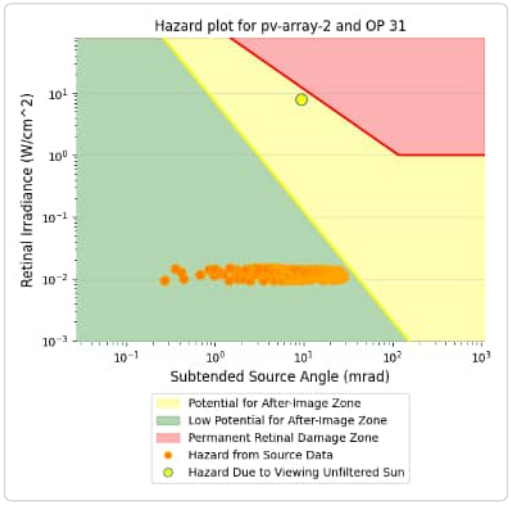
PV array 2 and OP 31

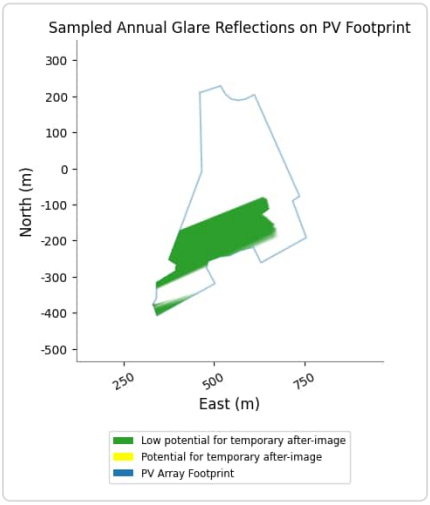
Yellow glare: none

Green glare: 1,452 min.





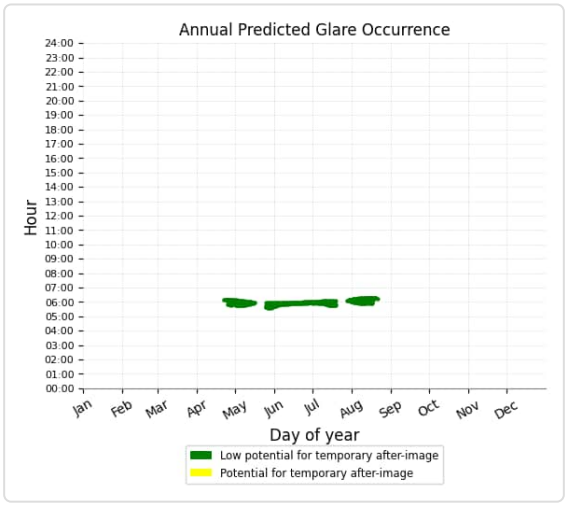


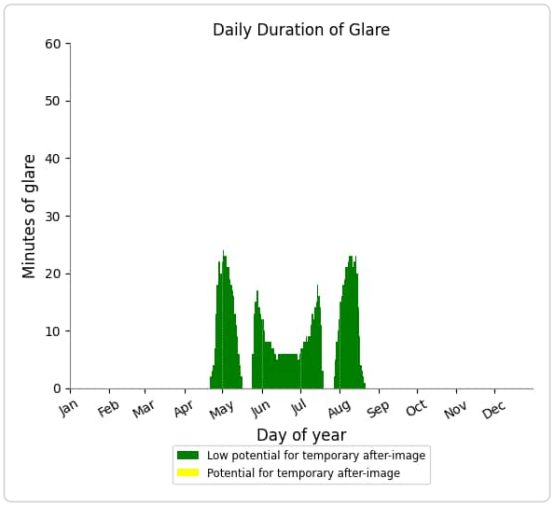


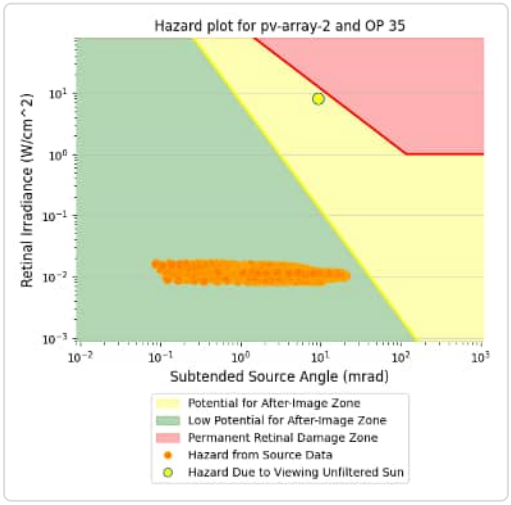
PV array 2 and OP 35

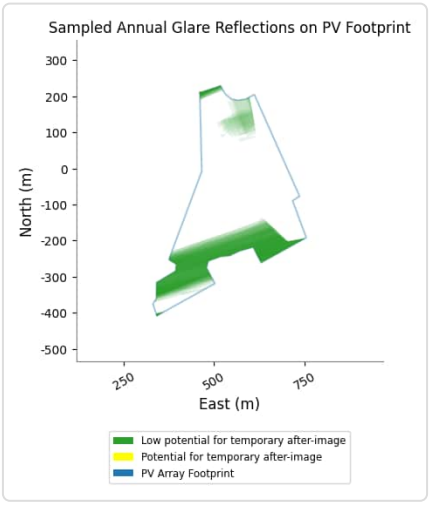
Yellow glare: none

Green glare: 1,216 min.



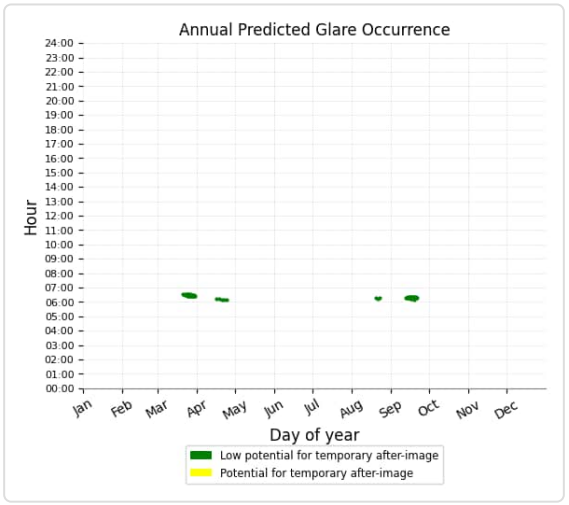


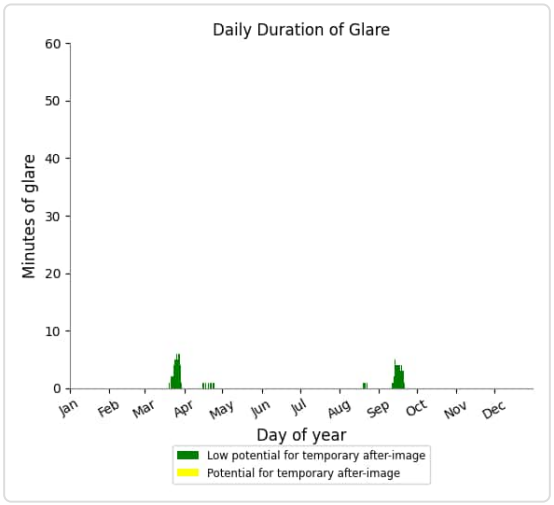


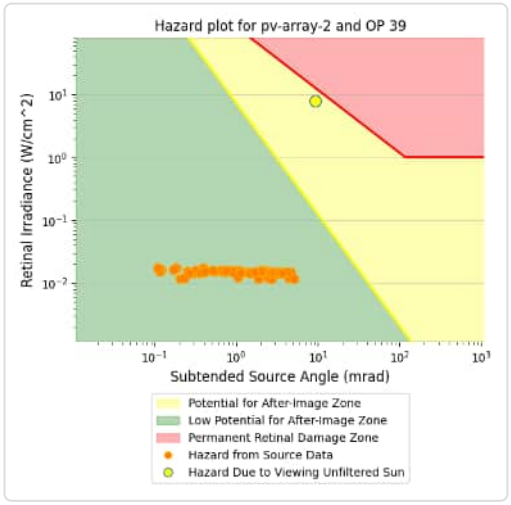


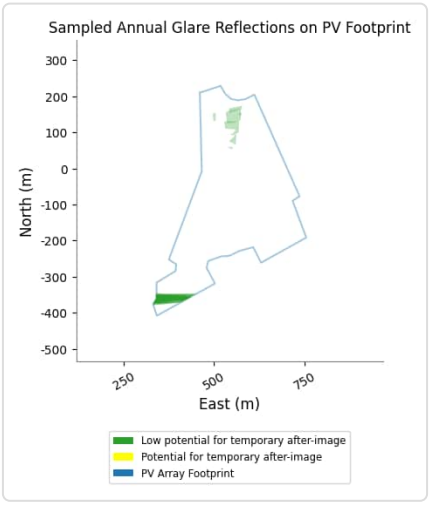
PV array 2 and OP 39

Yellow glare: none
Green glare: 75 min.









PV array 2 and OP 3

No glare found

PV array 2 and OP 4

No glare found

PV array 2 and OP 5

No glare found

PV array 2 and OP 6

No glare found

PV array 2 and OP 7

No glare found

PV array 2 and OP 8

No glare found

PV array 2 and OP 9

No glare found

PV array 2 and OP 10

No glare found

PV array 2 and OP 11

No glare found

PV array 2 and OP 13

No glare found

PV array 2 and OP 14

No glare found

PV array 2 and OP 15

No glare found

PV array 2 and OP 16

No glare found

PV array 2 and OP 17

No glare found

PV array 2 and OP 18

No glare found

PV array 2 and OP 19

No glare found

PV array 2 and OP 20

No glare found

PV array 2 and OP 21

No glare found

PV array 2 and OP 22

No glare found

PV array 2 and OP 23

No glare found

PV array 2 and OP 24

No glare found

PV array 2 and OP 25

No glare found

PV array 2 and OP 26

No glare found

PV array 2 and OP 28

No glare found

PV array 2 and OP 29

No glare found

PV array 2 and OP 30

No glare found

PV array 2 and OP 32

No glare found

PV array 2 and OP 33

No glare found

PV array 2 and OP 34

No glare found

PV array 2 and OP 36

No glare found

PV array 2 and OP 37

No glare found

PV array 2 and OP 38

No glare found

PV array 2 and OP 40

No glare found

PV array 2 and OP 41

No glare found

PV array 2 and OP 42

No glare found

PV array 2 and OP 43

No glare found

PV array 2 and OP 44

No glare found

PV array 2 and OP 45

No glare found

PV array 2 and OP 46

No glare found

PV array 2 and OP 47

No glare found

PV array 2 and OP 48

No glare found

PV array 2 and OP 49

No glare found

PV array 2 and OP 50

No glare found

PV array 2 and OP 51

No glare found

PV array 2 and OP 52

No glare found

PV: PV array 3 potential temporary after-image

Receptor results ordered by category of glare

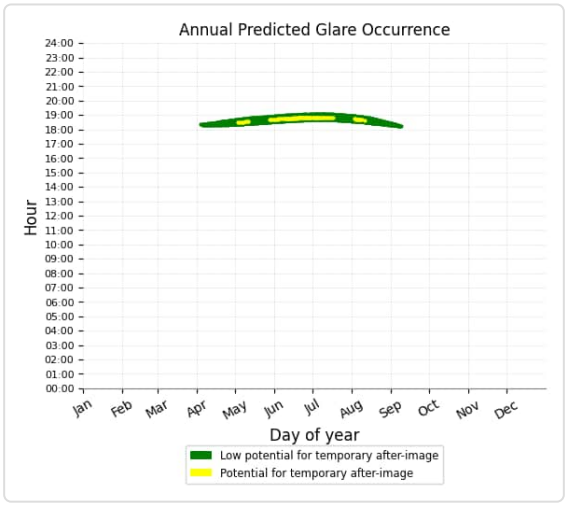
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 3	2,882	48.0	99	1.6
Route 1	144	2.4	0	0.0
Route 2	0	0.0	0	0.0
OP 12	27	0.5	0	0.0
OP 17	1,388	23.1	0	0.0
OP 18	1,754	29.2	0	0.0
OP 19	2,326	38.8	0	0.0
OP 20	1,974	32.9	0	0.0
OP 26	465	7.8	0	0.0
OP 31	28	0.5	0	0.0
OP 35	341	5.7	0	0.0
OP 36	217	3.6	0	0.0
OP 37	545	9.1	0	0.0
OP 38	377	6.3	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	0	0.0	0	0.0
OP 32	0	0.0	0	0.0

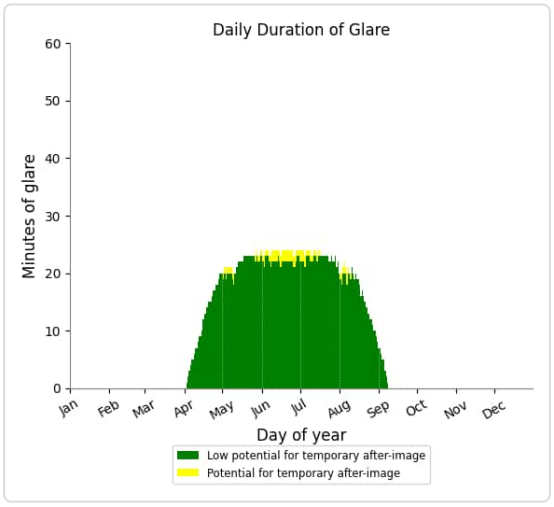
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

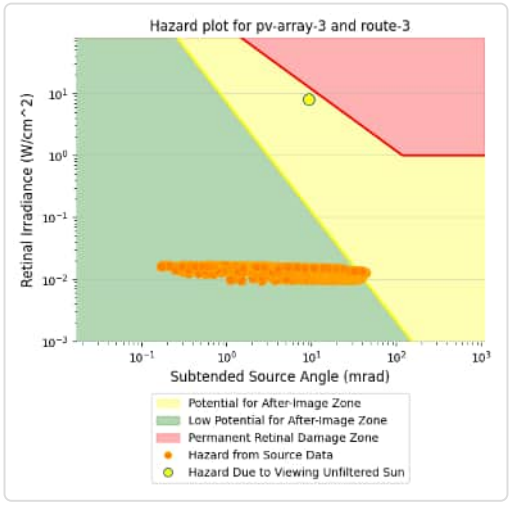
PV array 3 and Route: Route 3

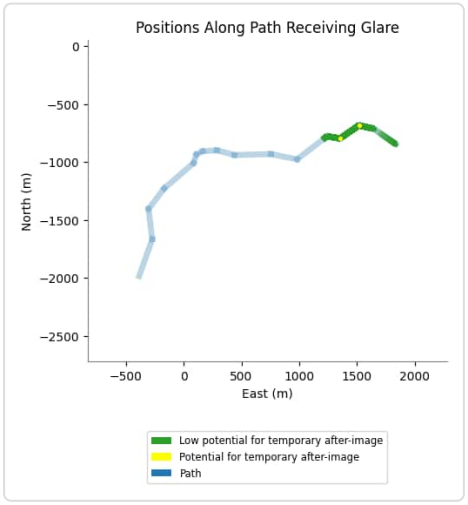
Yellow glare: 99 min.

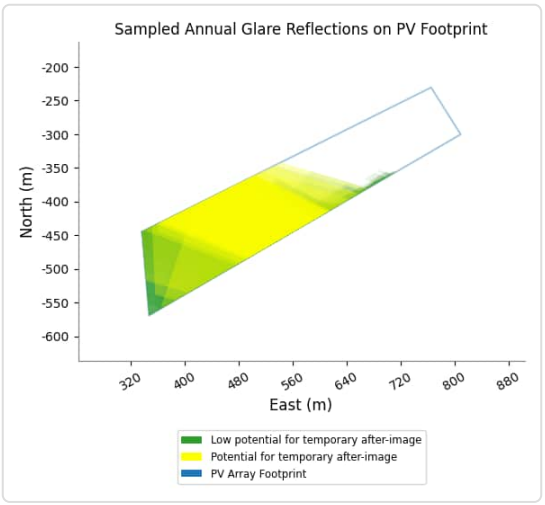
Green glare: 2,882 min.







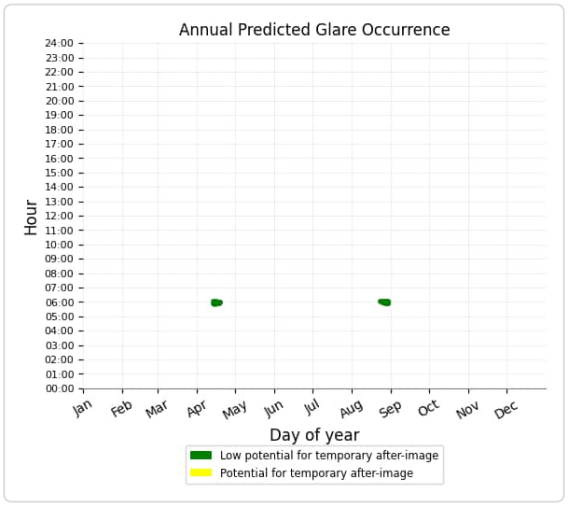


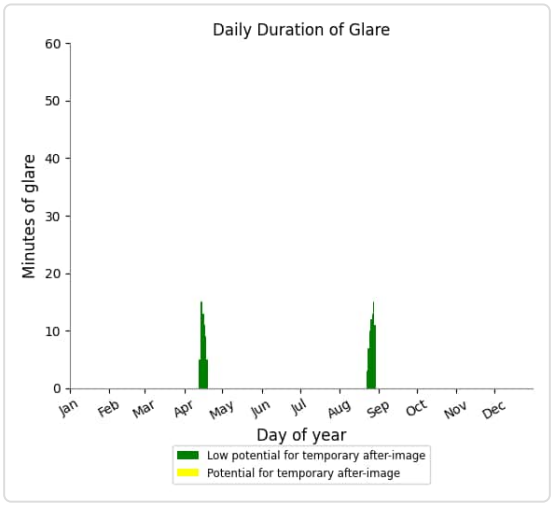


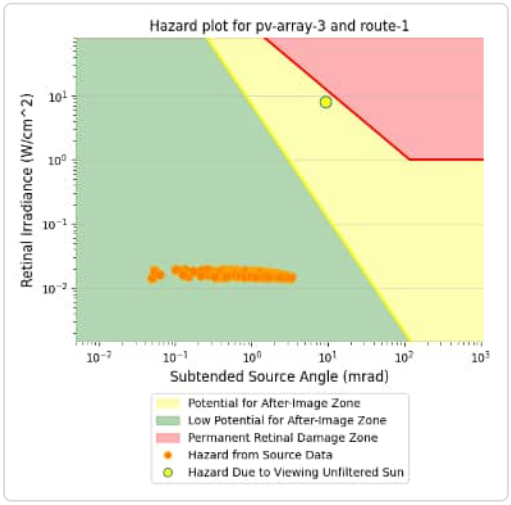
PV array 3 and Route: Route 1

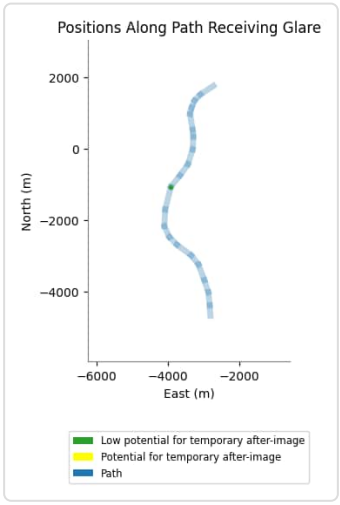
Yellow glare: none

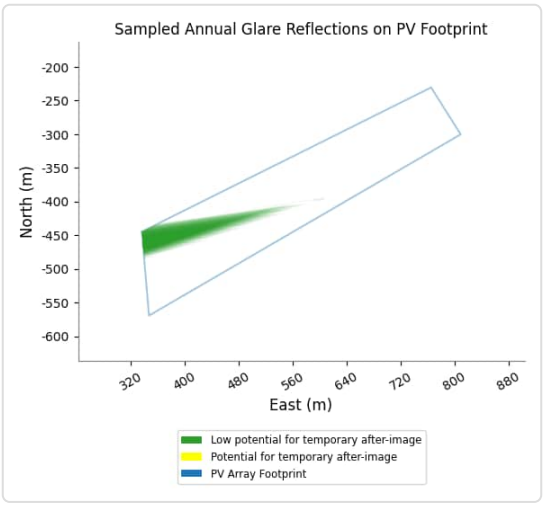
Green glare: 144 min.











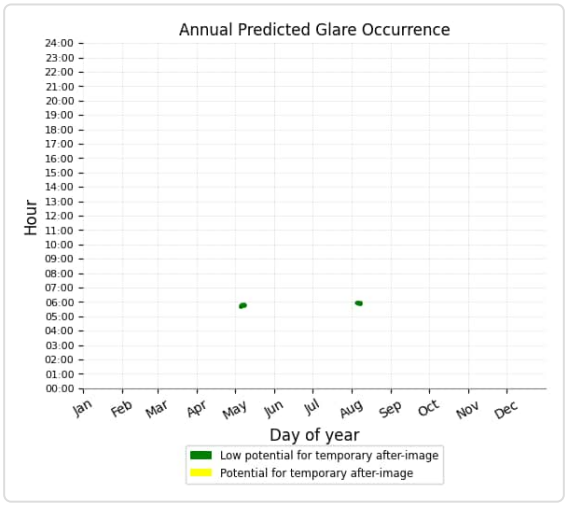
PV array 3 and Route: Route 2

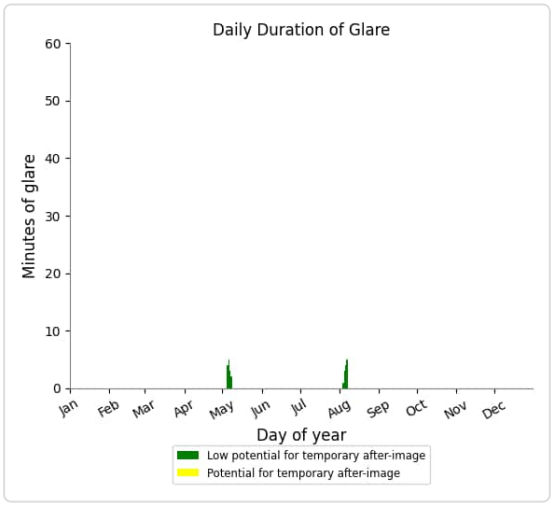
No glare found

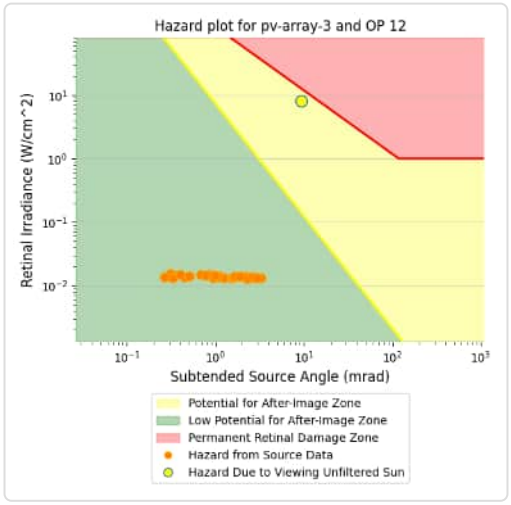
PV array 3 and OP 12

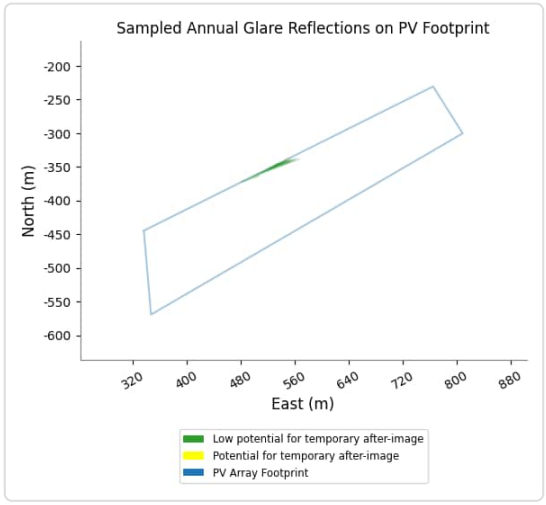
Yellow glare: none

Green glare: 27 min.





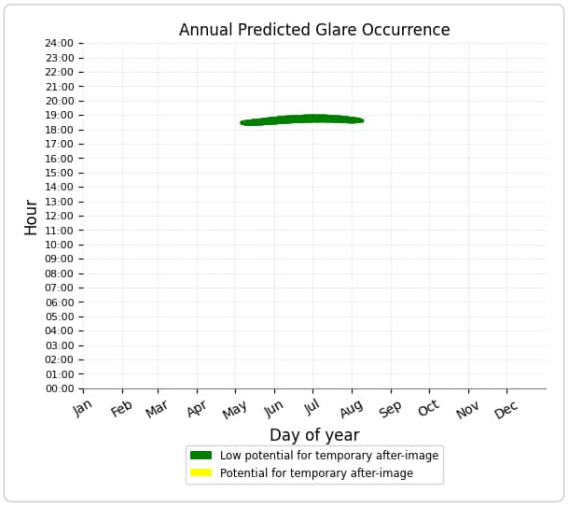


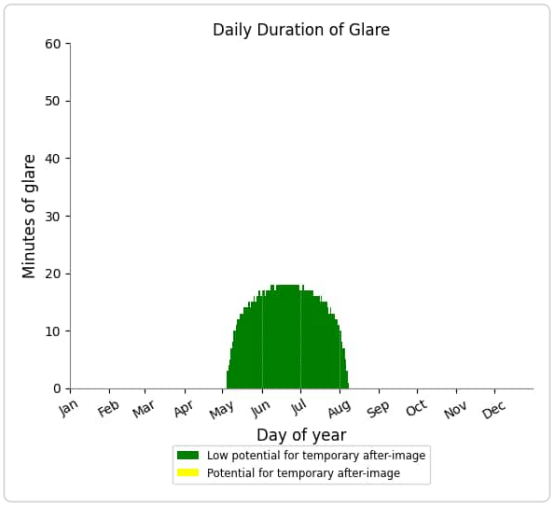


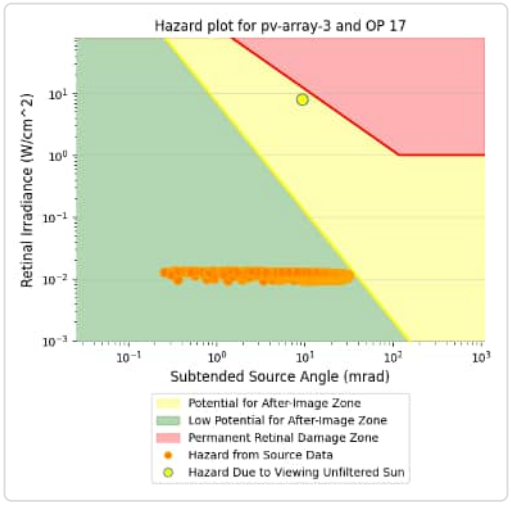
PV array 3 and OP 17

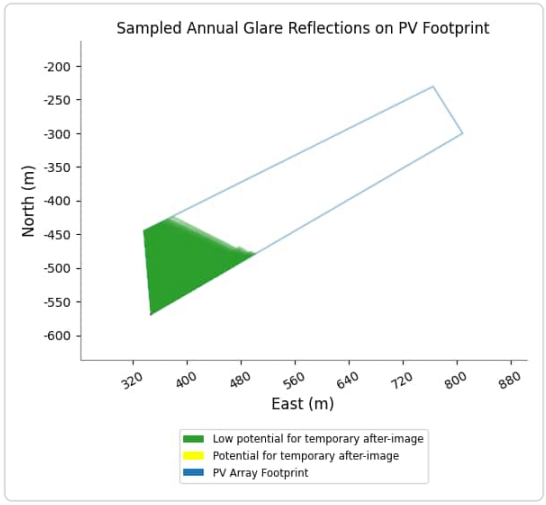
Yellow glare: none

Green glare: 1,388 min.





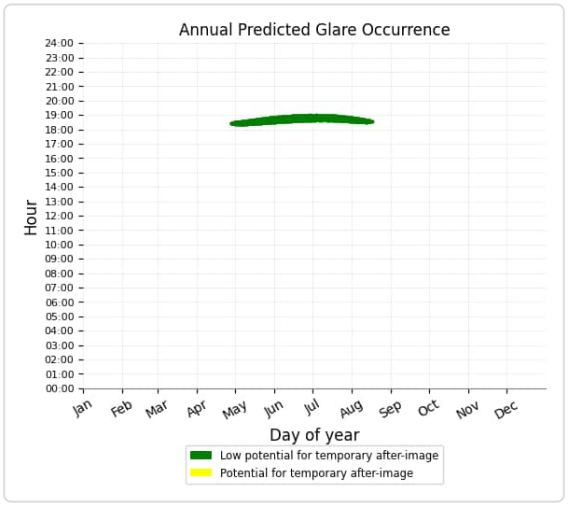


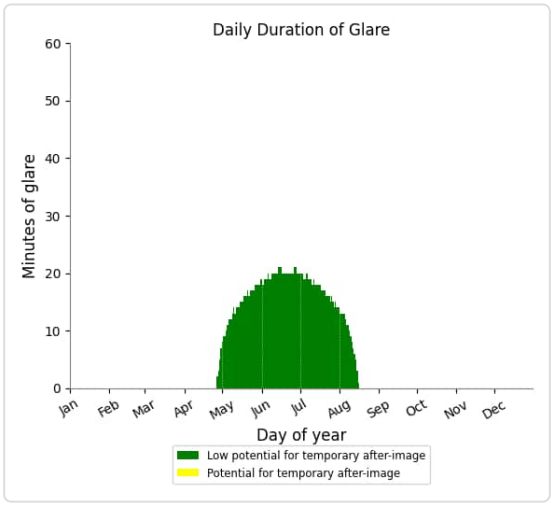


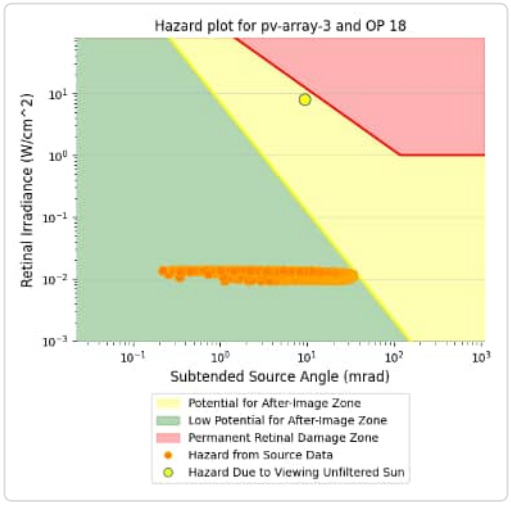
PV array 3 and OP 18

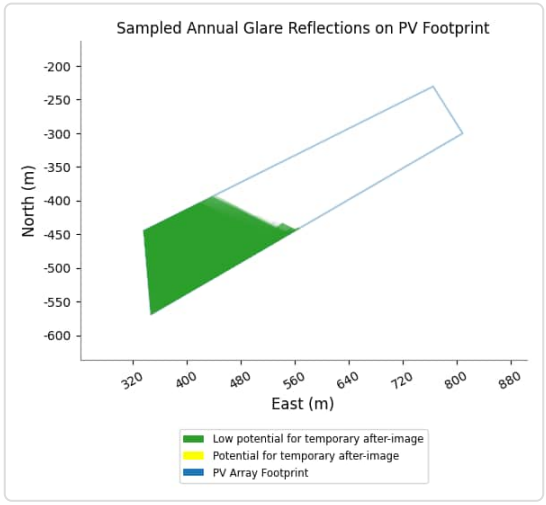
Yellow glare: none

Green glare: 1,754 min.





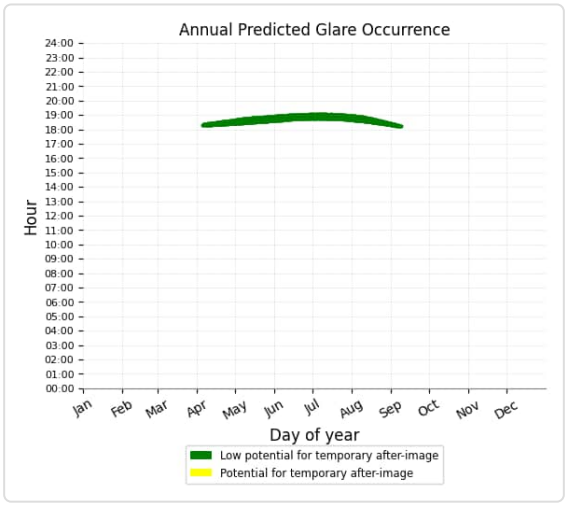


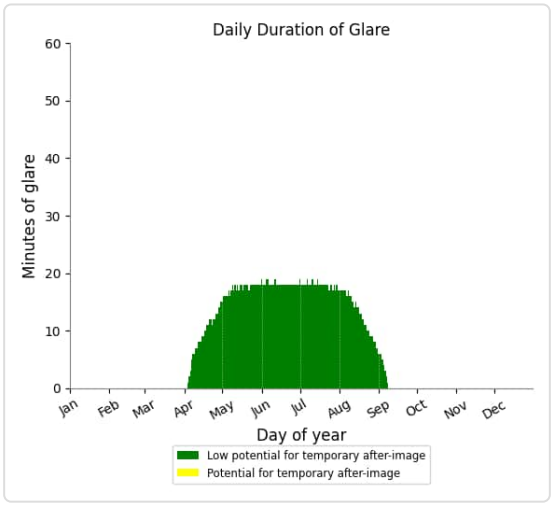


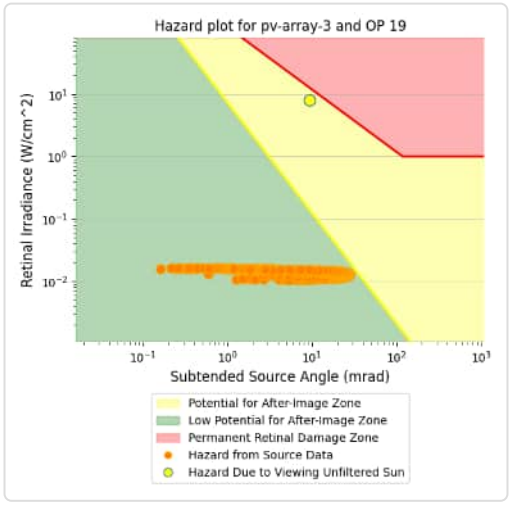
PV array 3 and OP 19

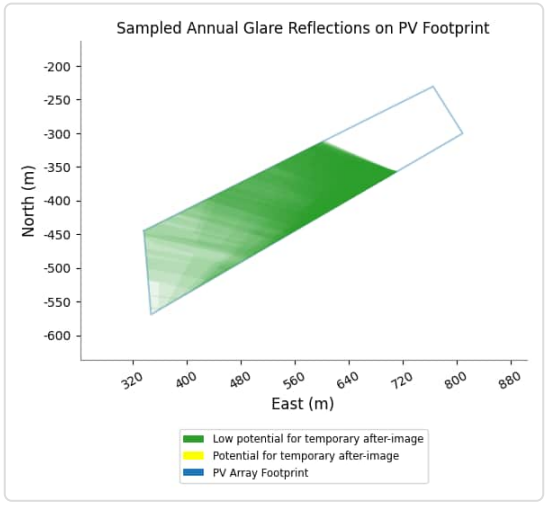
Yellow glare: none

Green glare: 2,326 min.





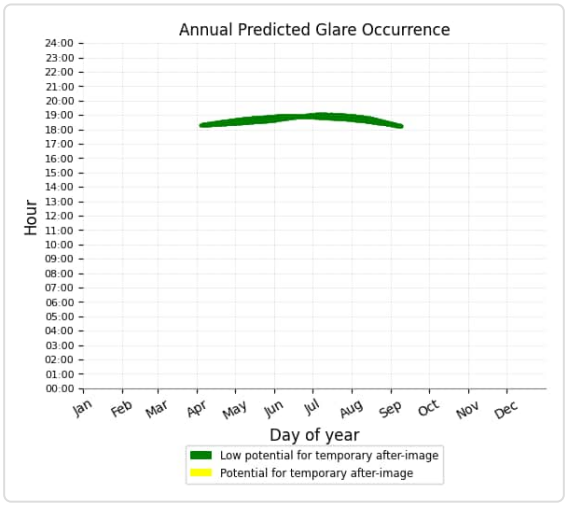


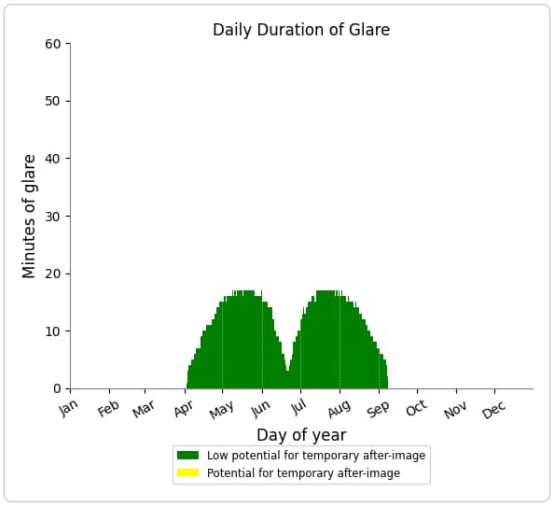


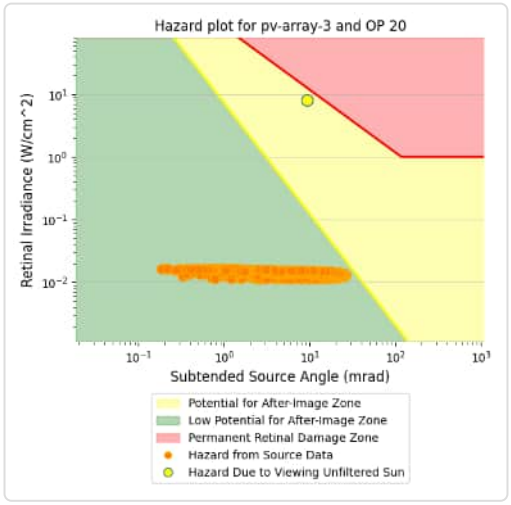
PV array 3 and OP 20

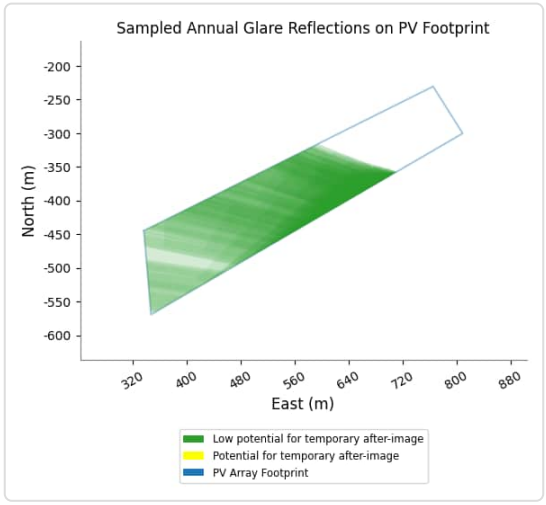
Yellow glare: none

Green glare: 1,974 min.





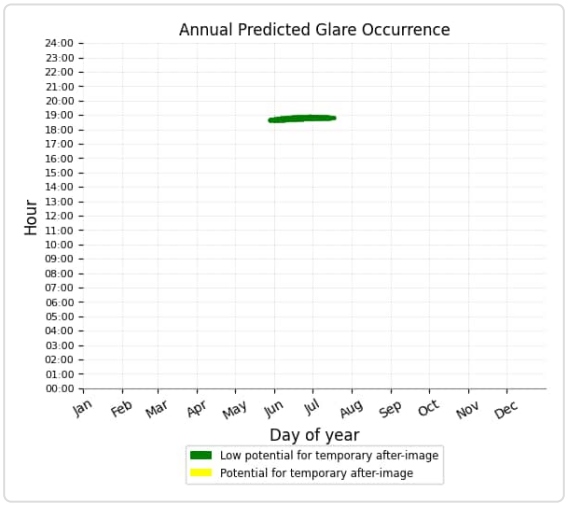


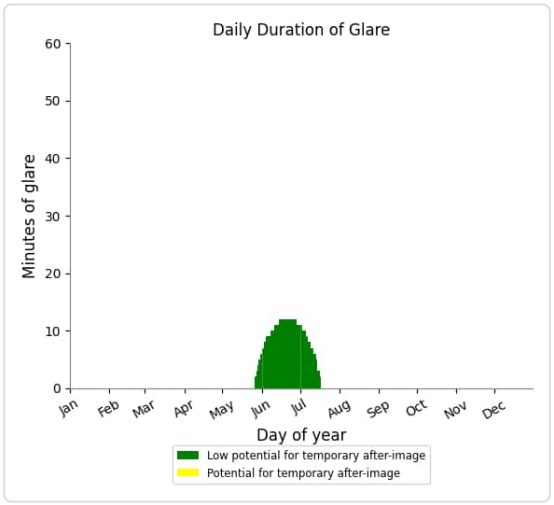


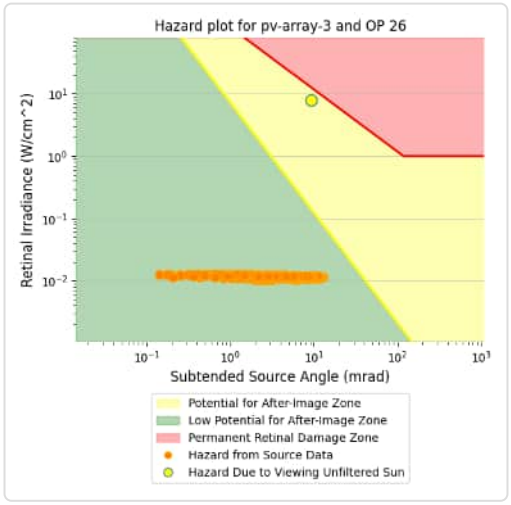
PV array 3 and OP 26

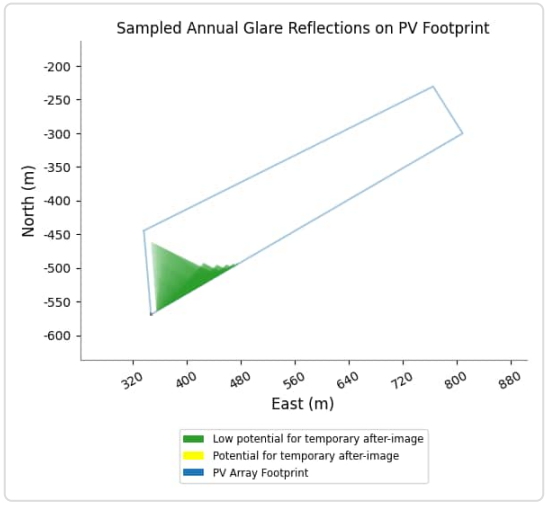
Yellow glare: none

Green glare: 465 min.





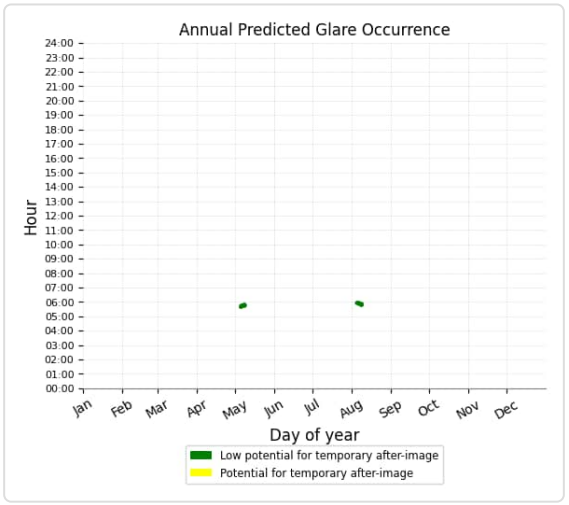


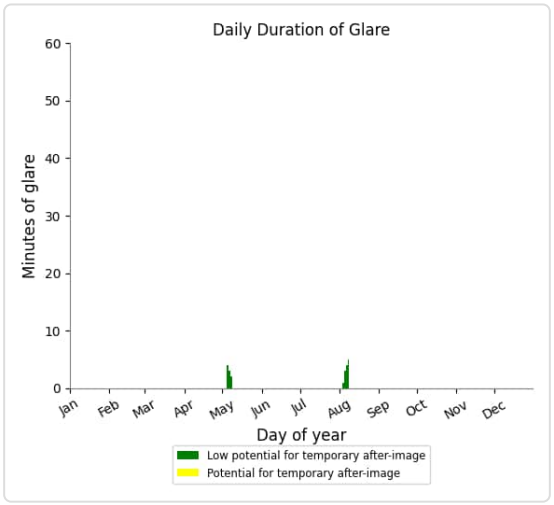


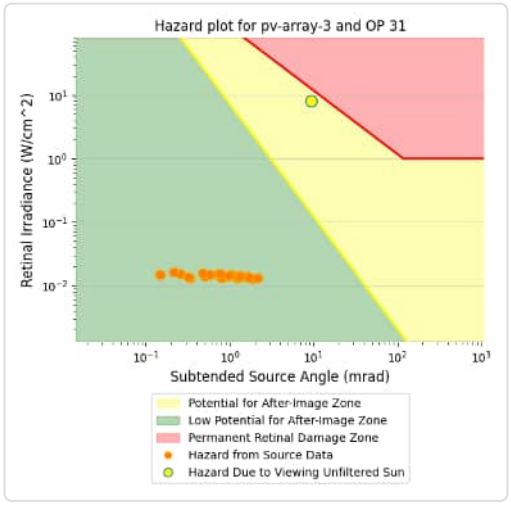
PV array 3 and OP 31

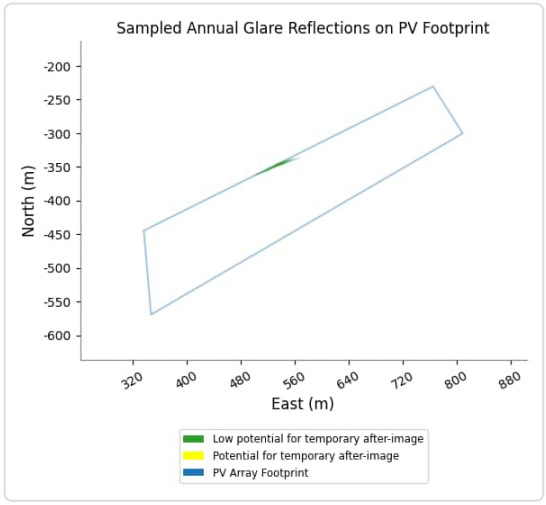
Yellow glare: none

Green glare: 28 min.





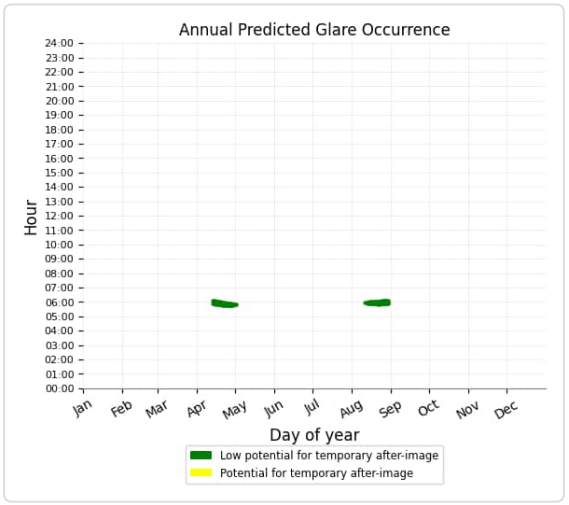


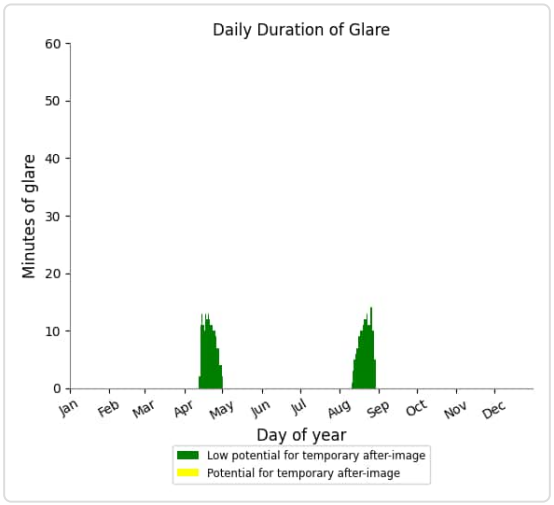


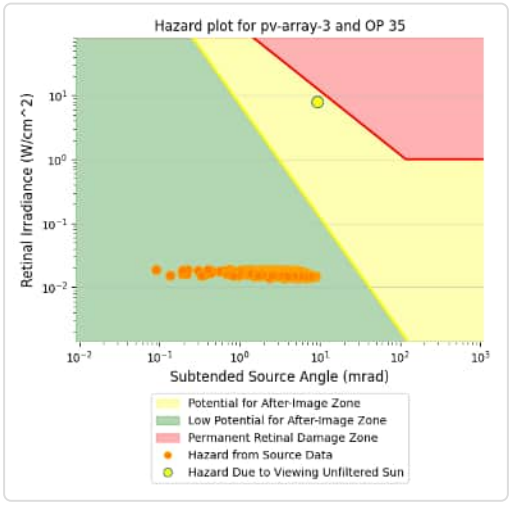
PV array 3 and OP 35

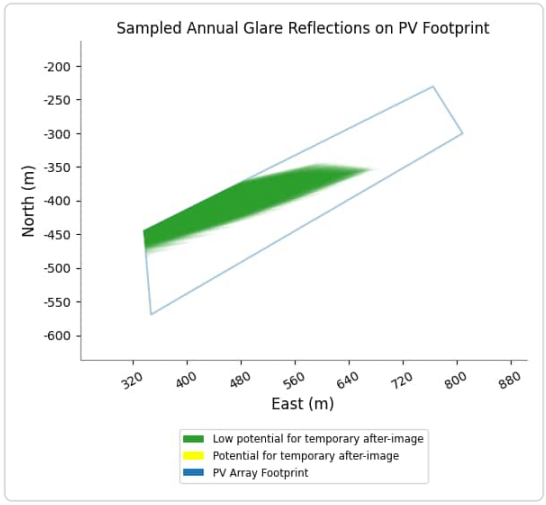
Yellow glare: none

Green glare: 341 min.





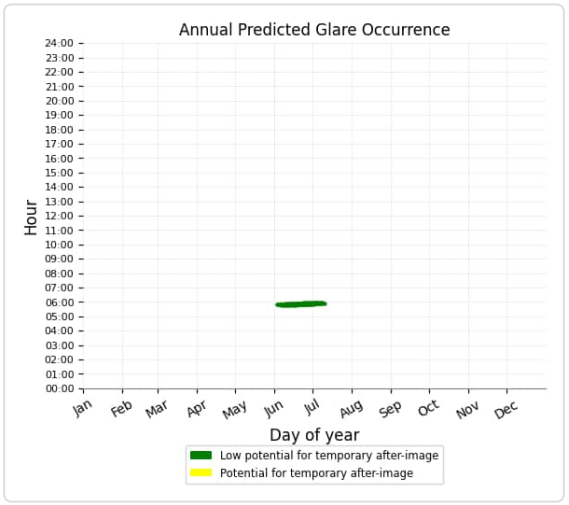


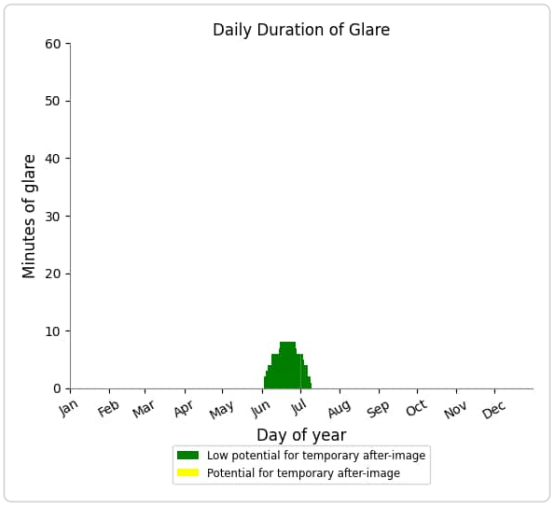


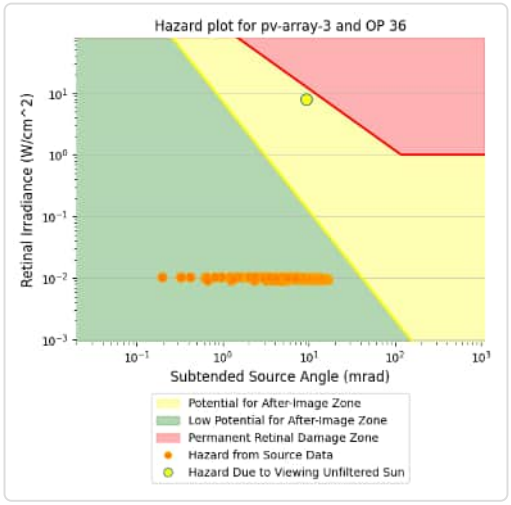
PV array 3 and OP 36

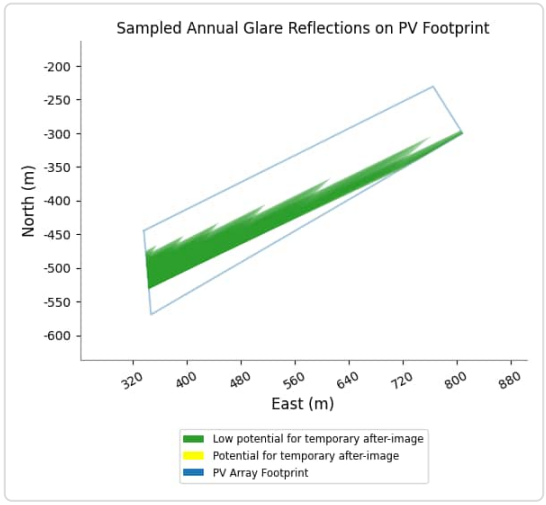
Yellow glare: none

Green glare: 217 min.





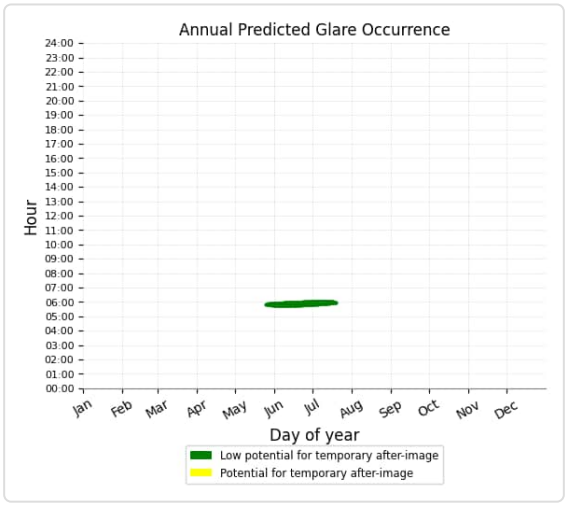


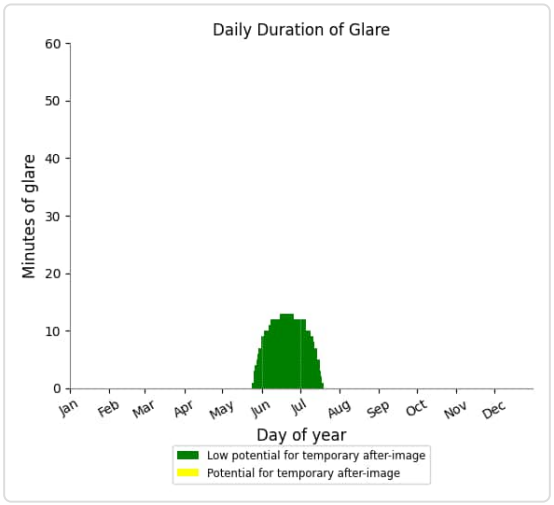


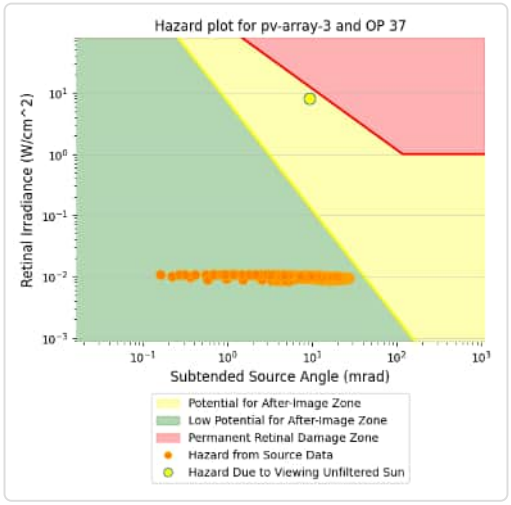
PV array 3 and OP 37

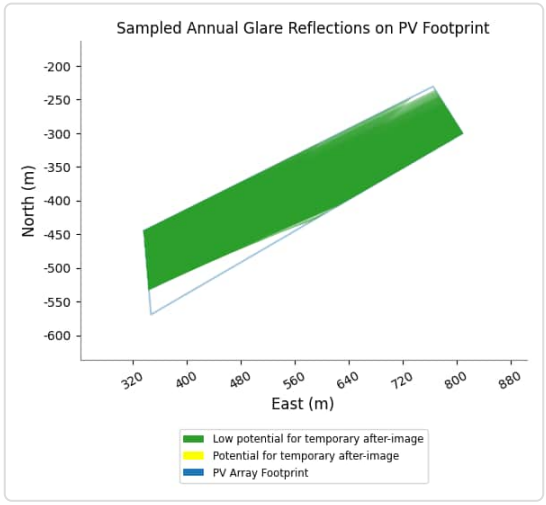
Yellow glare: none

Green glare: 545 min.



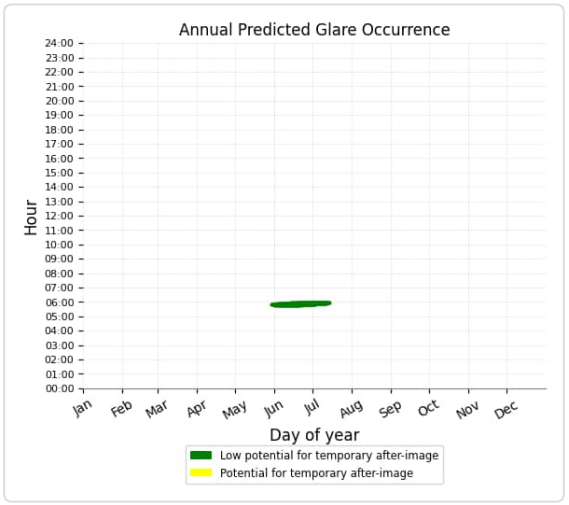


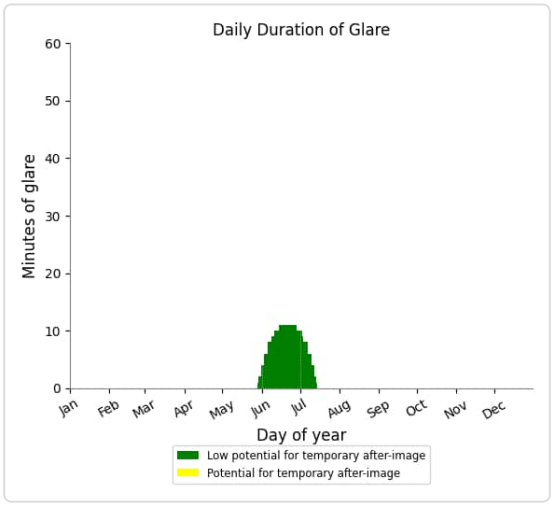


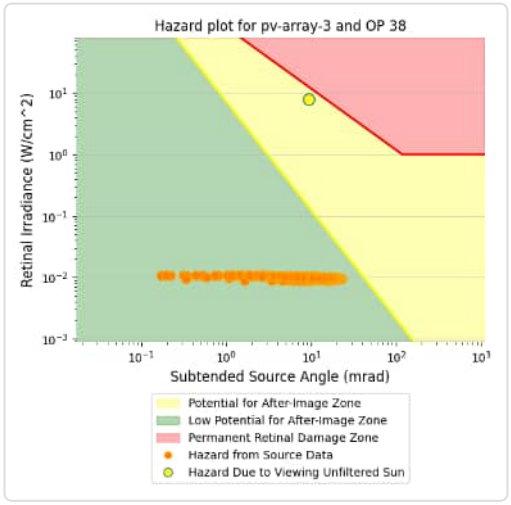


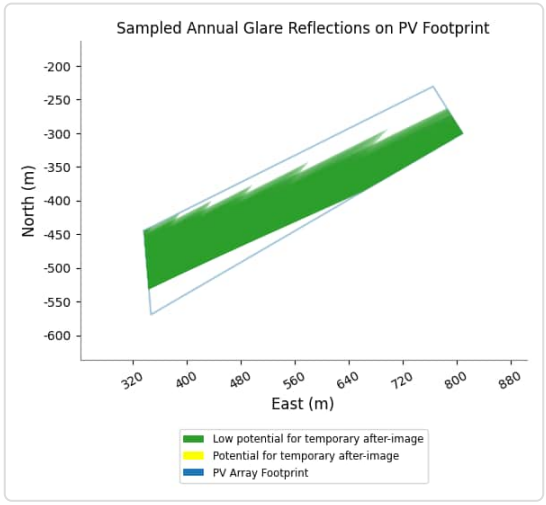
PV array 3 and OP 38

Yellow glare: none
Green glare: 377 min.









PV array 3 and OP 1

No glare found

PV array 3 and OP 2

No glare found

PV array 3 and OP 3

No glare found

PV array 3 and OP 4

No glare found

PV array 3 and OP 5

No glare found

PV array 3 and OP 6

No glare found

PV array 3 and OP 7

No glare found

PV array 3 and OP 8

No glare found

PV array 3 and OP 9

No glare found

PV array 3 and OP 10

No glare found

PV array 3 and OP 11

No glare found

PV array 3 and OP 13

No glare found

PV array 3 and OP 14

No glare found

PV array 3 and OP 15

No glare found

PV array 3 and OP 16

No glare found

PV array 3 and OP 21

No glare found

PV array 3 and OP 22

No glare found

PV array 3 and OP 23

No glare found

PV array 3 and OP 24

No glare found

PV array 3 and OP 25

No glare found

PV array 3 and OP 27

No glare found

PV array 3 and OP 28

No glare found

PV array 3 and OP 29

No glare found

PV array 3 and OP 30

No glare found

PV array 3 and OP 32

No glare found

PV array 3 and OP 33

No glare found

PV array 3 and OP 34

No glare found

PV array 3 and OP 39

No glare found

PV array 3 and OP 40

No glare found

PV array 3 and OP 41

No glare found

PV array 3 and OP 42

No glare found

PV array 3 and OP 43

No glare found

PV array 3 and OP 44

No glare found

PV array 3 and OP 45

No glare found

PV array 3 and OP 46

No glare found

PV array 3 and OP 47

No glare found

PV array 3 and OP 48

No glare found

PV array 3 and OP 49

No glare found

PV array 3 and OP 50

No glare found

PV array 3 and OP 51

No glare found

PV array 3 and OP 52

No glare found

PV: PV array 4 potential temporary after-image

Receptor results ordered by category of glare

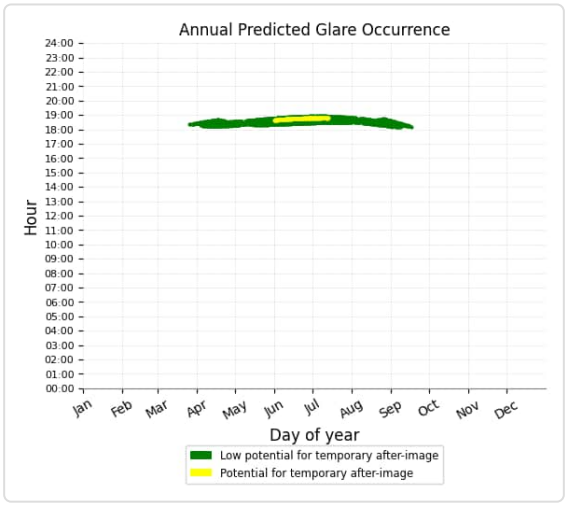
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 3	3,331	55.5	123	2.0
Route 1	243	4.0	0	0.0
Route 2	0	0.0	0	0.0
OP 12	1,891	31.5	0	0.0
OP 17	1,486	24.8	0	0.0
OP 18	1,273	21.2	0	0.0
OP 19	85	1.4	0	0.0
OP 26	1,221	20.4	0	0.0
OP 27	924	15.4	0	0.0
OP 28	760	12.7	0	0.0
OP 29	636	10.6	0	0.0
OP 30	951	15.8	0	0.0
OP 31	1,407	23.4	0	0.0
OP 35	961	16.0	0	0.0
OP 36	1,056	17.6	0	0.0
OP 37	1,233	20.6	0	0.0
OP 38	1,164	19.4	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 32	0	0.0	0	0.0

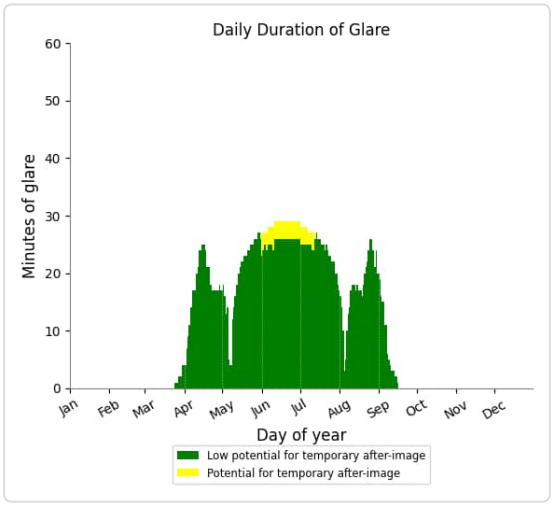
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 46	0	0.0	0	0.0
OP 47	0	0.0	0	0.0
OP 48	0	0.0	0	0.0
OP 49	0	0.0	0	0.0
OP 50	0	0.0	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0

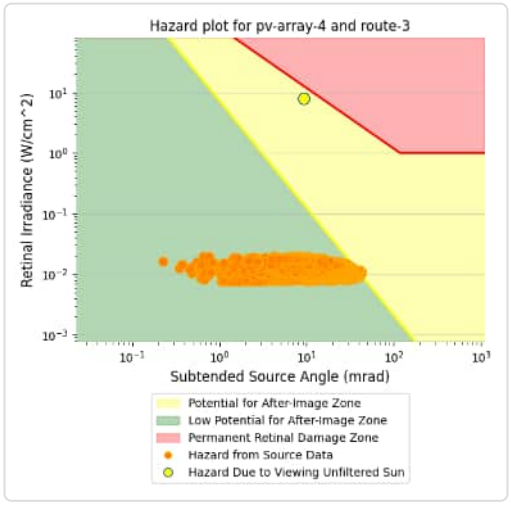
PV array 4 and Route: Route 3

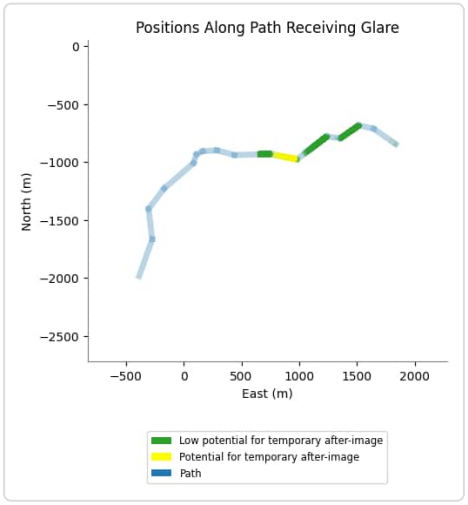
Yellow glare: 123 min.

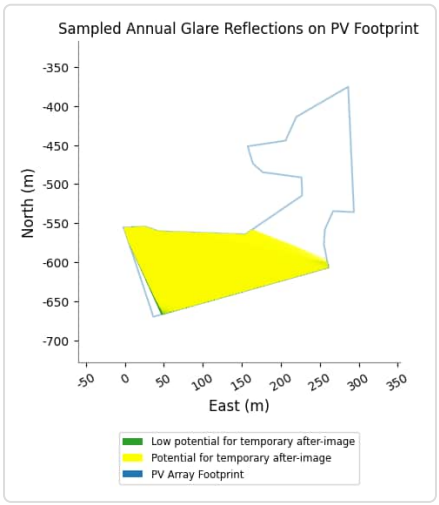
Green glare: 3,331 min.







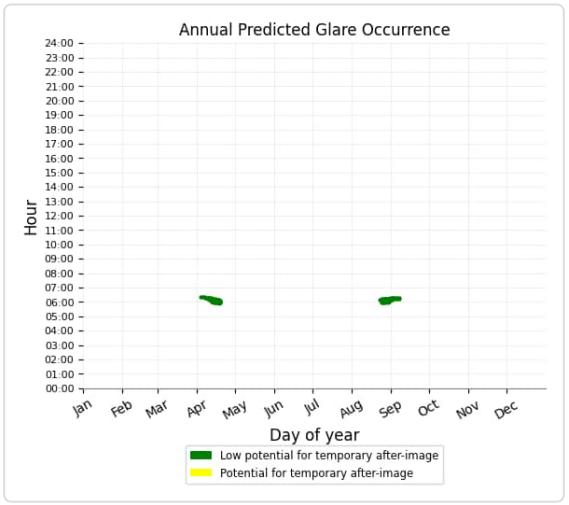


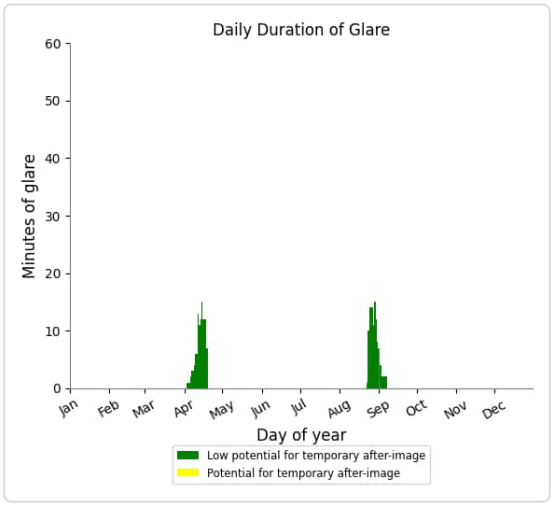


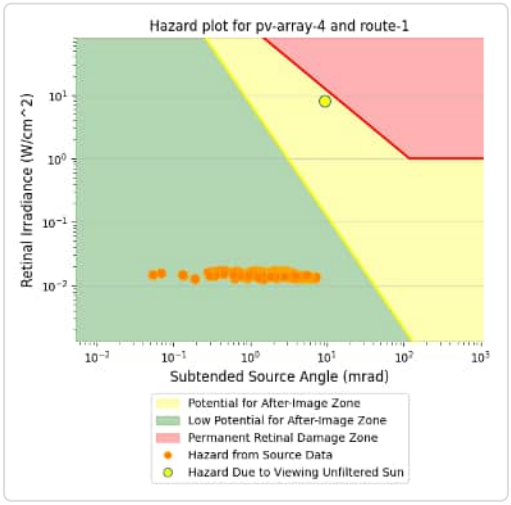
PV array 4 and Route: Route 1

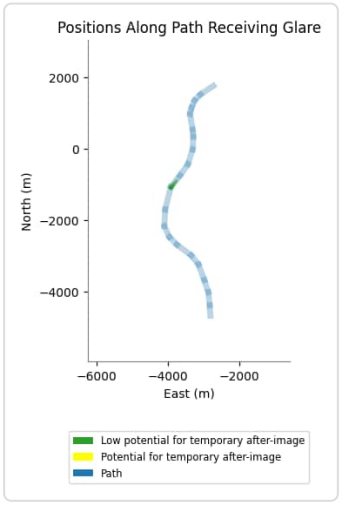
Yellow glare: none

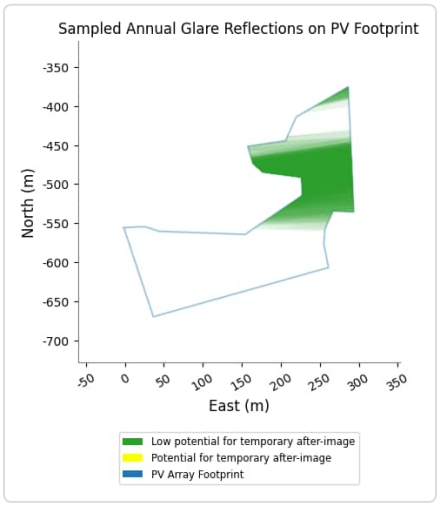
Green glare: 243 min.











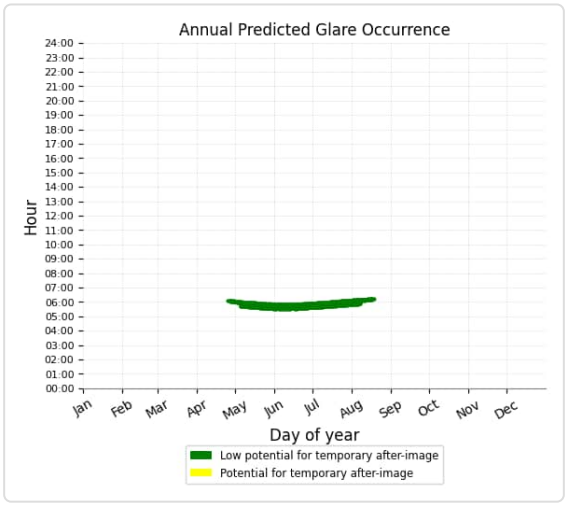
PV array 4 and Route: Route 2

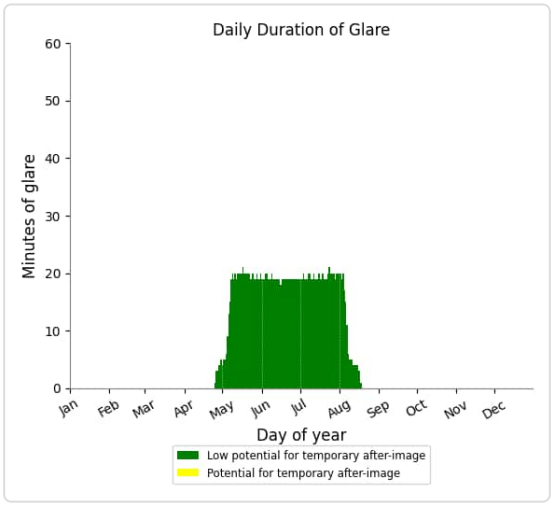
No glare found

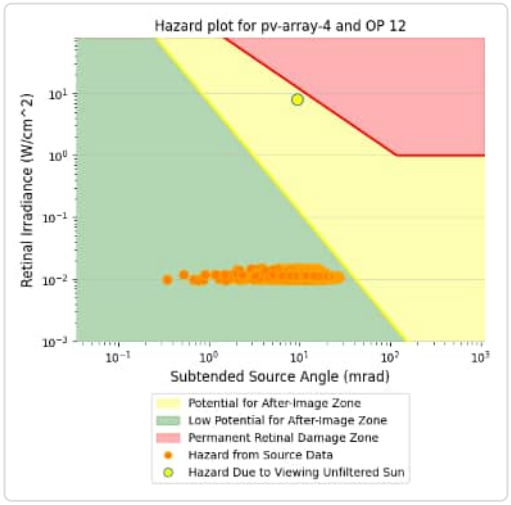
PV array 4 and OP 12

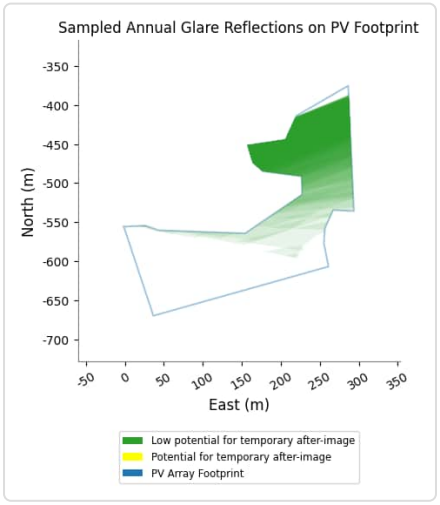
Yellow glare: none

Green glare: 1,891 min.





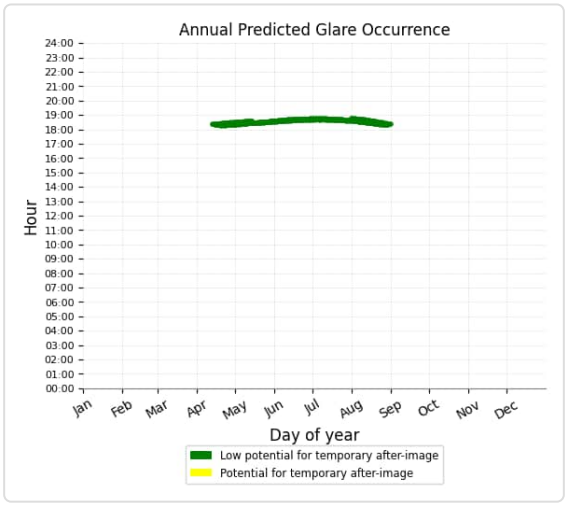


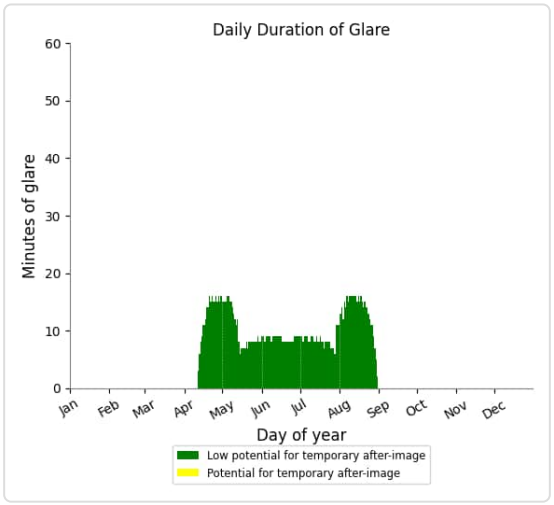


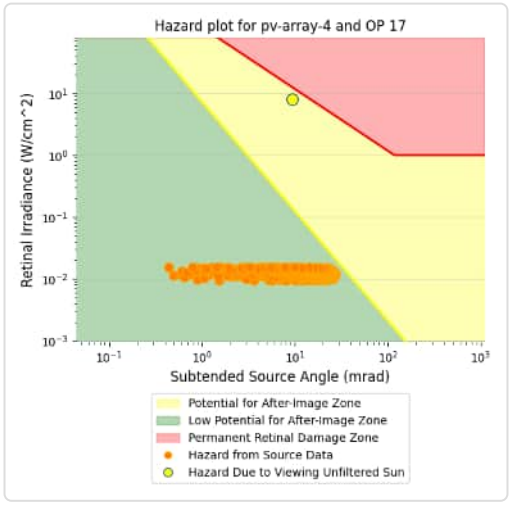
PV array 4 and OP 17

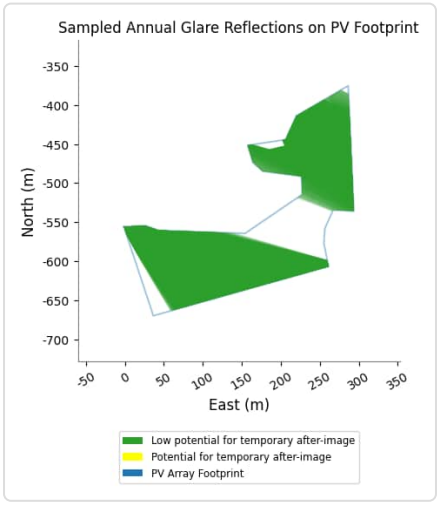
Yellow glare: none

Green glare: 1,486 min.





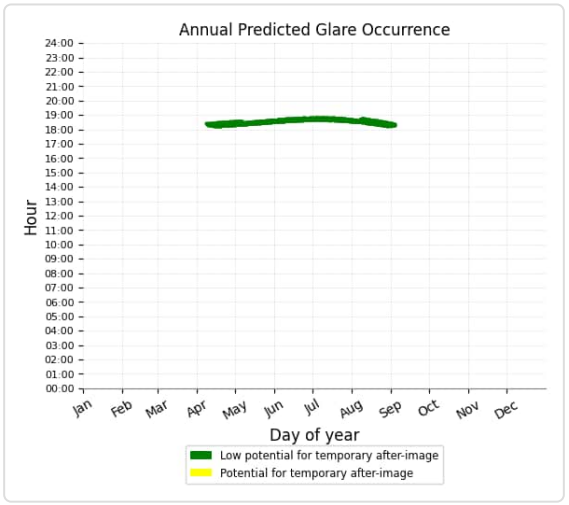


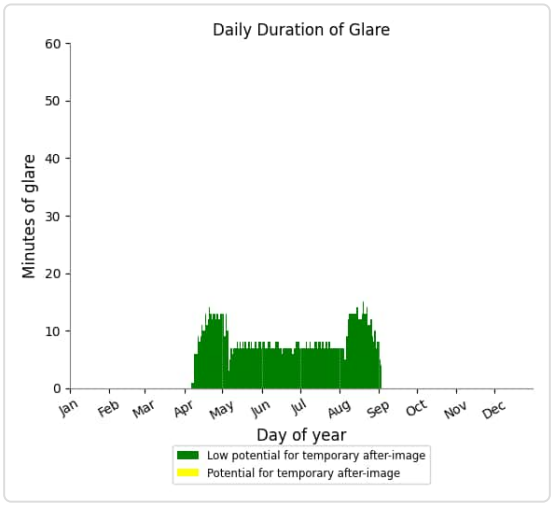


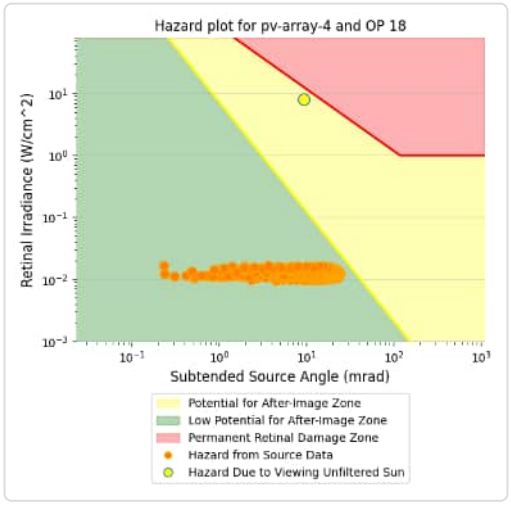
PV array 4 and OP 18

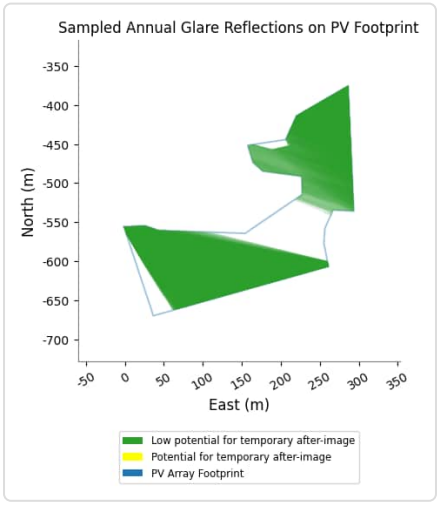
Yellow glare: none

Green glare: 1,273 min.





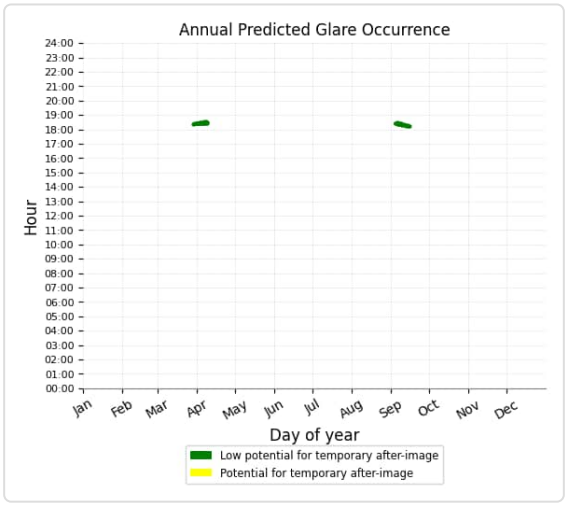


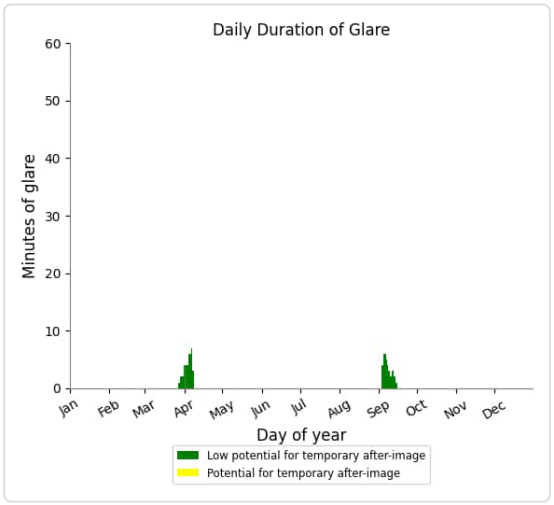


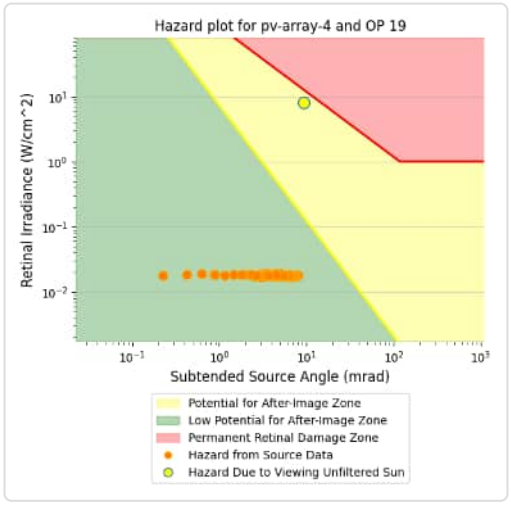
PV array 4 and OP 19

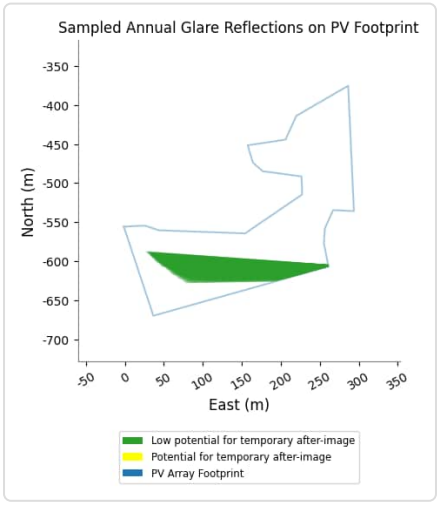
Yellow glare: none

Green glare: 85 min.





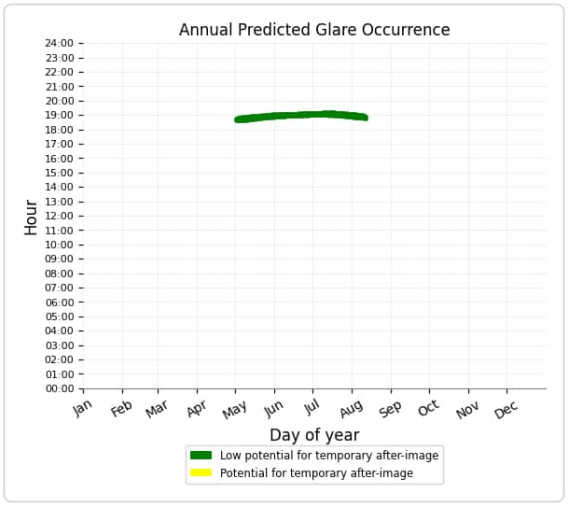


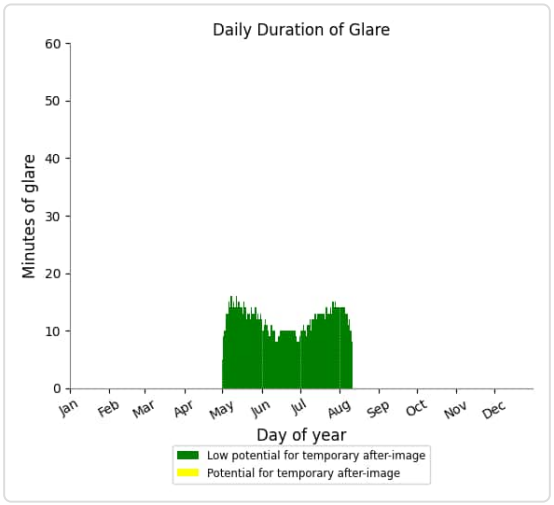


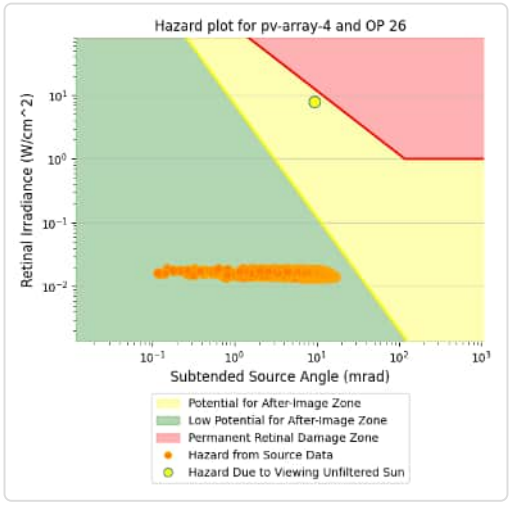
PV array 4 and OP 26

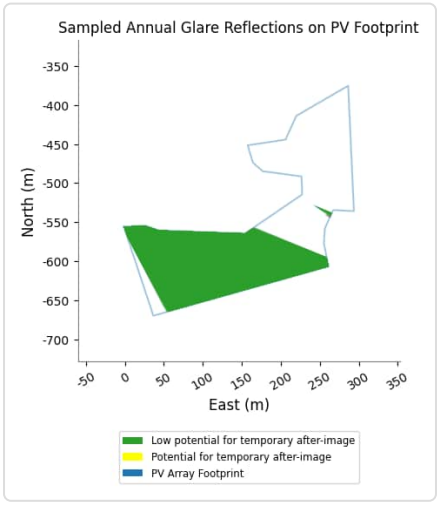
Yellow glare: none

Green glare: 1,221 min.





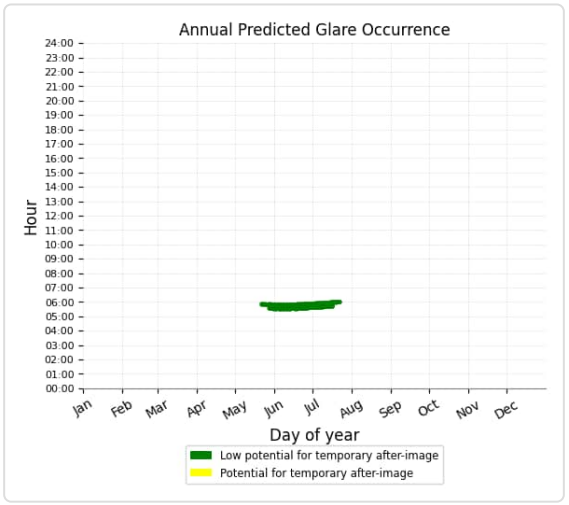


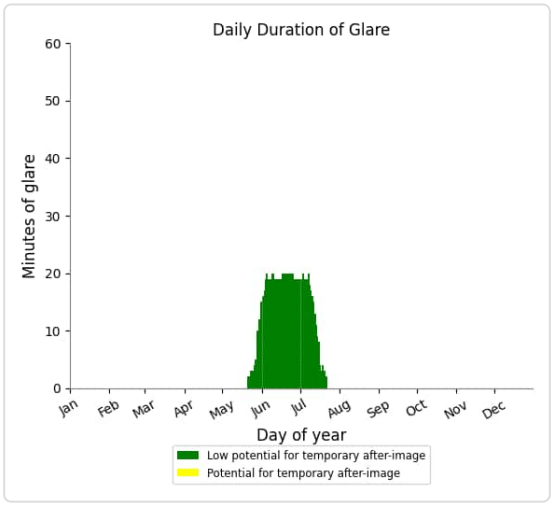


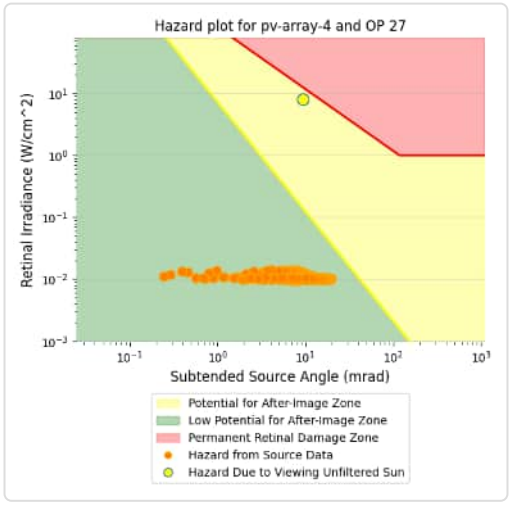
PV array 4 and OP 27

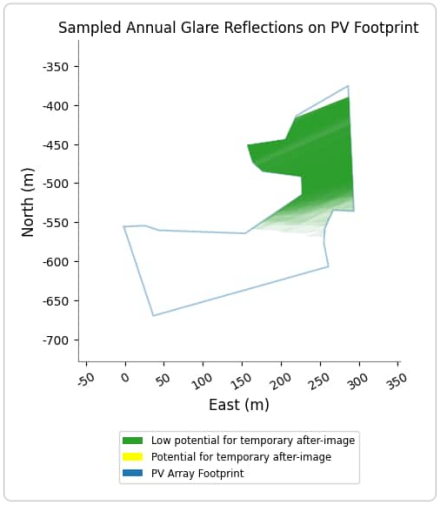
Yellow glare: none

Green glare: 924 min.





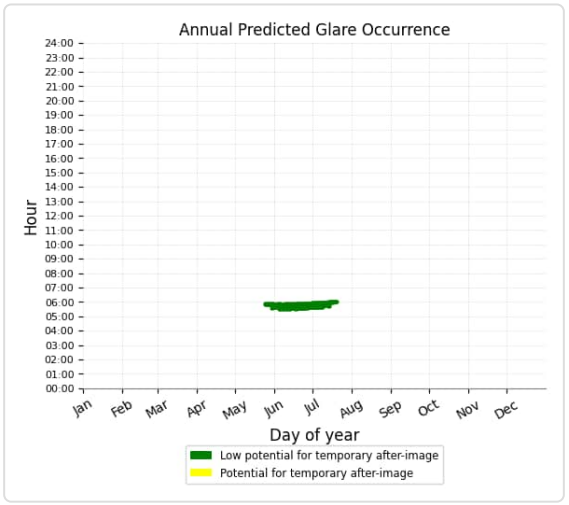


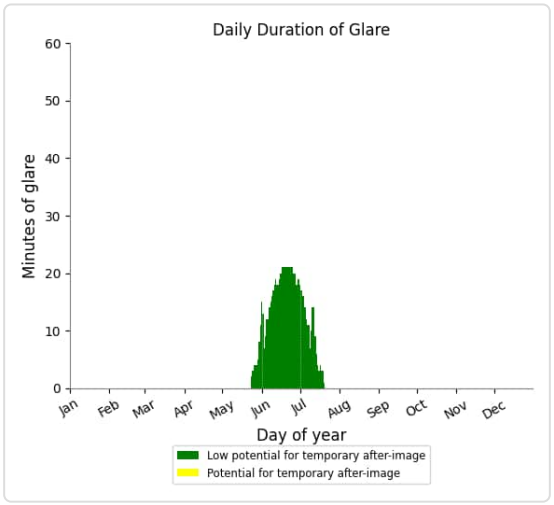


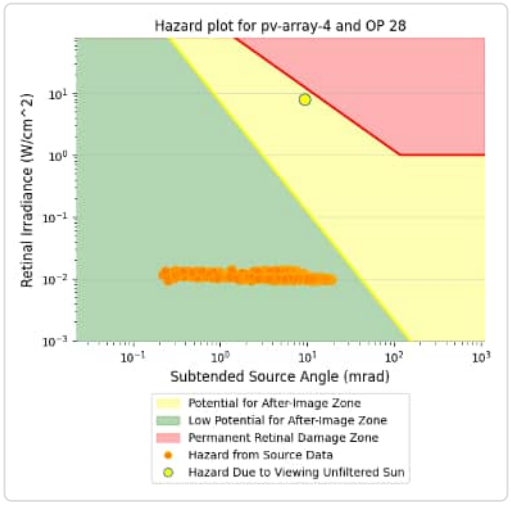
PV array 4 and OP 28

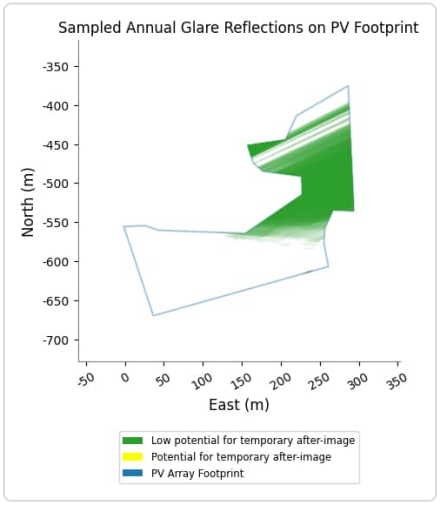
Yellow glare: none

Green glare: 760 min.





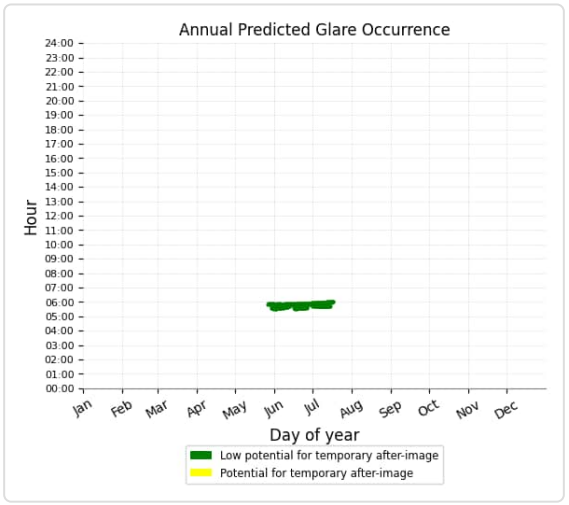


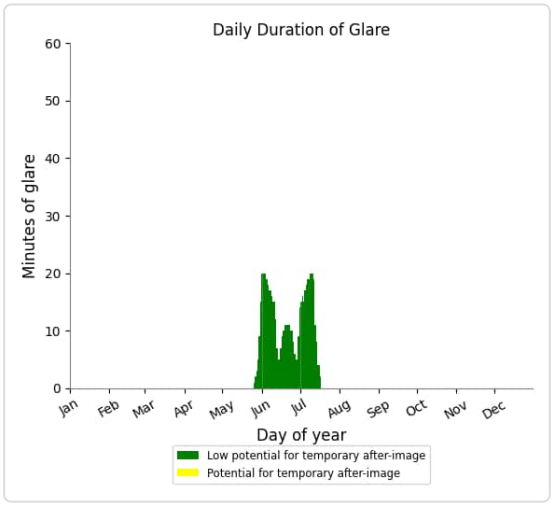


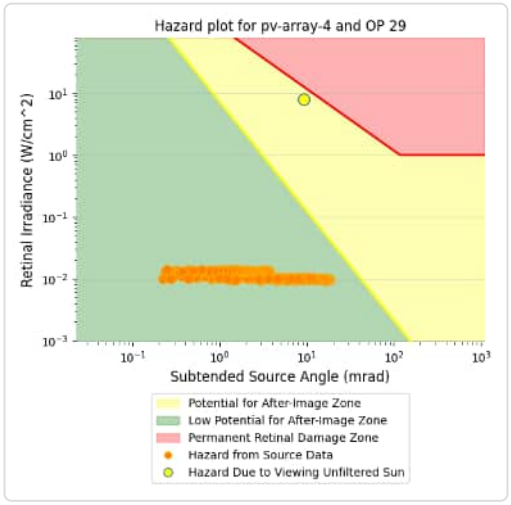
PV array 4 and OP 29

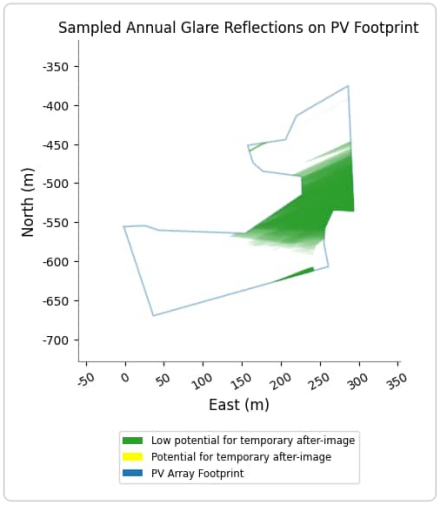
Yellow glare: none

Green glare: 636 min.





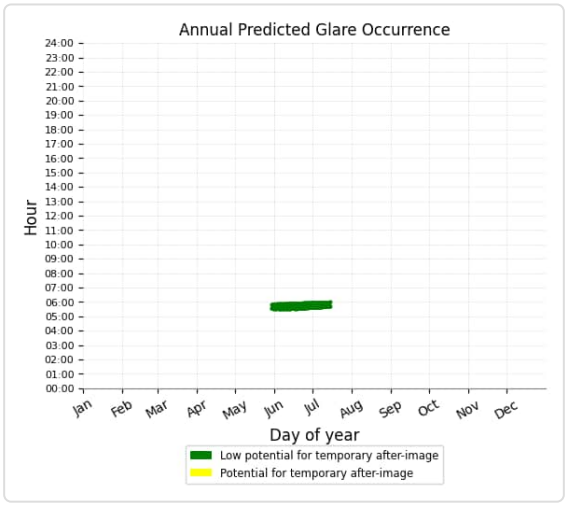


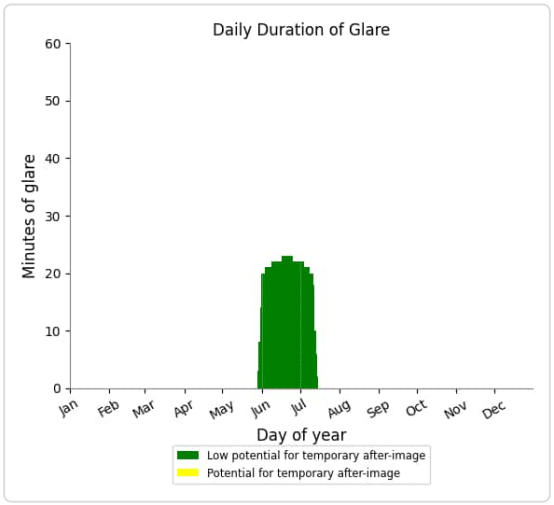


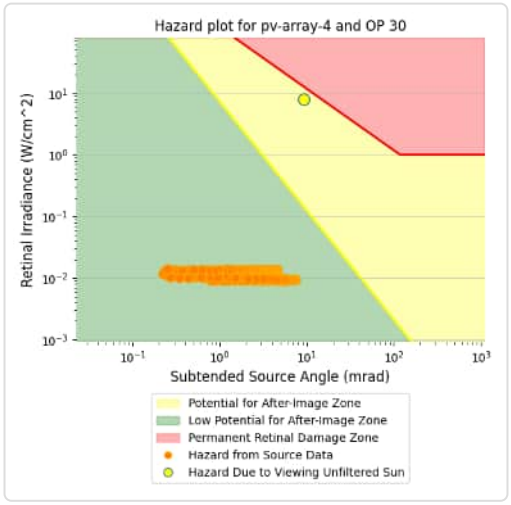
PV array 4 and OP 30

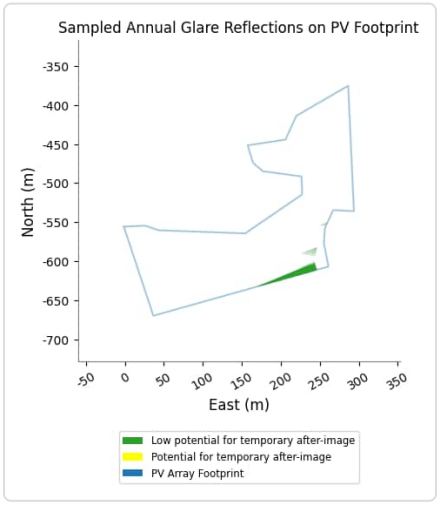
Yellow glare: none

Green glare: 951 min.





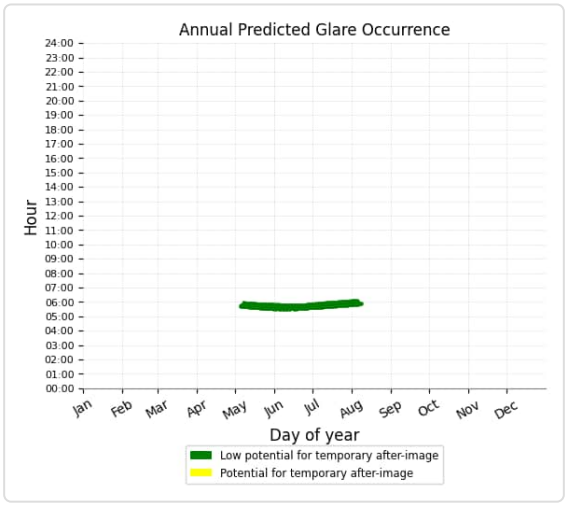


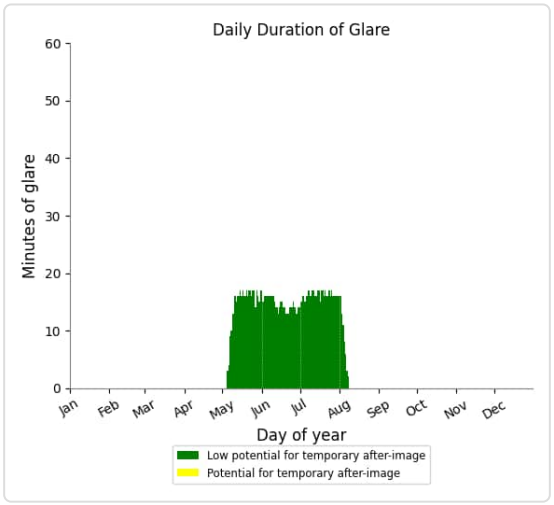


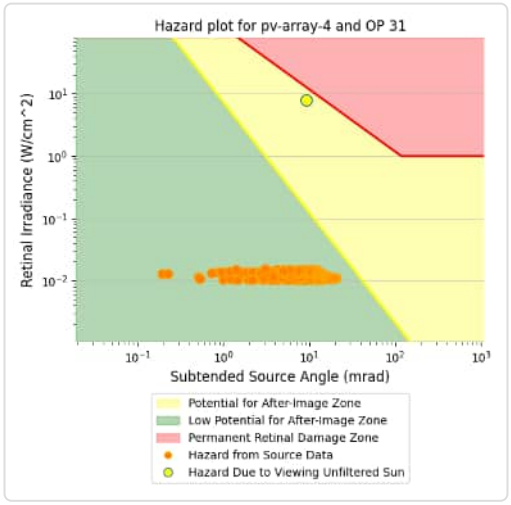
PV array 4 and OP 31

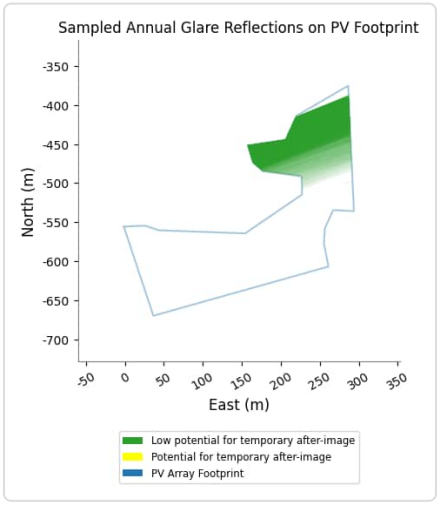
Yellow glare: none

Green glare: 1,407 min.





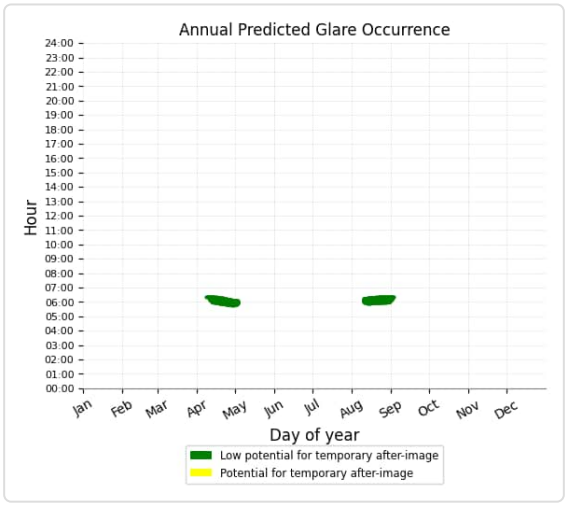


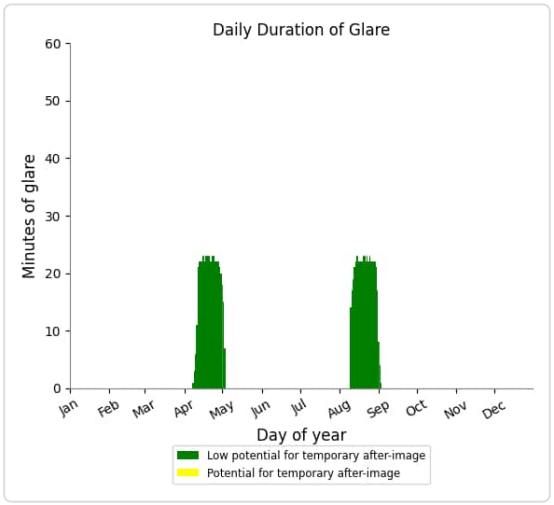


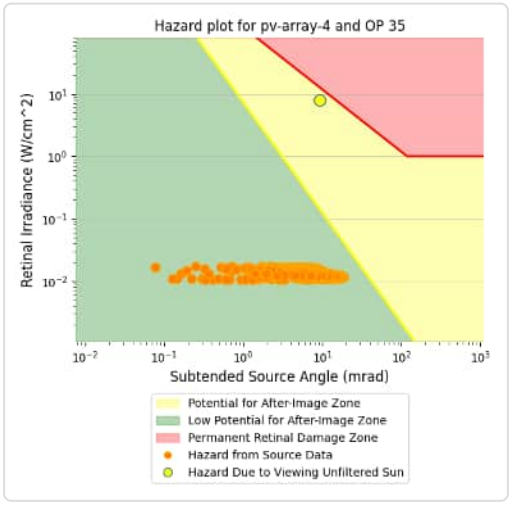
PV array 4 and OP 35

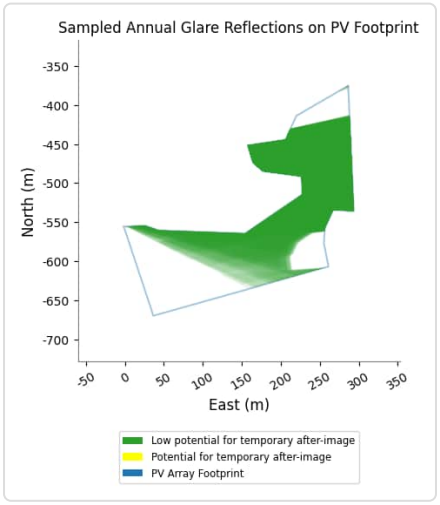
Yellow glare: none

Green glare: 961 min.





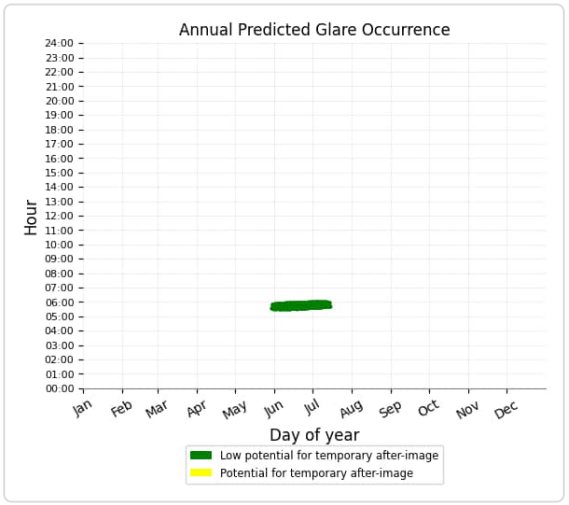


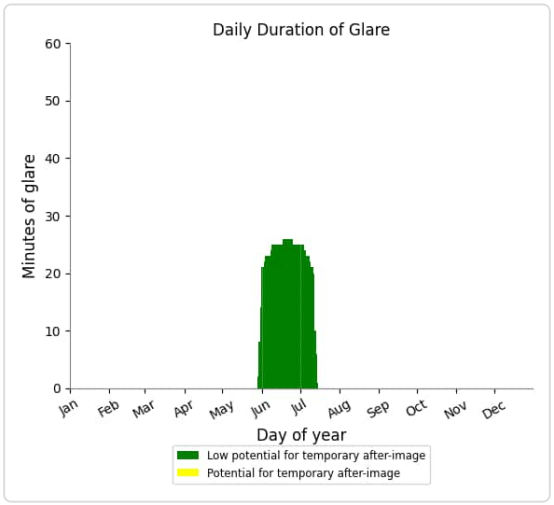


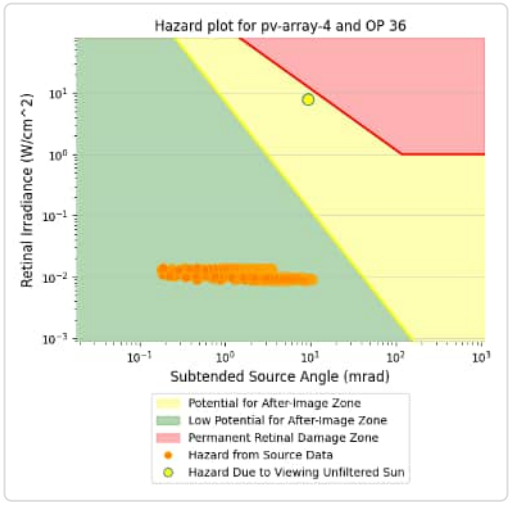
PV array 4 and OP 36

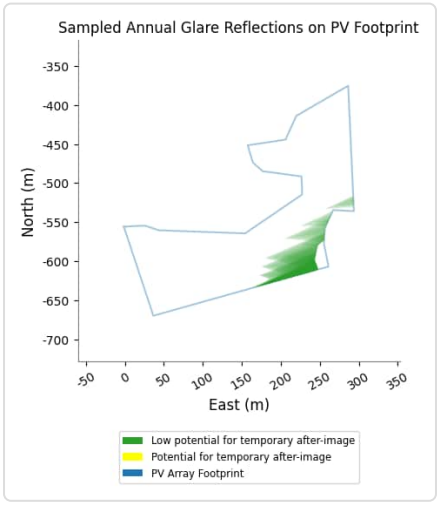
Yellow glare: none

Green glare: 1,056 min.





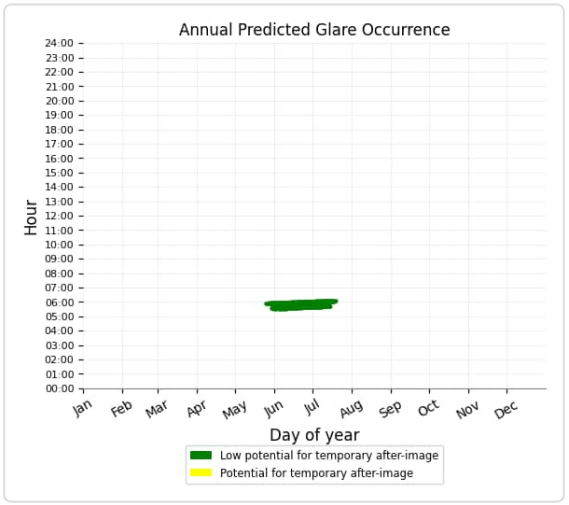


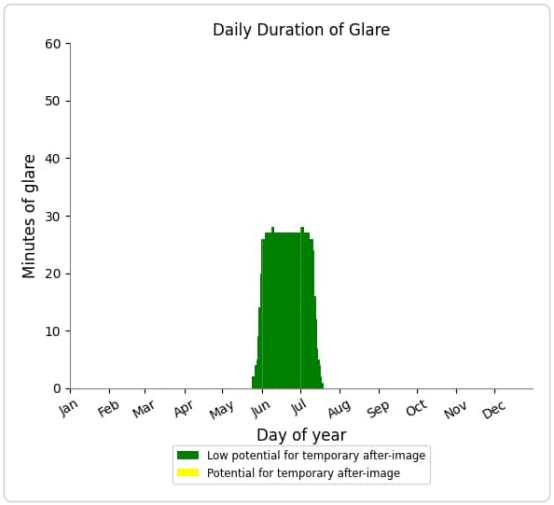


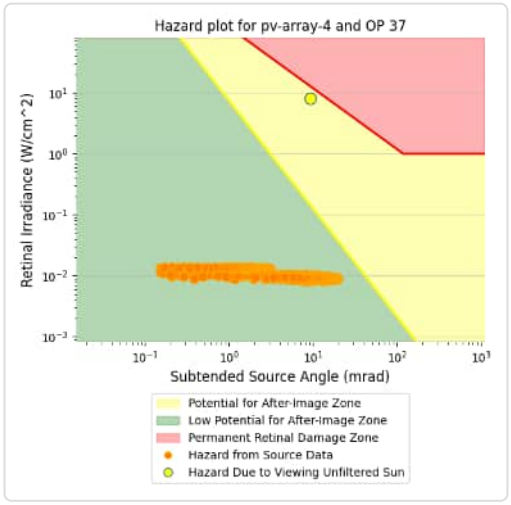
PV array 4 and OP 37

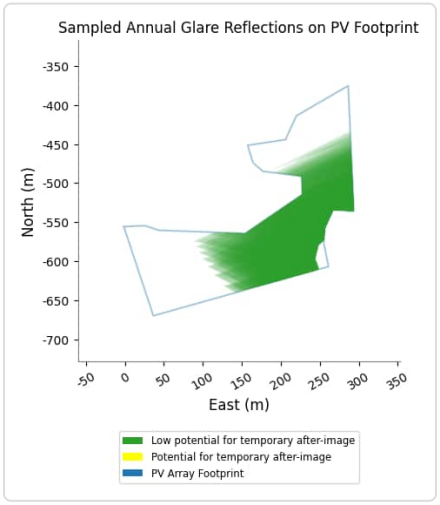
Yellow glare: none

Green glare: 1,233 min.



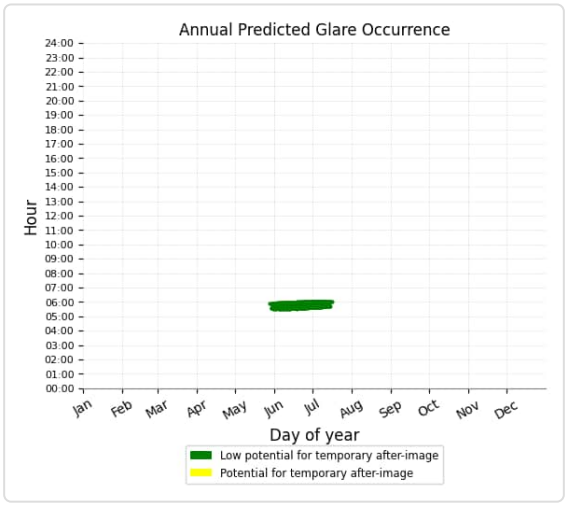


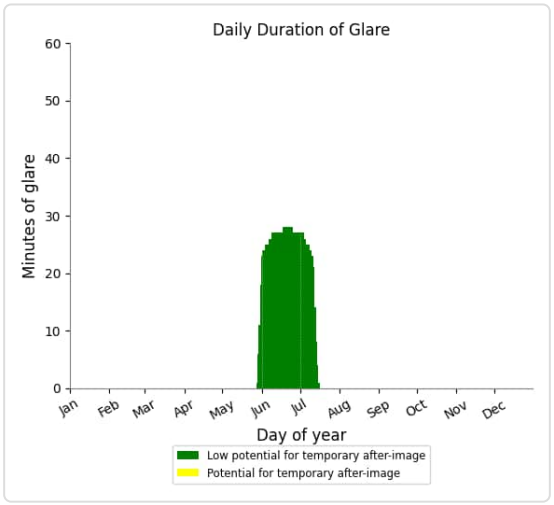


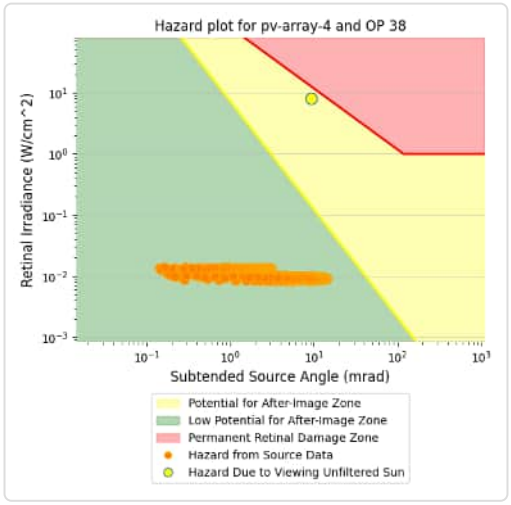


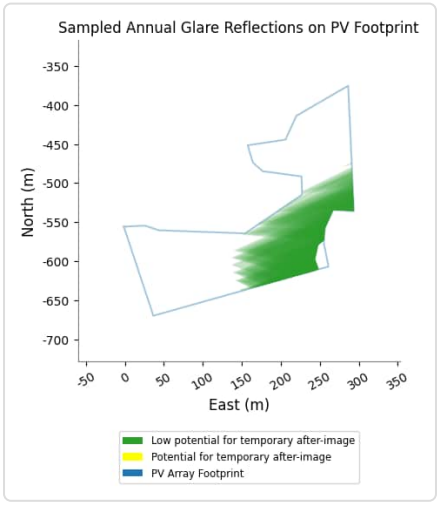
PV array 4 and OP 38

Yellow glare: none
Green glare: 1,164 min.









PV array 4 and OP 1

No glare found

PV array 4 and OP 2

No glare found

PV array 4 and OP 3

No glare found

PV array 4 and OP 4

No glare found

PV array 4 and OP 5

No glare found

PV array 4 and OP 6

No glare found

PV array 4 and OP 7

No glare found

PV array 4 and OP 8

No glare found

PV array 4 and OP 9

No glare found

PV array 4 and OP 10

No glare found

PV array 4 and OP 11

No glare found

PV array 4 and OP 13

No glare found

PV array 4 and OP 14

No glare found

PV array 4 and OP 15

No glare found

PV array 4 and OP 16

No glare found

PV array 4 and OP 20

No glare found

PV array 4 and OP 21

No glare found

PV array 4 and OP 22

No glare found

PV array 4 and OP 23

No glare found

PV array 4 and OP 24

No glare found

PV array 4 and OP 25

No glare found

PV array 4 and OP 32

No glare found

PV array 4 and OP 33

No glare found

PV array 4 and OP 34

No glare found

PV array 4 and OP 39

No glare found

PV array 4 and OP 40

No glare found

PV array 4 and OP 41

No glare found

PV array 4 and OP 42

No glare found

PV array 4 and OP 43

No glare found

PV array 4 and OP 44

No glare found

PV array 4 and OP 45

No glare found

PV array 4 and OP 46

No glare found

PV array 4 and OP 47

No glare found

PV array 4 and OP 48

No glare found

PV array 4 and OP 49

No glare found

PV array 4 and OP 50

No glare found

PV array 4 and OP 51

No glare found

PV array 4 and OP 52

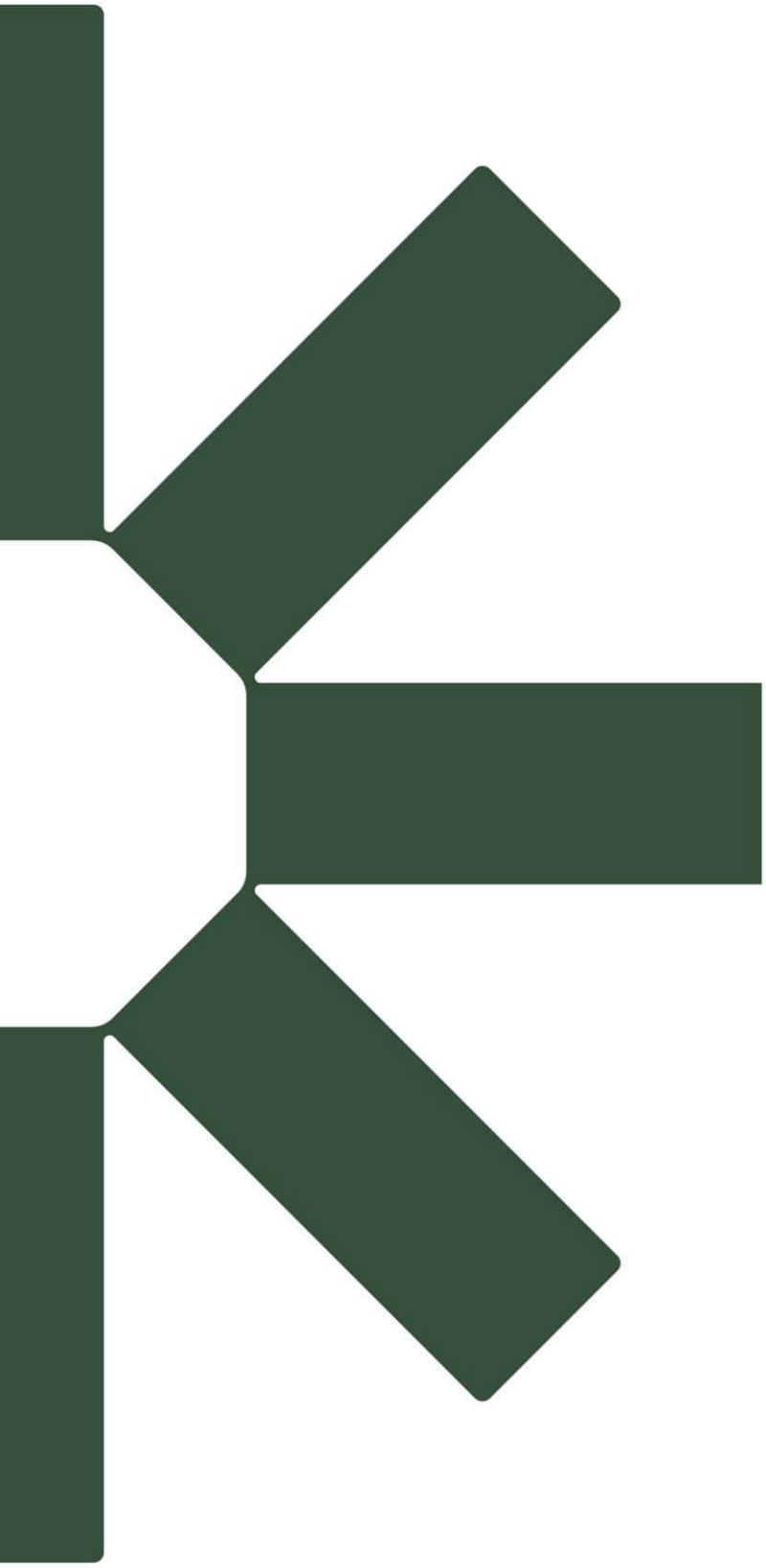
No glare found

Assumptions

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

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

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



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