Technical Appendix 2.6: Glint and Glare Assessment

Kirknewton Solar & BESS EIA Report

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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 Kirknewton Solar Development (the 'Proposed Development') which is located south of Kirknewton in West Lothian, Scotland, United Kingdom. The National Grid reference for the Site is NT 10511 65059.

The Proposed Development would have an export capacity of 40 MW solar PV installation and 9 MW export capacity from the Battery Energy Storage System (BESS). The proposed solar array area covers a total area of approximately 51.7 hectares (ha).

This G&G assessment is informed by the latest design performed by SLR and information provided by Trio Power Limited (herein "the Applicant"). **Graphic 1-1** shows the three (3) PV areas considered for analysis in the G&G software.

Graphic 1-1: 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

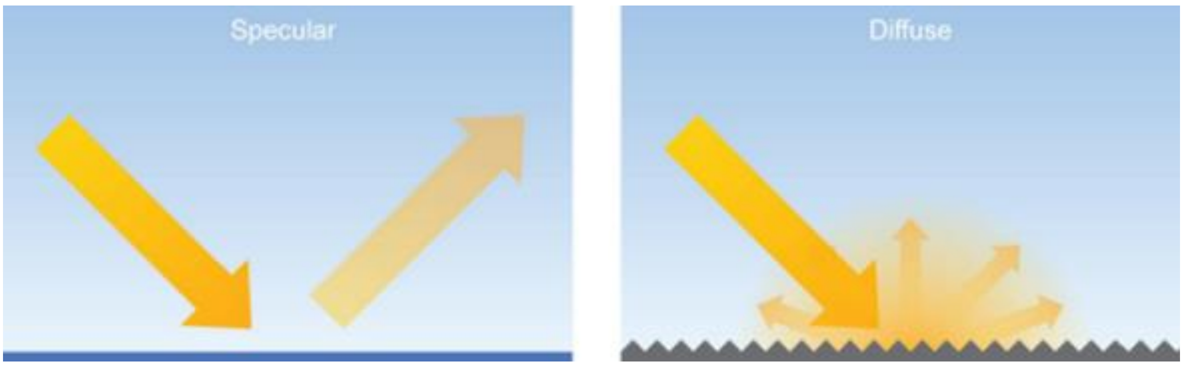
Glint, glare and dazzle are often used interchangeably but are defined in this report as described in **Table 1-2** below.

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 glint and glare, 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 glint and glare interchangeably. In this report, in line with the Forge Solar modelling software, the term ‘glare’ is used as an umbrella term to cover glint and glare 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.

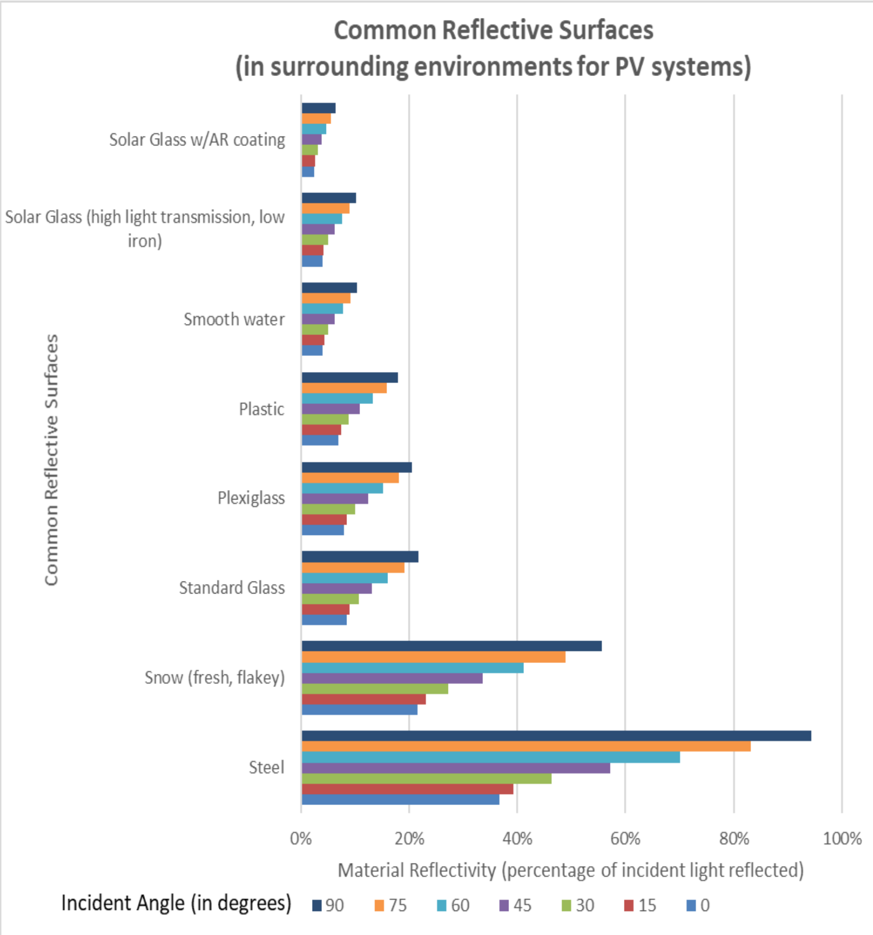
1.3 The Reflectivity of Solar Panels

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

West Lothian Council's Local Development Plan (LDP)[3] was adopted in September 2018. The LDP is supported by Supplementary Guidance documents that provide detailed explanations of how planning policies will be implemented. These include guidance on renewables and low-carbon energy development, noise assessments, flooding and drainage, among others. The Supplementary Guidance document on 'Renewables and Low Carbon Energy Development (Excluding Wind Energy)'[4] has specified that the applications for solar PV projects shall include an assessment of the potential for solar PV panels to cause G&G.

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

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[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] West Lothian Council's Local Development Plan https://www.westlothian.gov.uk/media/38765/West-Lothian-Local-Development-Plan-Adopted-2018/pdf/West_Lothian_Local_Development_Plan_-__Adopted_final_Web_Version_Amended_-_2020-01-08.pdf
https://www.fife.gov.uk/kb/docs/articles/planning-and-building2/planning/development-plan-and-planning-guidance/local-development-plan-fifeplan

[4] Supplementary Guidance https://www.westlothian.gov.uk/media/49607/SG-Supplementary-Guidance-Renewables-and-Low-Carbon-Energy-Development-Excluding-Wind-Energy-Adopted-July-2021/pdf/SG_-_Renewables_and_Low_Carbon_Energy_Excluding_Wind_Development_-_Adopted_15_July_2021.pdf

- Federal Aviation Administration (FAA)

BRE state that the sensitivities associated with glint and glare, the landscape/visual impact and the potential impact on aircraft safety, should be a consideration. In some instances, it may be necessary to seek a G&G assessment as part of a planning application[5]. 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'[5] such as 'differential diurnal and/or seasonal'[5] 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'[6]. 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 glint and glare should be made over a wider area' and indicate a range of up to 5 km from an Aerodrome Reference Point (ARP)[7] 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.

[5] 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

[6] 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

[7] 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 glint and glare.

- Only twenty (20) obstructions can be modelled. As a result, many existing obstructions such as tree and 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 1.2 EIA Report) and the Landscape Enhancement and Mitigation Plan (LEMP) (**Technical Appendix 6.5** of the EIA Report). 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 1 km radius from the Proposed Development for all ground-based receptors (buildings, 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 (see **Graphic 4-1**). Key locations include:

- Residential buildings to the east of Kirnewton Solar, located in Newlands.
- Residential buildings to the north and south of Kirknewton Solar.
- Residential dwellings along the road on the southwest side of Kirknewton Solar.

A total of 60 ground-based observation points (OPs) represent buildings within the study area. These receptors are all off-site residential properties of one or two storeys.

4.1.2 Roads and Trainline

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

- Main Road, A70, south of the Proposed Development. It runs from Edinburgh to Ayr.
- Leyden Road, intersecting the Proposed Solar.

There is no railway line within a 1 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

The closest aviation receptor within a 5 km radius of the Proposed Development is a Royal Air Force Base, which lies to the east of the Proposed Development, with two runways (see **Graphic 4-2**). It provides flying experience and training to members of the Royal Air Force Air Cadets.

Four air-based receptors (two-mile flight path) corresponding to two runways at the Royal Air Force Station have been modelled in ForgeSolar. The flight paths extend 2 miles from the threshold, off the end of and parallel to each runway, and the angle of climb and descent is assumed to be 10° glide angle.

Graphic 4-2: The Proposed Development and identified air-based receptors (yellow).

5.0 G&G Assessment

5.1 Modelling Input

Three 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	Two routes: Leyden Road and A70
Residential Dwellings - Observation points	60 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 – Kirknewton.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: 3	From mid-Apr to Aug, between 18:00 and 20:00, for up to 58 minutes per day
Route 2	Green	PV Area: 1, 3	During Mar, Apr, Aug, and Sep, between 18:00 and 19:00, for up to 20 minutes per day
Flight Path 4 (FP4)	Green	PV Areas: 1, 2, 3	During Mar, Apr, May, and from mid-Jul to mid-Oct, between 17:30 and 19:00, for up to 32 minutes per day
OP 2	Green	PV Area: 3	During mid-Mar to mid-Sep, between 05:30 and 06:30, for up to 10 minutes per day
OP 5	Green	PV Area: 3	During mid-Mar to mid-Sep, between 05:30 and 07:00, for up to 5 minutes per day
OP 8	Green	PV Area: 3	During May, Jun, and Jul, between 18:00 and 19:00, for up to 21 minutes per day
OP 9	Green	PV Area: 3	During Apr to mid-Sep, between 18:00 and 19:00, for up to 22 minutes per day
OP 33	Green	PV Area: 1	During Jun to mid-Jul, between 18:00 and 19:00, for up to 5 mins per day
OP 39	Green	PV Area: 3	From Jun to mid-Jul, between 18:30 and 19:30, for up to 25 minutes per day
OP 50	Green	PV Area: 3	During Apr, May and from mid-Jul to mid-Sep, between 18:00 and 19:30, for up to 30 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 colour in **Graphic 5-1**. The screenings are based on information available in Google Earth Pro and the LMP as shared by the Applicant.

In addition, several obstructions have been modelled in the simulation as “Imp”, “P” or “ImpP”, which are part of study recommendation and defined as below and colour-coded in **Graphic 5-1**:

- Imp (green) – existing vegetation to be improved
- P (white) – vegetation up to a height of 5m proposed to fill gaps around the site boundary
- ImpP (blue) – both, improve existing vegetation and plant more vegetation up to a height of 3 m

Graphic 5-1: Existing and proposed screenings included in the simulation.

5.3.1 Fixed Ground Receptors

Out of the 60 identified ground-based fixed receptors, 7 receptors are potentially affected by G&G from the Proposed Development, primarily from PV Areas 1 and 3, as indicated in **Table 5-4**.

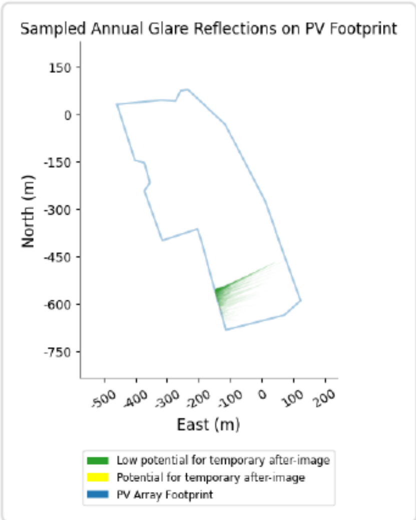
Among these 7 receptors, none of the receptors is expected to potentially experience yellow glare from the Proposed Development. All fixed receptors experience only green glare, which indicates a low potential for after-image formation and poses minimal risk to health and safety.

- OP 2 could receive up to 10 minutes per day of green glare between mid-March and mid-September, in the early mornings (05:30 to 06:30). This is attributed to the sun rising in the east and reflecting westwards towards the receptor.

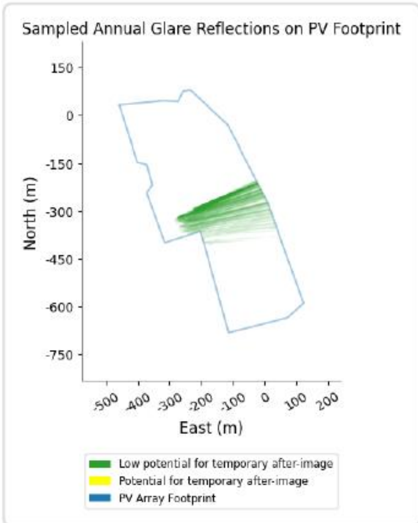
- OP 5: up to 5 minutes per day of green glare between mid-March and mid-September, in the early mornings (05:30 to 07:00).
- OP 8: up to 21 minutes per day of green glare during May, June, and July, in the evening (18:00 to 19:00). This is attributed to the sun setting in the west and reflecting eastwards towards the receptor.
- OP 9: up to 22 minutes per day of green glare between April and mid-September, in the evening (18:00 to 19:00).
- OP 33: up to 5 minutes per day of green glare between June and mid-July, in the evening (18:00 to 19:00).
- OP 39: up to 25 minutes per day of green glare between June and mid-July, in the evening (18:30 to 19:30).
- OP 50: up to 30 minutes per day of green glare during April, May and from mid-July to mid-September, in the evening (18:00 to 19:30).

In addition, **Graphic 5-2** illustrates the areas of the Proposed Development from which the green glare affecting the fixed receptors emanates.

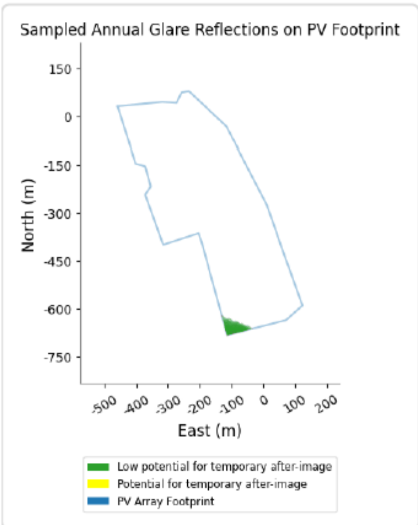
PV Array 3 to OP 2



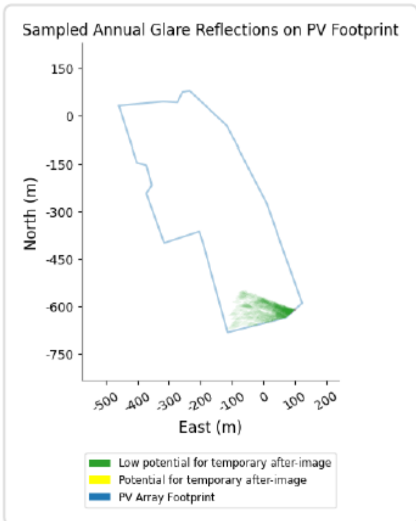
PV Array 3 to OP 5



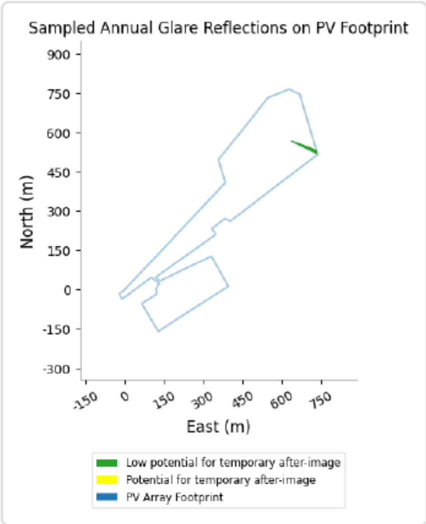
PV Array 3 to OP 8



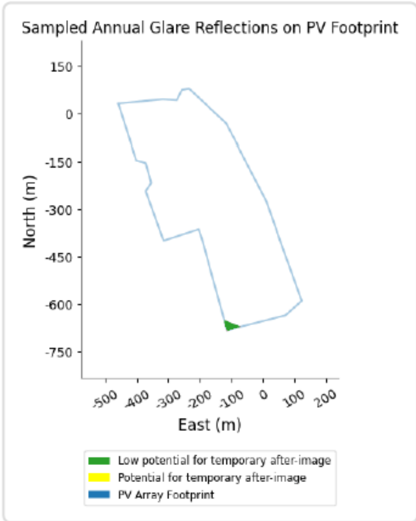
PV Array 3 to OP 9



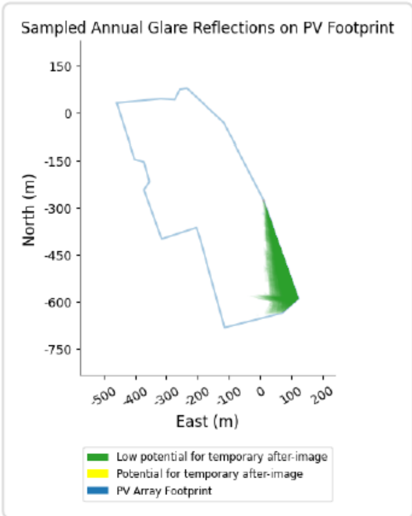
PV Array 1 to OP 33



PV Array 3 to OP 39



PV Array 3 to OP 50



Graphic 5-2: Areas of PV Arrays from where G&G emanates on affected fixed receptors.

These receptors are located south (OP 8, OP 9, OP 39, OP 50), west (OP 2 and OP 5) and east (OP 33) of the Proposed Development. As discussed in **Section 5.3** above, the simulation has accounted for several screening measures which are part of the study recommendation, including proposed vegetation (white), existing screening with improvement (green), and existing screening with improvement and proposed vegetation (blue). One such screening measure near OP 9 along Leyden Road is depicted below in **Graphic 5-3** which needs to be improved as well as more planting is required. The LEMP includes additional hedgerow infill and tree planting in the south-east of the western land parcel which will reduce the impact at OP 9.

Graphic 5-3: Screening measure near OP 9 included in the simulation.

Despite this mitigation, some residual glare is still predicted which has been discussed above. In the worst-case scenario, this could result in up to 30 minutes of glare per day for OP 50 during the evening hours (18:00 to 19:30) when the sun is low in the sky and reflects eastwards before sunset, with no occurrence outside of the April to July 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**.

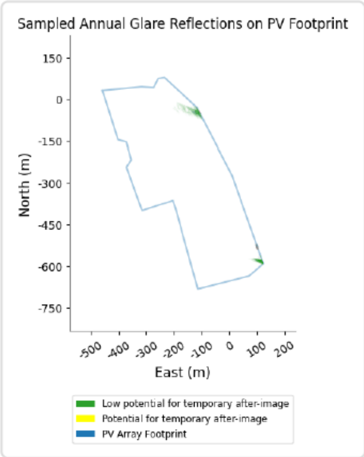
5.3.2 Roads

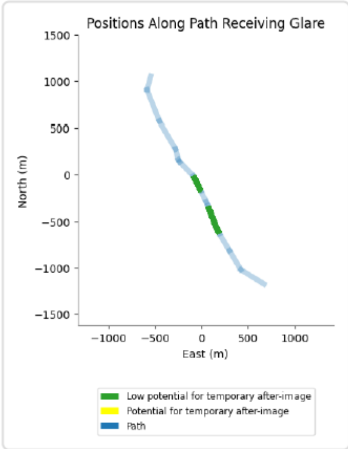
The G&G assessment evaluated two routes: two roads (Leyden Road and A70). Existing screening measures, such as trees and hedgerows, as well as proposed vegetation (discussed above), have been incorporated in the simulation. However, due to modelling limitations, it was not possible to include all the 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.

Both the routes - Route 1 (Leyden Road) and Route 2 (A70) are expected to be potentially affected by green glare only. According to the Forge Solar Analysis:

- Route 1 (Leyden Road) is potentially impacted by glare up to 58 minutes per day from mid-April to August during the evening hours (18:00 to 20:00) due to the low angle of the sun at that time of the day. Route 1 is only affected by PV Area 3.
- Route 2 (A70) may be subjected to glare for up to 20 minutes per day during March, April, August, and September during the evening hours (18:00 to 19.00), again due to the low angle of the sun at that time of the day. PV Areas 1 & 3 affect the Route 2.

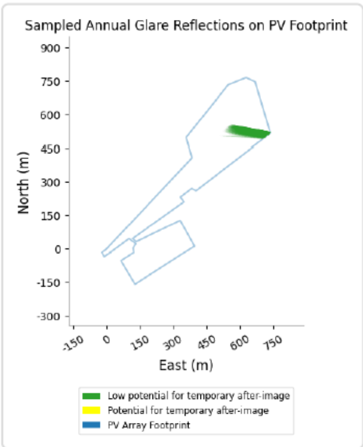
Additionally, **Graphic 5-4** and **Graphic 5-5** illustrate where the G&G emanates from, and which part of the route is affected by it.

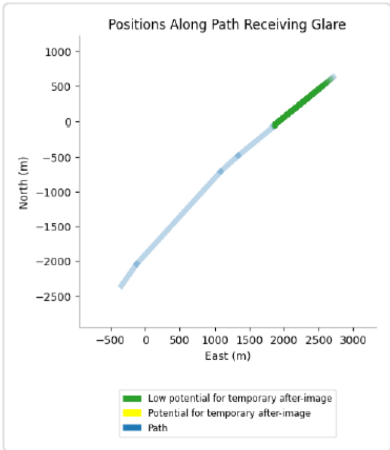




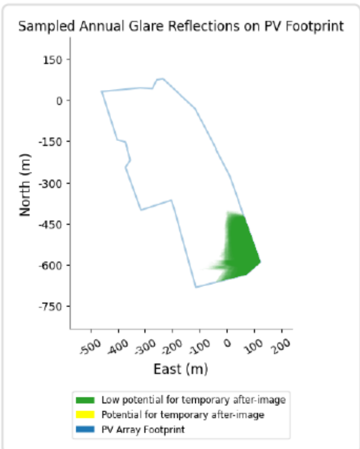
Graphic 5-4: Glare emanating from PV Area 3 (left) and impacting on several sections of Route 1 (right).

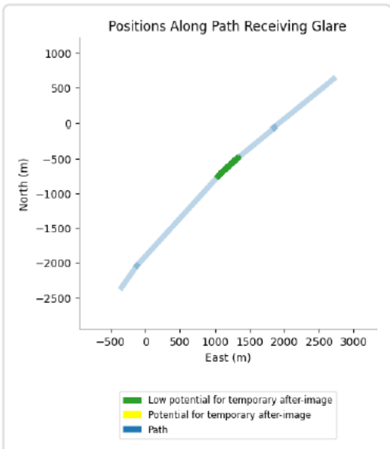
PV Area 1





PV Area 3





Graphic 5-5: Glare emanating from PV Areas 1 & 3 (left) and impacting on several sections of Route 2 (right).

While there are already existing and proposed screenings (as discussed in **Section 5.3**) in place, additionally there are several existing screenings such as trees, hedgerows and buildings along route 2 that would partially obstruct the glare under real-life conditions. However, this obstruction (see **Graphic 5-6**) could not be included in the modelling due to software limitations.

Graphic 5-6: Existing screening along Route 2 not included in the simulation.

In conclusion, the combination of short exposure durations (101 hours for Route 1 and 28 hours for Route 2), no occurrence of yellow glare, and existing and proposed mitigation measures means that the potential G&G impact on Routes 1 & 2 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**.

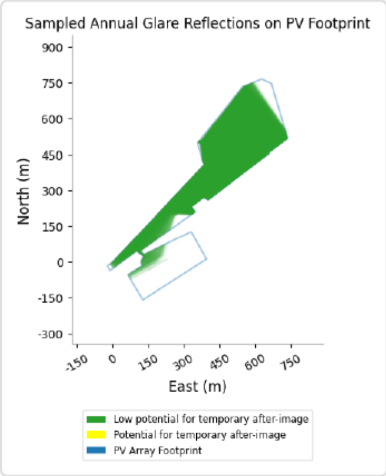
5.3.3 Air based Receptors

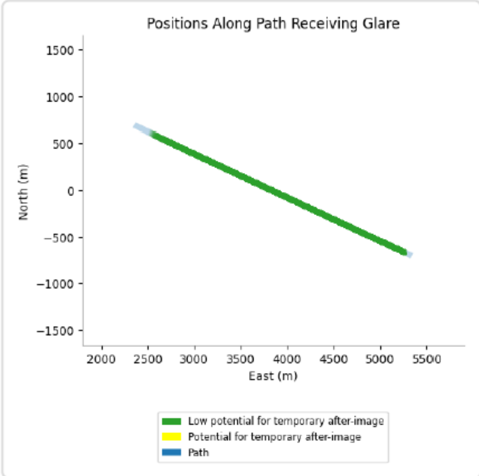
The G&G assessment evaluated four flight paths corresponding to two runways in the Royal Air Force Base. According to the Forge Solar Analysis, only Flight Path 4 (FP 4) is expected to be potentially affected by green glare only.

FP 4 is potentially impacted by glare up to 32 minutes per day during March, April, May and from mid-July to mid-October during the evening hours (17:30 to 19:00) due to the low angle of the sun at that time of the day. FP 4 is affected by all PV Areas 1, 2, & 3.

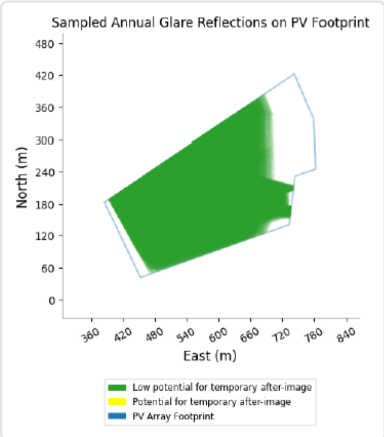
Additionally, **Graphic 5-7** illustrate where the G&G emanates from, and which part of the flight path is affected by it.

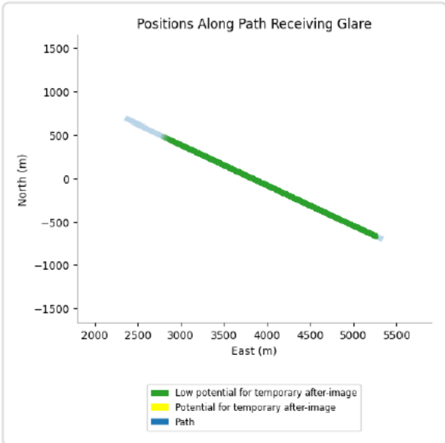
PV Area 1



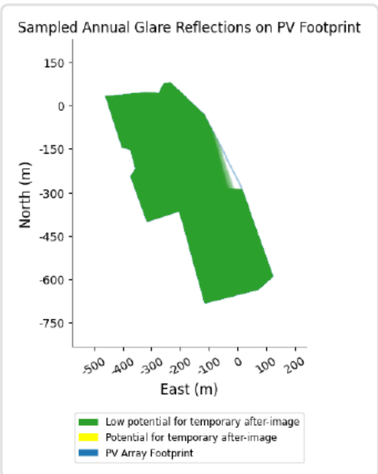


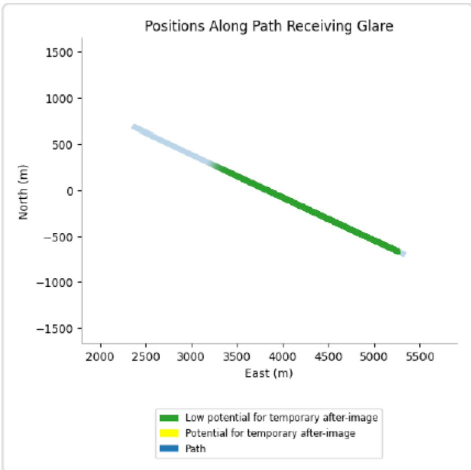
PV Area 2





PV Area 3





Graphic 5-7: Glare emanating from PV Areas 1, 2 & 3 (left) and impacting on several sections of FP 4 (right).

While there are already existing and proposed screenings (as discussed in **Section 5.3**) in place, additionally there are several existing screenings such as trees, hedgerows, buildings along the B7031 (west of Royal Air Force Station) and along Newlands Road (also west of Royal Air Force Station) that would partially obstruct the glare under real-life conditions. However, these obstruction (see **Graphic 5-8**) could not be included in the assessment due to software limitations.

Existing screening along B7031 not included in simulation

Existing screening along 10 Newlands not included in simulation

Graphic 5-8: Existing screening along B7031 and 10 Newlands not included in the simulation.

Additionally, gliders only use the RAF station during the weekends. Therefore, the duration of any potential glare impact would be significantly reduced in real-life conditions.

In conclusion, the combination of short exposure durations, no occurrence of yellow glare, and existing and proposed mitigation measures, means that the potential G&G impact on Flight Path 4 is negligible and unlikely to pose a risk to health or safety.

Furthermore, the impact occurs during evening hours, when training activities may not take place and thus the risk is assessed to be **negligible**.

6.0 Conclusion

The purpose of this G&G assessment is to consider the effects of G&G arising from the proposed solar farm on receptors around the Proposed Development. 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, transport routes, and air receptors surrounding the Proposed Development. Of the 60 assessed fixed ground receptors, only seven receptors are expected to experience low-intensity (green) glare with no health or safety implications.

For transport routes, both routes (Route 1 and Route 2) are also expected to be potentially affected by green glare only. The study has proposed and included three types of screening measures (discussed in **Section 5.3**) in addition to existing screenings: new vegetation, improving existing vegetation, and both new vegetation and improving existing vegetation. Existing screening measures, along with conservative modelling assumptions, indicate that these impacts are overstated and unlikely to cause any significant impacts.

For air-based receptors, including flight paths at the Royal Air Force Station, the assessment indicates occurrence of green glare during the evening hours of March, April, May and from mid-July to mid-October. In addition to existing and proposed screenings, there are several existing screenings which would restrict these impacts but have not been included in the simulation, thus ensuring no aviation-related safety concerns.

These results are also based on conservative assumptions, and real-world impacts are expected to be lower or negligible.

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 negligible. With the proposed screening measures, residual glare effects are expected to be minimal, reducing the likelihood of significant risks to road, residential receptors, or aviation receptors.

Annex A Forge Solar Analysis

Kirknewton Solar & BESS EIA Report

TRIO Power Limited

SLR Project No.: 405.065786.00001

11 December 2025

The simulation results from the ForgeSolar software are provided separately in PDF format, under the document name '*Forge Solar Analysis – Kirknewton'.*

FORGESOLAR GLARE ANALYSIS

Project: **Kirknewton Solar Farm**
Site configuration: **Kirknewton Solar Farm**

Client: Trio Power Ltd

Created 11 Sep, 2025
Updated 15 Sep, 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 159138.26678

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 low 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	4,591	76.5	0	0.0	-
PV array 2	20.0	180.0	1,218	20.3	0	0.0	-
PV array 3	20.0	180.0	17,731	295.5	0	0.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	6,068	101.1	0	0.0
Route 2	1,659	27.6	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
FP 3	0	0.0	0	0.0
FP 4	6,627	110.5	0	0.0
OP 1	0	0.0	0	0.0
OP 2	1,373	22.9	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	685	11.4	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 8	1,094	18.2	0	0.0
OP 9	2,740	45.7	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
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	153	2.5	0	0.0
OP 34	0	0.0	0	0.0
OP 35	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 39	877	14.6	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	2,264	37.7	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	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	55.869678	-3.433923	209.35	2.67	212.02
2	55.873344	-3.427786	200.86	2.67	203.53
3	55.874126	-3.428215	198.38	2.67	201.05
4	55.876257	-3.425190	193.81	2.67	196.48
5	55.876546	-3.423902	191.46	2.67	194.13
6	55.876377	-3.423258	191.58	2.67	194.25
7	55.874307	-3.422164	195.93	2.67	198.60
8	55.872020	-3.427507	204.10	2.67	206.77
9	55.872116	-3.427807	204.24	2.67	206.91
10	55.871767	-3.428623	205.88	2.67	208.55
11	55.871574	-3.428365	205.96	2.67	208.63
12	55.870092	-3.432056	209.06	2.67	211.73
13	55.869966	-3.431802	209.14	2.67	211.81
14	55.870823	-3.428638	207.79	2.67	210.46
15	55.869787	-3.427615	220.75	2.67	223.42
16	55.868248	-3.431888	227.01	2.67	229.68
17	55.869196	-3.432890	213.24	2.67	215.91
18	55.869524	-3.431972	213.33	2.67	216.00
19	55.869714	-3.432020	211.00	2.67	213.67
20	55.869885	-3.431832	209.68	2.67	212.35
21	55.870089	-3.432316	209.43	2.67	212.10
22	55.869526	-3.433673	209.94	2.67	212.61
23	55.869520	-3.433661	209.96	2.67	212.63
24	55.869359	-3.434089	210.07	2.67	212.74
25	55.869527	-3.434258	209.13	2.67	211.80

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	55.871324	-3.427775	206.41	2.67	209.08
2	55.870054	-3.426692	219.00	2.67	221.67
3	55.870945	-3.422207	221.44	2.67	224.11
4	55.871763	-3.422035	213.96	2.67	216.63
5	55.871884	-3.421413	213.93	2.67	216.60
6	55.872715	-3.421477	207.48	2.67	210.15
7	55.873473	-3.422057	199.05	2.67	201.72

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	55.869976	-3.441251	198.36	2.67	201.03
2	55.870096	-3.438998	200.06	2.67	202.73
3	55.870072	-3.438289	200.56	2.67	203.23
4	55.870361	-3.438032	200.60	2.67	203.27
5	55.870397	-3.437667	201.00	2.67	203.67
6	55.869410	-3.435779	207.35	2.67	210.02
7	55.867231	-3.433762	230.43	2.67	233.10
8	55.864389	-3.431959	249.77	2.67	252.44
9	55.863980	-3.432775	252.88	2.67	255.55
10	55.863558	-3.435736	256.11	2.67	258.78
11	55.866123	-3.437002	237.28	2.67	239.95
12	55.866430	-3.437184	234.88	2.67	237.55
13	55.866105	-3.438955	232.14	2.67	234.81
14	55.867514	-3.439856	213.97	2.67	216.64
15	55.867742	-3.439577	212.13	2.67	214.80
16	55.868308	-3.439856	209.18	2.67	211.85
17	55.868380	-3.440349	207.15	2.67	209.82

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	55.879148	-3.442655	176.06	1.50	177.56
2	55.877827	-3.443325	181.77	1.50	183.27
3	55.874813	-3.441157	192.69	1.50	194.19
4	55.872174	-3.438395	197.29	1.50	198.79
5	55.871148	-3.437916	194.17	1.50	195.67
6	55.870943	-3.437675	196.48	1.50	197.98
7	55.869586	-3.435352	208.33	1.50	209.83
8	55.868128	-3.434038	220.64	1.50	222.14
9	55.867089	-3.433100	234.70	1.50	236.20
10	55.866701	-3.432799	236.82	1.50	238.32
11	55.864668	-3.431414	248.92	1.50	250.42
12	55.863998	-3.430850	251.49	1.50	252.99
13	55.862351	-3.429112	250.50	1.50	252.00
14	55.860510	-3.427161	253.28	1.50	254.78
15	55.859107	-3.423156	244.77	1.50	246.27

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	55.875366	-3.390608	196.96	1.50	198.46
2	55.869118	-3.404277	212.24	1.50	213.74
3	55.865347	-3.412467	218.62	1.50	220.12
4	55.863288	-3.416566	224.57	1.50	226.07
5	55.851341	-3.435858	283.05	1.50	284.55
6	55.848541	-3.439360	288.41	1.50	289.91

Flight Path Receptors

Name: FP 1
Description:
Threshold height: 15 m
Direction: 232.0°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	55.875655	-3.394396	199.12	15.24	214.36
Two-mile	55.893439	-3.353714	125.76	656.14	781.90

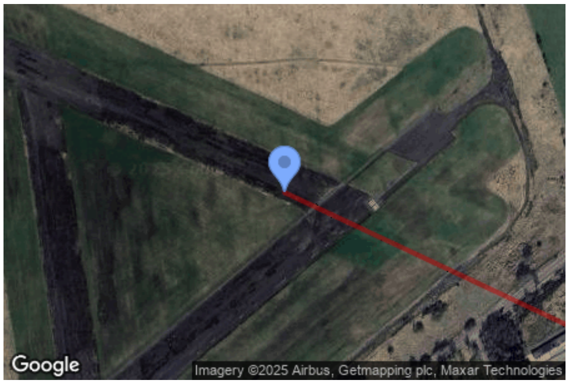
Name: FP 2
Description:
Threshold height: 15 m
Direction: 50.4°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	55.871185	-3.403788	210.75	15.24	225.99
Two-mile	55.852763	-3.443552	316.39	477.14	793.54

Name: FP 3
Description:
Threshold height: 15 m
Direction: 113.5°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	55.878146	-3.405250	189.70	15.24	204.94
Two-mile	55.889670	-3.452576	136.07	636.42	772.49

Name: FP 4
Description:
Threshold height: 15 m
Direction: 295.1°
Glide slope: 10.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	55.875767	-3.395852	199.62	15.24	214.86
Two-mile	55.863512	-3.349118	249.18	533.22	782.40

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	55.863464	-3.440464	248.63	4.50
OP 2	2	55.863585	-3.440225	249.24	4.50
OP 3	3	55.862314	-3.438118	261.44	4.50
OP 4	4	55.865588	-3.442344	231.00	4.50
OP 5	5	55.865897	-3.442038	229.98	4.50
OP 6	6	55.860861	-3.428670	257.46	4.50
OP 7	7	55.861266	-3.428177	255.00	4.50
OP 8	8	55.862023	-3.427994	252.37	4.50
OP 9	9	55.863440	-3.429713	250.56	4.50
OP 10	10	55.871205	-3.419910	223.66	4.50
OP 11	11	55.871500	-3.420226	221.48	4.50
OP 12	12	55.871310	-3.418928	223.21	4.50
OP 13	13	55.871451	-3.419105	222.73	4.50
OP 14	14	55.870771	-3.418944	224.02	4.50
OP 15	15	55.870702	-3.419422	224.19	4.50
OP 16	16	55.871075	-3.418258	223.01	4.50
OP 17	17	55.871132	-3.417807	222.86	4.50
OP 18	18	55.870314	-3.418166	222.75	4.50
OP 19	19	55.869457	-3.417264	224.42	4.50
OP 20	20	55.869674	-3.417993	224.26	4.50
OP 21	21	55.870047	-3.418101	223.42	4.50
OP 22	22	55.872634	-3.414390	211.54	4.50
OP 23	23	55.873597	-3.414991	206.19	4.50
OP 24	24	55.864880	-3.412881	220.12	4.50
OP 25	25	55.864682	-3.412363	218.73	4.50
OP 26	26	55.873322	-3.439891	192.56	4.50
OP 27	27	55.873244	-3.440280	192.91	4.50
OP 28	28	55.875225	-3.436126	192.74	4.50
OP 29	29	55.878399	-3.414410	187.76	4.50
OP 30	30	55.878434	-3.410589	188.46	4.50
OP 31	31	55.871268	-3.416705	222.01	4.50
OP 32	32	55.870708	-3.416469	222.22	4.50
OP 33	33	55.871906	-3.413293	217.24	4.50
OP 34	34	55.871749	-3.412263	218.13	4.50
OP 35	35	55.856914	-3.427850	250.24	4.50
OP 36	36	55.857755	-3.426289	245.60	4.50
OP 37	37	55.857490	-3.417676	221.83	4.50
OP 38	38	55.857765	-3.417148	220.27	4.50
OP 39	39	55.858361	-3.417171	220.58	4.50
OP 40	40	55.880198	-3.442740	178.31	4.50
OP 41	41	55.882163	-3.439392	179.45	4.50
OP 42	42	55.882193	-3.438727	179.59	4.50
OP 43	43	55.882563	-3.437783	179.96	4.50
OP 44	44	55.884738	-3.425548	178.91	4.50
OP 45	45	55.886201	-3.419280	168.89	4.50
OP 46	46	55.886739	-3.418099	163.78	4.50
OP 47	47	55.887622	-3.428353	168.68	4.50
OP 48	48	55.887523	-3.427908	168.39	4.50
OP 49	49	55.888254	-3.431689	162.80	4.50
OP 50	50	55.862672	-3.413288	210.53	4.50
OP 51	51	55.860466	-3.431434	265.29	4.50

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 52	52	55.870744	-3.415730	221.60	4.50
OP 53	53	55.870789	-3.415220	220.99	4.50
OP 54	54	55.871270	-3.415671	221.50	4.50
OP 55	55	55.871388	-3.414995	221.15	4.50
OP 56	56	55.870843	-3.414598	220.60	4.50
OP 57	57	55.870367	-3.416486	222.63	4.50
OP 58	58	55.869949	-3.416411	222.59	4.50
OP 59	59	55.869485	-3.416706	224.58	4.50
OP 60	60	55.871183	-3.417243	222.36	4.50

Obstruction Components

Name: Obstruction 1
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.869843	-3.434965	207.85
2	55.869602	-3.435330	208.42
3	55.867086	-3.433066	234.81
4	55.869451	-3.426318	227.49
5	55.871444	-3.428163	205.53
6	55.871215	-3.428549	205.86
7	55.869578	-3.427015	225.80
8	55.867519	-3.432841	233.28
9	55.869843	-3.434965	207.85

Name: Obstruction 10 Imp
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.869897	-3.434948	207.55
2	55.869864	-3.434872	207.95
3	55.873450	-3.428892	201.24
4	55.873624	-3.428574	200.80
5	55.874180	-3.428827	199.72
6	55.874178	-3.428900	199.76
7	55.873655	-3.428656	200.82
8	55.869897	-3.434948	207.55

Name: Obstruction 11 P
Top height: 5.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.871790	-3.421105	215.56
2	55.871750	-3.421384	215.31
3	55.871459	-3.421288	219.16
4	55.871422	-3.421550	218.89
5	55.871212	-3.421572	220.54
6	55.871197	-3.421330	221.23
7	55.870953	-3.421384	222.48
8	55.870953	-3.421180	222.82
9	55.871356	-3.420907	220.60
10	55.871790	-3.421105	215.56

Name: Obstruction 12 P
Top height: 5.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.876931	-3.423561	192.28
2	55.876915	-3.423701	192.31
3	55.876752	-3.423537	192.15
4	55.876657	-3.423543	192.15
5	55.876674	-3.423162	191.95
6	55.876439	-3.423097	192.16
7	55.876480	-3.422859	193.20
8	55.876729	-3.423022	191.88
9	55.876729	-3.423443	192.10
10	55.876931	-3.423561	192.28

Name: Obstruction 13 ImpP
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.866157	-3.437571	236.31
2	55.866193	-3.437410	236.83
3	55.863207	-3.436101	257.37
4	55.863201	-3.436305	257.06
5	55.866157	-3.437571	236.31

Name: Obstruction 14 P
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.870191	-3.441777	196.31
2	55.870161	-3.441916	196.05
3	55.865869	-3.439320	234.38
4	55.865929	-3.439095	234.25
5	55.870191	-3.441777	196.31

Name: Obstruction 15
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.870644	-3.438818	193.48
2	55.870502	-3.438689	195.50
3	55.870632	-3.437997	199.58
4	55.870773	-3.437617	199.01
5	55.869617	-3.435589	207.54
6	55.869119	-3.435069	210.58
7	55.869131	-3.434991	210.92
8	55.869659	-3.435530	207.64
9	55.871053	-3.437928	194.73
10	55.870644	-3.438818	193.48

Name: Obstruction 16
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.865798	-3.441787	229.56
2	55.865622	-3.441669	231.03
3	55.865523	-3.442125	231.00
4	55.865735	-3.442222	230.24
5	55.865798	-3.441787	229.56

Name: Obstruction 17
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.863578	-3.440050	249.50
2	55.863314	-3.439993	250.09
3	55.863338	-3.440564	248.74
4	55.863226	-3.440551	249.45
5	55.863167	-3.439749	250.90
6	55.863582	-3.439870	249.71
7	55.863578	-3.440050	249.50

Name: Obstruction 18
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.862561	-3.438081	259.68
2	55.863148	-3.437963	254.72
3	55.861516	-3.437083	265.56
4	55.861312	-3.437743	265.50
5	55.863043	-3.439578	251.93
6	55.863034	-3.438118	255.39
7	55.862471	-3.438505	259.37
8	55.862561	-3.438081	259.68

Name: Obstruction 19 ImpP
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.864100	-3.431011	251.07
2	55.864088	-3.431086	250.96
3	55.862291	-3.429203	250.90
4	55.862327	-3.429133	250.59
5	55.864100	-3.431011	251.07

Name: Obstruction 2
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.869515	-3.426304	227.23
2	55.870623	-3.421348	225.06
3	55.870957	-3.421037	223.01
4	55.870912	-3.420607	223.65
5	55.871056	-3.419771	224.11
6	55.870933	-3.419615	224.43
7	55.870692	-3.419958	224.37
8	55.870280	-3.420264	225.19
9	55.869124	-3.425811	229.02
10	55.869515	-3.426304	227.23

Name: Obstruction 20 ImpP
Top height: 3.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.869068	-3.434936	211.09
2	55.869041	-3.435037	210.76
3	55.866960	-3.433158	234.98
4	55.864279	-3.431290	250.19
5	55.864291	-3.431204	250.16
6	55.867048	-3.433092	234.93
7	55.869068	-3.434936	211.09

Name: Obstruction 3
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.873848	-3.421847	196.98
2	55.873975	-3.420930	197.46
3	55.871744	-3.419820	219.36
4	55.871720	-3.420742	217.78
5	55.871504	-3.420742	220.17
6	55.871504	-3.420893	219.41
7	55.872575	-3.421054	209.60
8	55.873848	-3.421847	196.98

Name: Obstruction 4
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.876719	-3.422950	191.87
2	55.876845	-3.420579	190.49
3	55.874263	-3.421303	195.73
4	55.876719	-3.422950	191.87

Name: Obstruction 5
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.873294	-3.439564	193.30
2	55.872054	-3.438384	198.37
3	55.871314	-3.438319	199.52
4	55.870947	-3.439585	205.20
5	55.870519	-3.443115	203.75
6	55.871037	-3.443673	204.74
7	55.871224	-3.442407	203.82
8	55.872795	-3.442482	198.16
9	55.872897	-3.440819	198.72
10	55.873294	-3.439564	193.30

Name: Obstruction 6
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.874225	-3.428799	199.64
2	55.876668	-3.425451	195.06
3	55.876990	-3.423531	192.48
4	55.877941	-3.423863	191.36
5	55.878110	-3.425258	197.59
6	55.878645	-3.425569	191.35
7	55.877556	-3.430451	195.52
8	55.874225	-3.428799	199.64

Name: Obstruction 7
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.879813	-3.421750	192.43
2	55.878116	-3.421342	189.41
3	55.878067	-3.419110	193.63
4	55.876057	-3.417566	192.18
5	55.876418	-3.416664	190.85
6	55.878296	-3.417780	195.54
7	55.879018	-3.414840	188.03
8	55.880487	-3.418574	190.90
9	55.879813	-3.421750	192.43

Name: Obstruction 8
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.878525	-3.436729	183.60
2	55.878640	-3.435828	183.65
3	55.875781	-3.434540	191.93
4	55.875691	-3.434937	191.39
5	55.873536	-3.433779	199.00
6	55.873283	-3.433993	200.44
7	55.878525	-3.436729	183.60

Name: Obstruction 9
Top height: 10.0 m

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	55.868365	-3.421600	226.81
2	55.868491	-3.421010	227.22
3	55.865373	-3.419701	231.99
4	55.864982	-3.421300	234.39
5	55.866107	-3.421590	236.66
6	55.865505	-3.424336	240.02
7	55.865734	-3.424401	239.31
8	55.866294	-3.421718	235.91
9	55.868365	-3.421600	226.81

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	20.0	180.0	4,591	76.5	0	0.0	-
PV array 2	20.0	180.0	1,218	20.3	0	0.0	-
PV array 3	20.0	180.0	17,731	295.5	0	0.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	6,068	101.1	0	0.0
Route 2	1,659	27.6	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
FP 3	0	0.0	0	0.0
FP 4	6,627	110.5	0	0.0
OP 1	0	0.0	0	0.0
OP 2	1,373	22.9	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	685	11.4	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	1,094	18.2	0	0.0
OP 9	2,740	45.7	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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
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
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	153	2.5	0	0.0
OP 34	0	0.0	0	0.0
OP 35	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 39	877	14.6	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	2,264	37.7	0	0.0
OP 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0

PV: PV array 1 low potential for temporary after-image

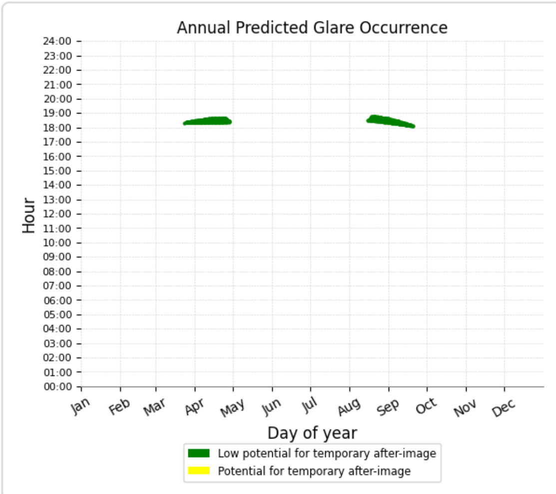
Receptor results ordered by category of glare

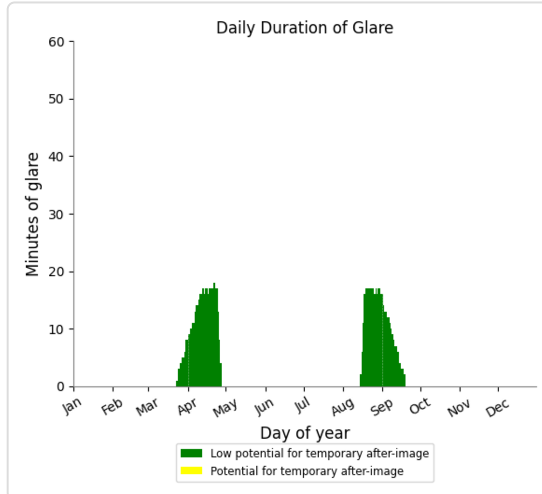
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 2	823	13.7	0	0.0
Route 1	0	0.0	0	0.0
FP 4	3,615	60.2	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
FP 3	0	0.0	0	0.0
OP 33	153	2.5	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
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

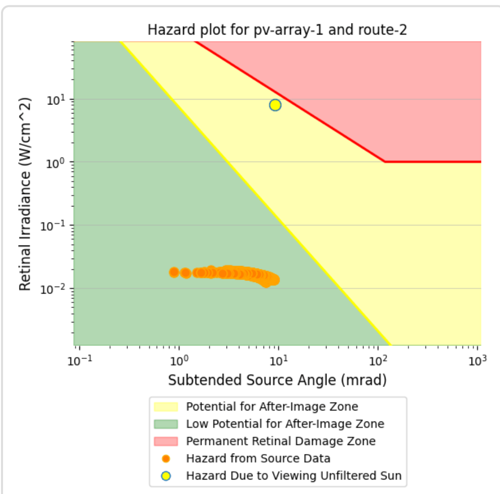
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 39	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 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
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0

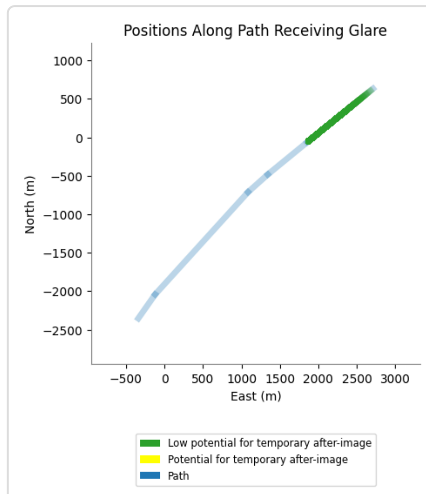
PV array 1 and Route: Route 2

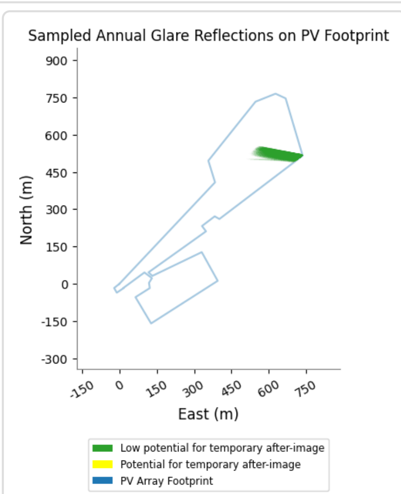
Yellow glare: none
Green glare: 823 min.











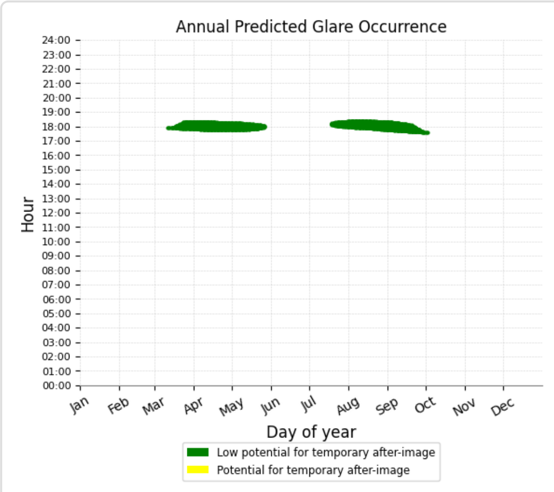
PV array 1 and Route: Route 1

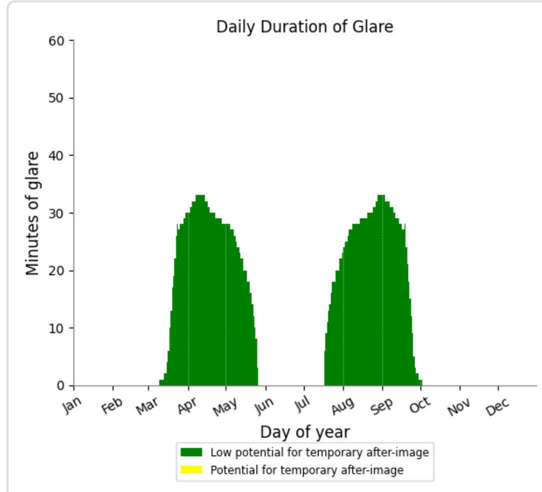
No glare found

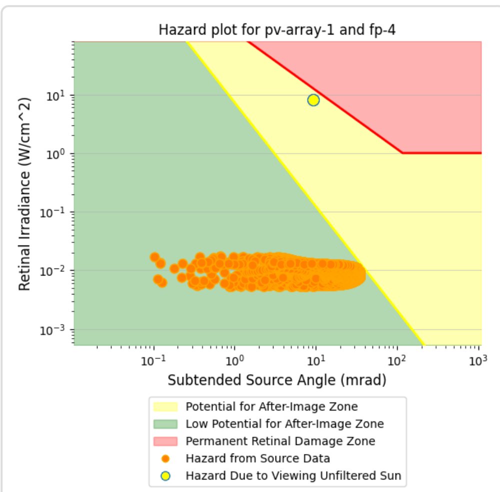
PV array 1 and FP: FP 4

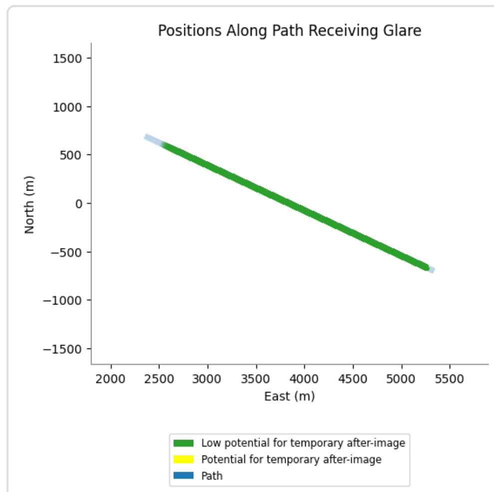
Yellow glare: none

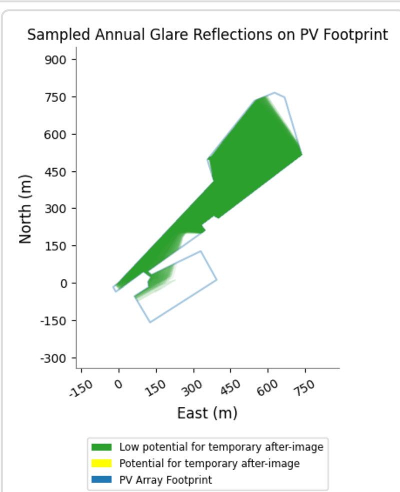
Green glare: 3,615 min.

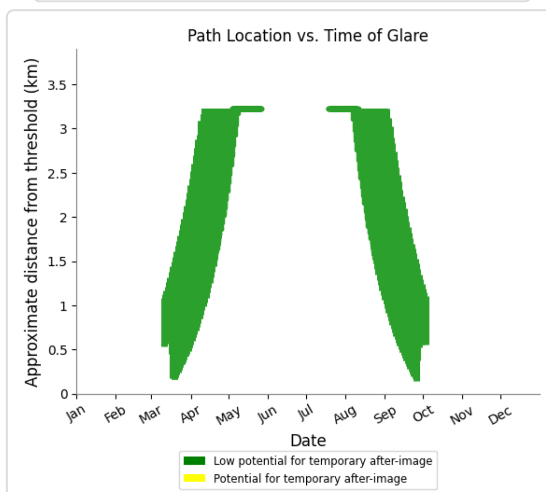












PV array 1 and FP: FP 1

No glare found

PV array 1 and FP: FP 2

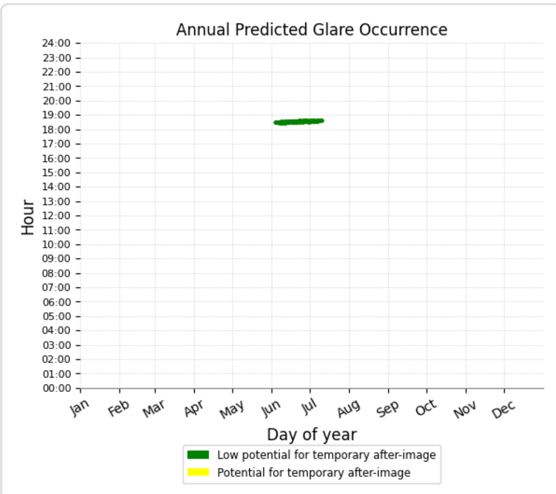
No glare found

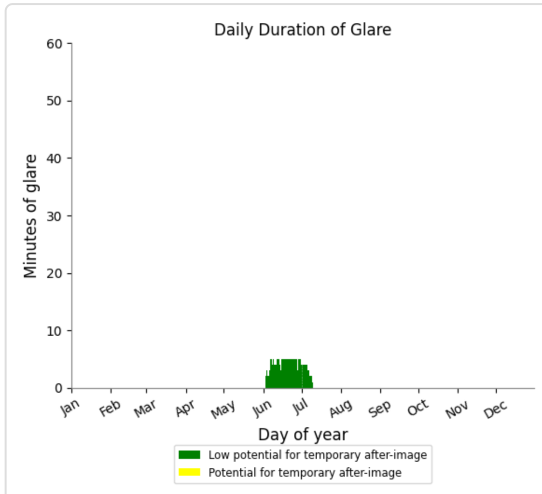
PV array 1 and FP: FP 3

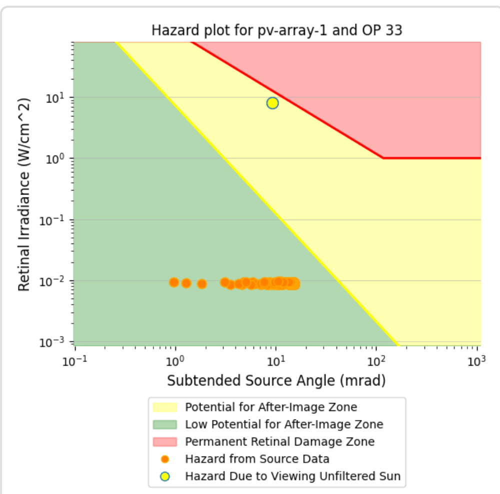
No glare found

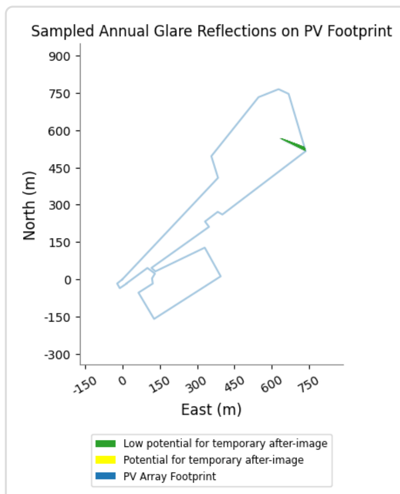
PV array 1 and OP 33

Yellow glare: none
Green glare: 153 min.









PV array 1 and OP 1

No glare found

PV array 1 and OP 2

No glare found

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 31

No glare found

PV array 1 and OP 32

No glare found

PV array 1 and OP 34

No glare found

PV array 1 and OP 35

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 39

No glare found

PV array 1 and OP 40

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 array 1 and OP 53

No glare found

PV array 1 and OP 54

No glare found

PV array 1 and OP 55

No glare found

PV array 1 and OP 56

No glare found

PV array 1 and OP 57

No glare found

PV array 1 and OP 58

No glare found

PV array 1 and OP 59

No glare found

PV array 1 and OP 60

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	0	0.0	0	0.0
Route 2	0	0.0	0	0.0
FP 4	1,218	20.3	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
FP 3	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
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
OP 31	0	0.0	0	0.0
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 34	0	0.0	0	0.0
OP 35	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 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
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0

PV array 2 and Route: Route 1

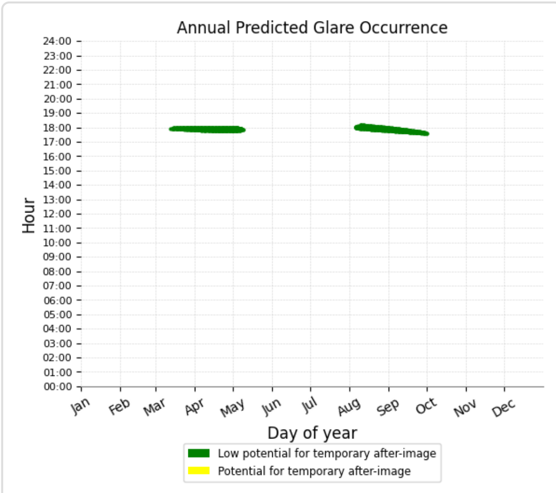
No glare found

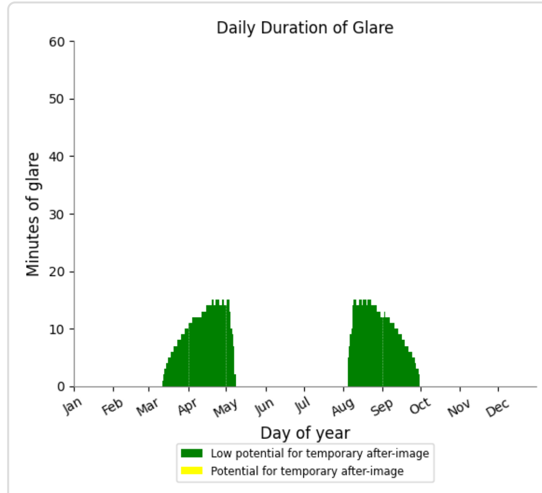
PV array 2 and Route: Route 2

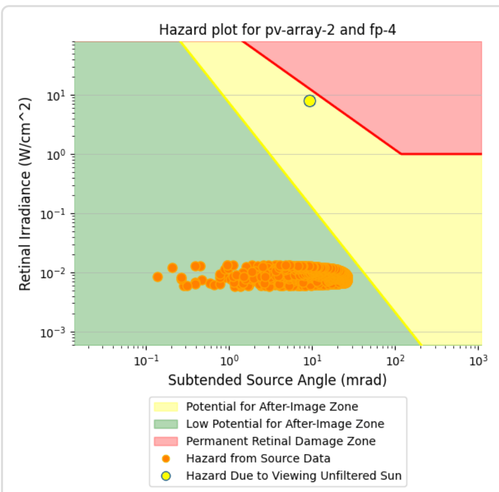
No glare found

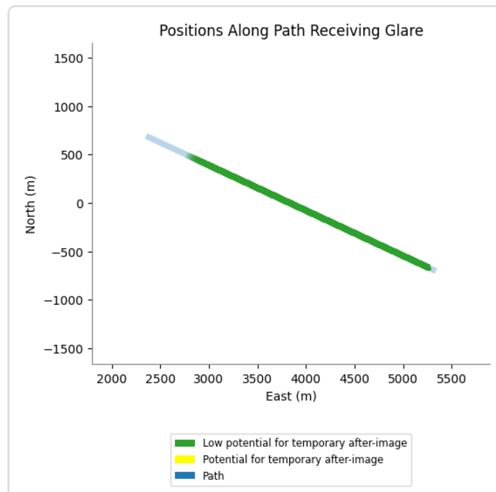
PV array 2 and FP: FP 4

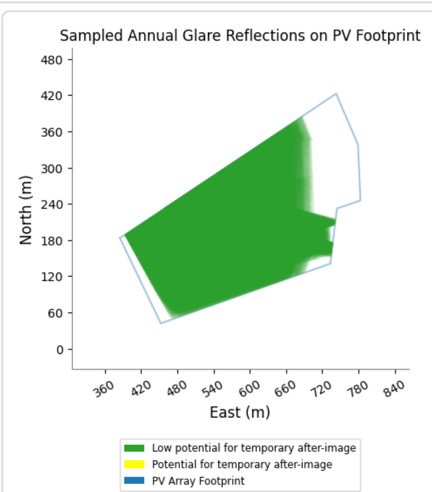
Yellow glare: none
Green glare: 1,218 min.

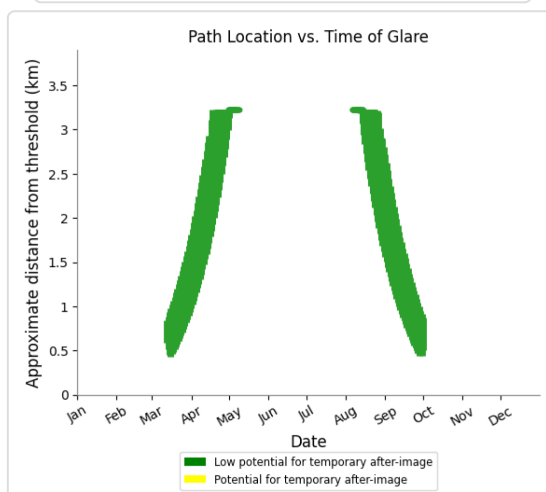












PV array 2 and FP: FP 1

No glare found

PV array 2 and FP: FP 2

No glare found

PV array 2 and FP: FP 3

No glare found

PV array 2 and OP 1

No glare found

PV array 2 and OP 2

No glare found

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 12

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 27

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 31

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 35

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 39

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 array 2 and OP 53

No glare found

PV array 2 and OP 54

No glare found

PV array 2 and OP 55

No glare found

PV array 2 and OP 56

No glare found

PV array 2 and OP 57

No glare found

PV array 2 and OP 58

No glare found

PV array 2 and OP 59

No glare found

PV array 2 and OP 60

No glare found

PV: PV array 3 low potential for temporary after-image

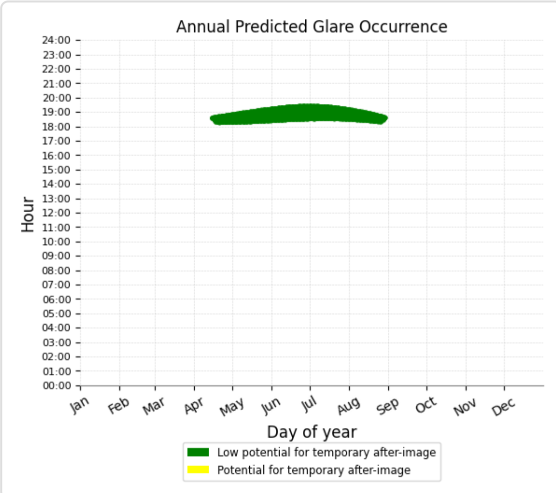
Receptor results ordered by category of glare

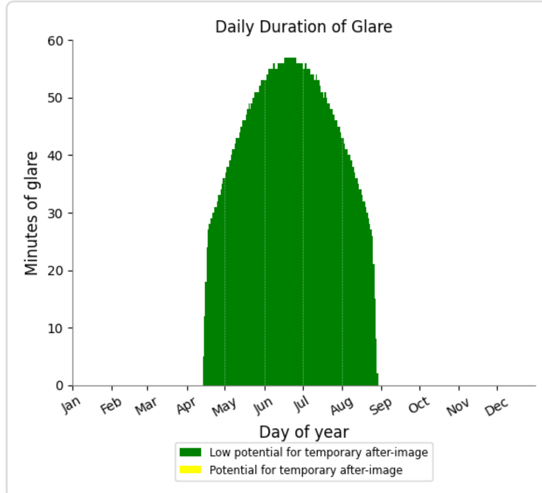
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	6,068	101.1	0	0.0
Route 2	836	13.9	0	0.0
FP 4	1,794	29.9	0	0.0
FP 1	0	0.0	0	0.0
FP 2	0	0.0	0	0.0
FP 3	0	0.0	0	0.0
OP 2	1,373	22.9	0	0.0
OP 5	685	11.4	0	0.0
OP 8	1,094	18.2	0	0.0
OP 9	2,740	45.7	0	0.0
OP 39	877	14.6	0	0.0
OP 50	2,264	37.7	0	0.0
OP 1	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	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
OP 31	0	0.0	0	0.0

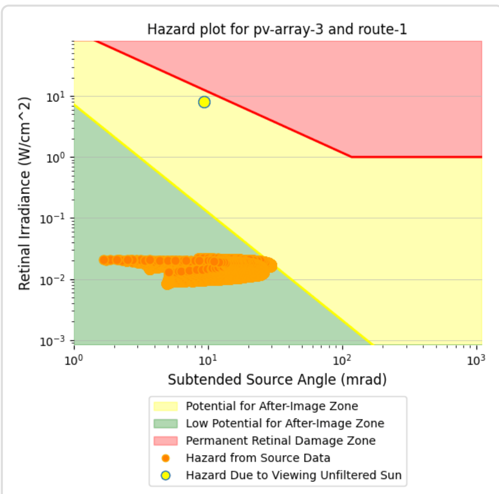
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 32	0	0.0	0	0.0
OP 33	0	0.0	0	0.0
OP 34	0	0.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	0	0.0	0	0.0
OP 40	0	0.0	0	0.0
OP 41	0	0.0	0	0.0
OP 42	0	0.0	0	0.0
OP 43	0	0.0	0	0.0
OP 44	0	0.0	0	0.0
OP 45	0	0.0	0	0.0
OP 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 51	0	0.0	0	0.0
OP 52	0	0.0	0	0.0
OP 53	0	0.0	0	0.0
OP 54	0	0.0	0	0.0
OP 55	0	0.0	0	0.0
OP 56	0	0.0	0	0.0
OP 57	0	0.0	0	0.0
OP 58	0	0.0	0	0.0
OP 59	0	0.0	0	0.0
OP 60	0	0.0	0	0.0

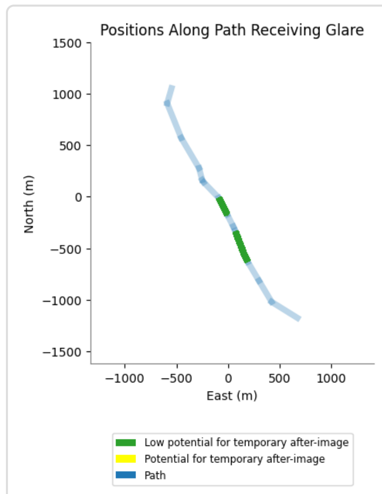
PV array 3 and Route: Route 1

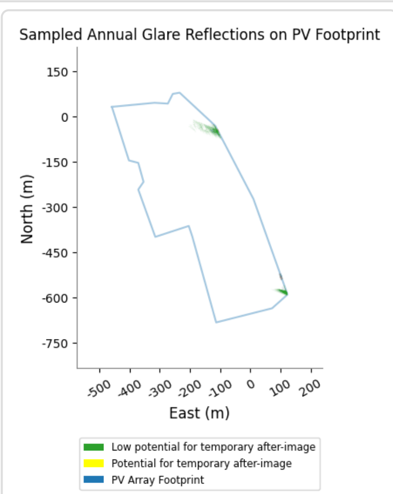
Yellow glare: none
Green glare: 6,068 min.





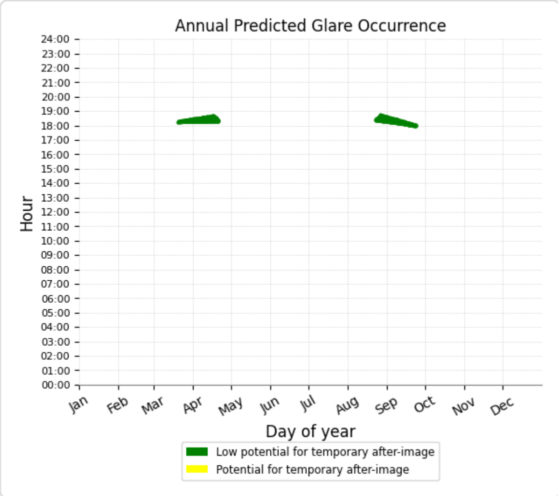


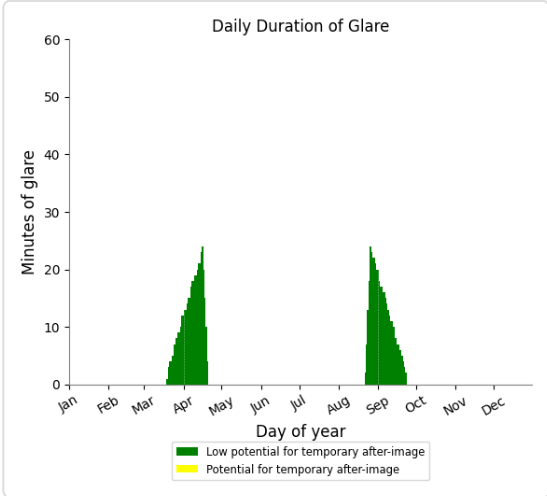


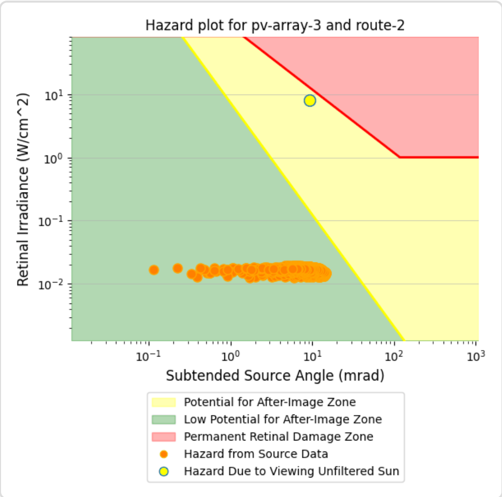


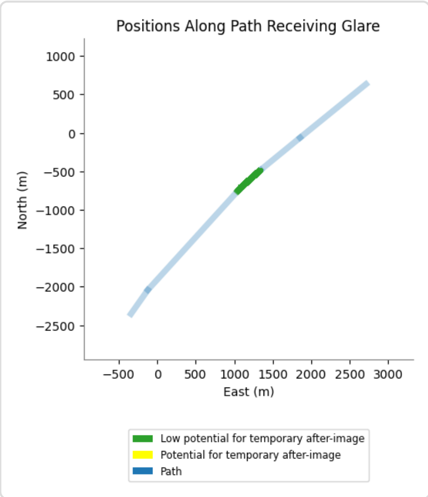
PV array 3 and Route: Route 2

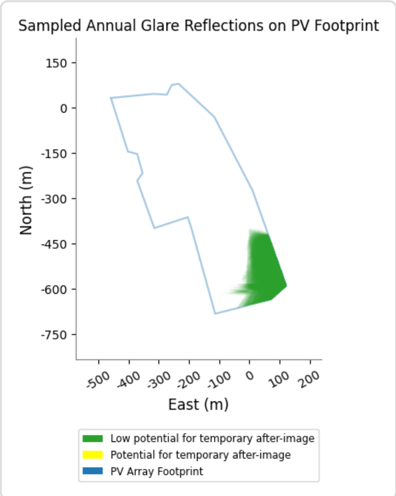
Yellow glare: none
Green glare: 836 min.







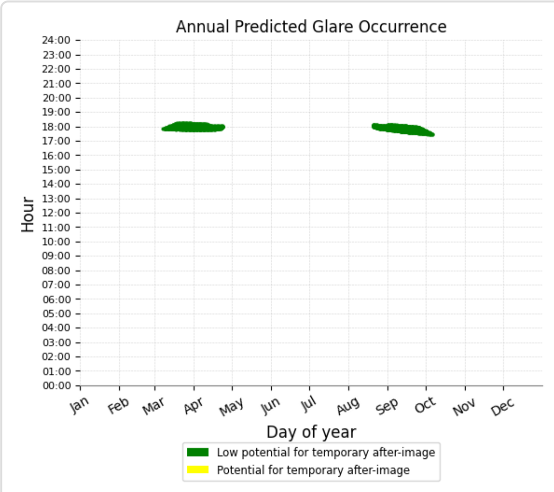


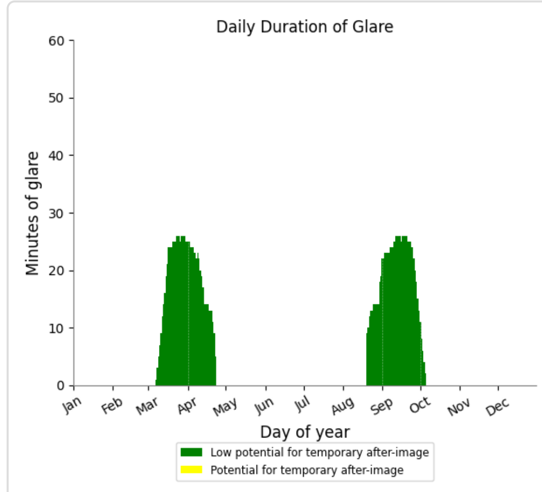


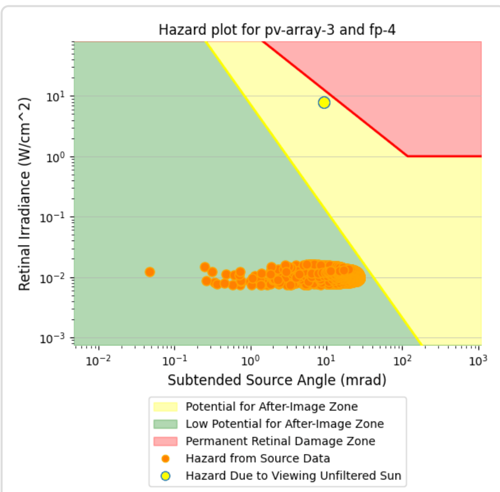
PV array 3 and FP: FP 4

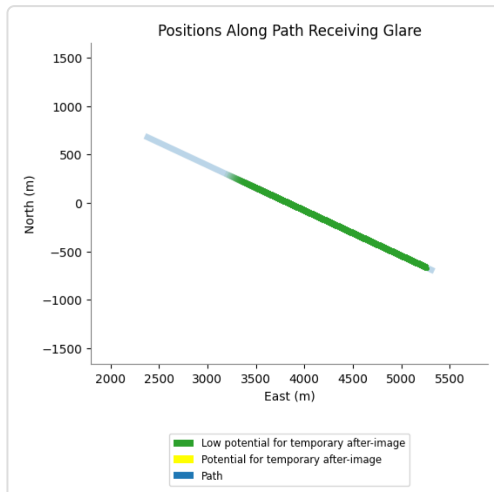
Yellow glare: none

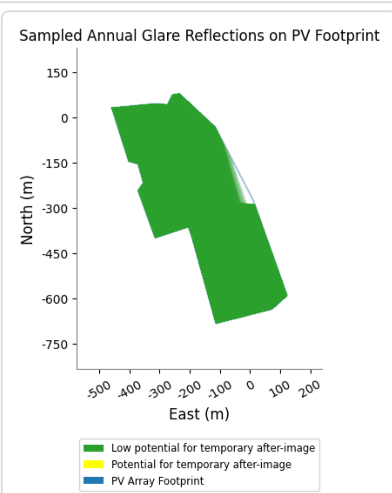
Green glare: 1,794 min.

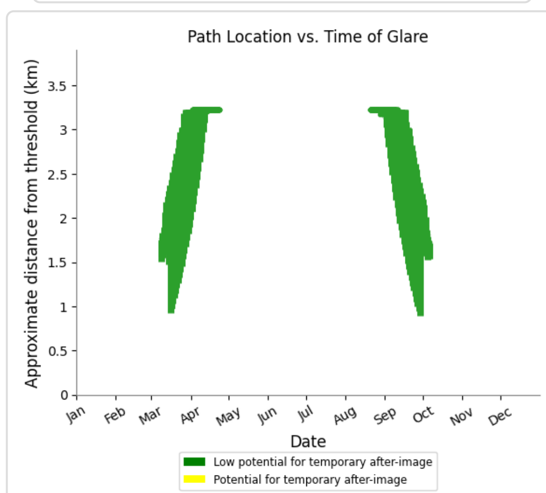












PV array 3 and FP: FP 1

No glare found

PV array 3 and FP: FP 2

No glare found

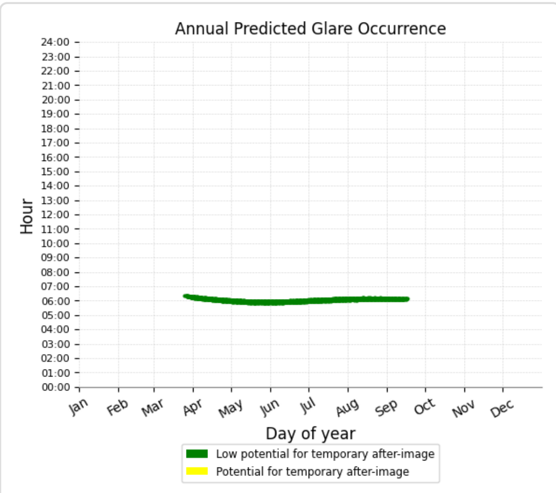
PV array 3 and FP: FP 3

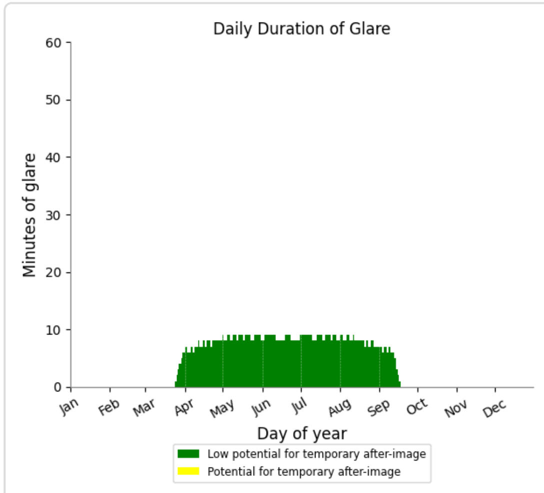
No glare found

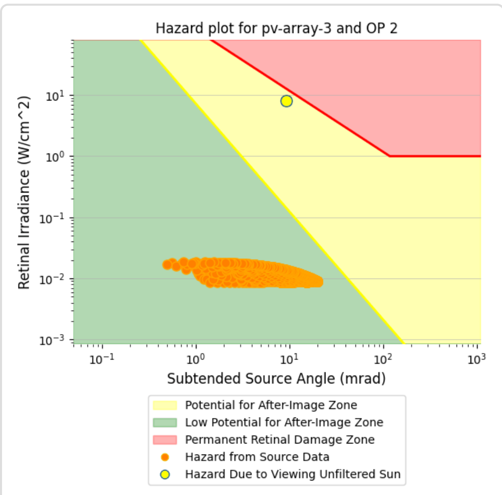
PV array 3 and OP 2

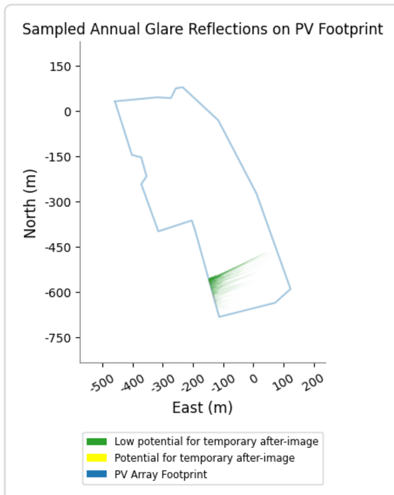
Yellow glare: none

Green glare: 1,373 min.





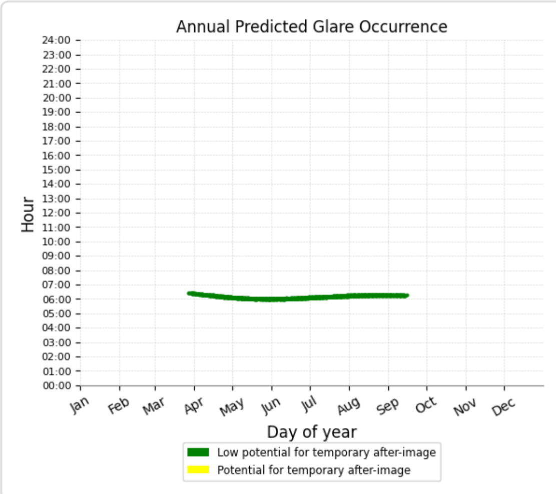


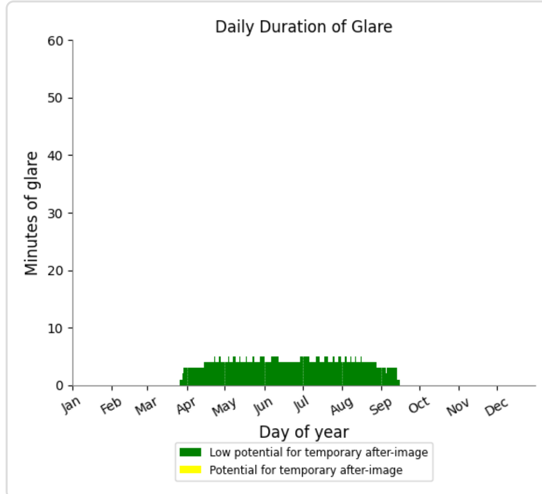


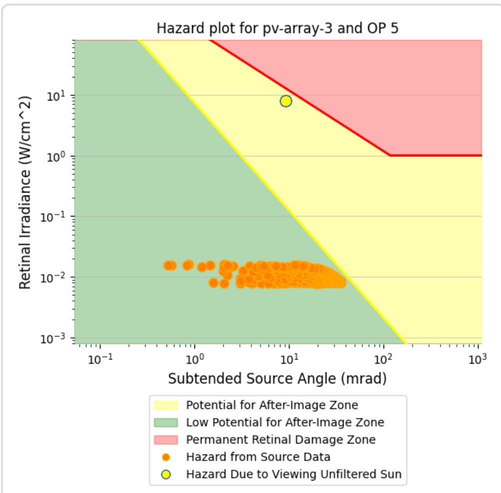
PV array 3 and OP 5

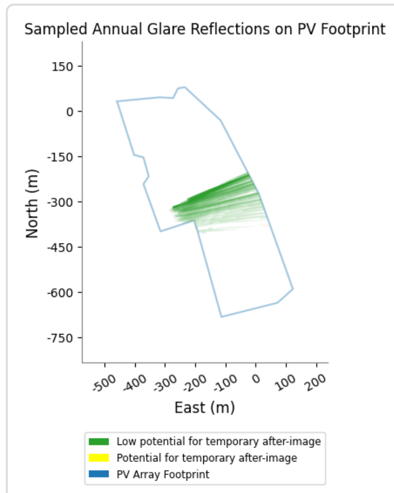
Yellow glare: none

Green glare: 685 min.





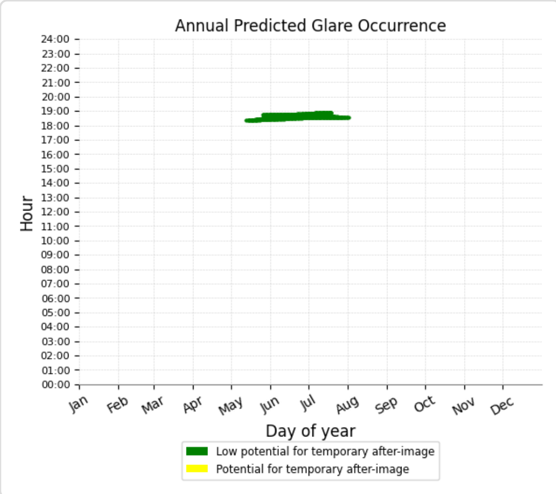


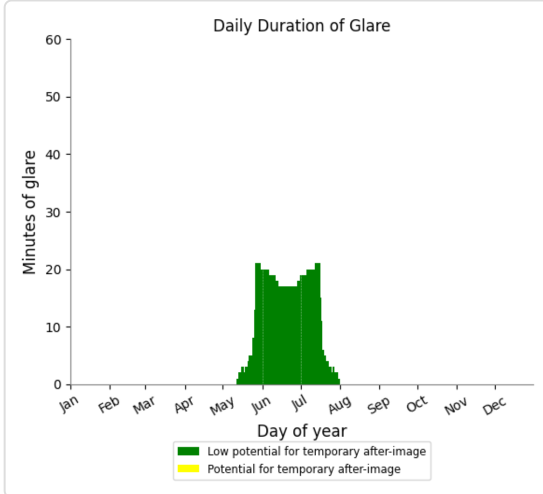


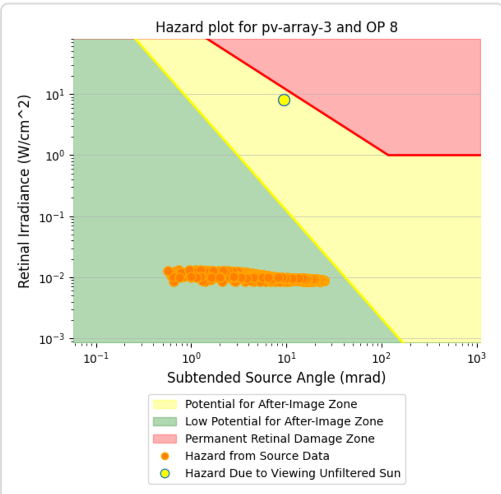
PV array 3 and OP 8

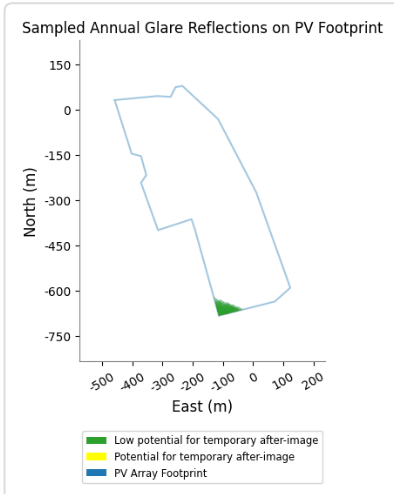
Yellow glare: none

Green glare: 1,094 min.





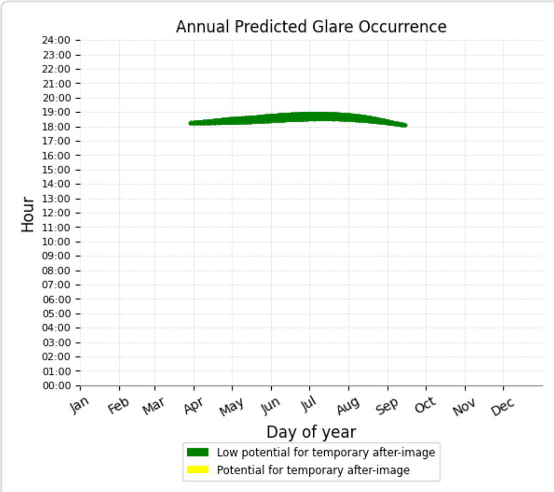


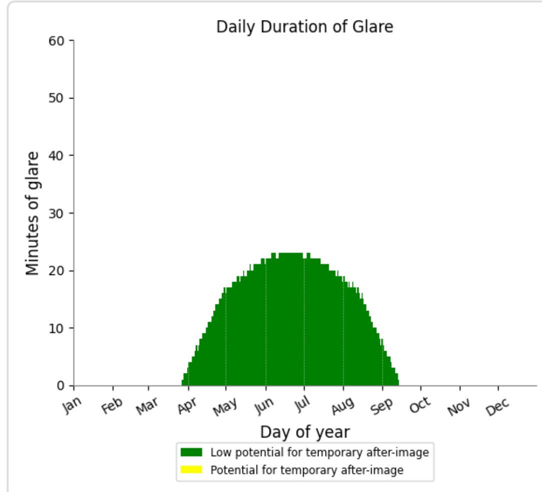


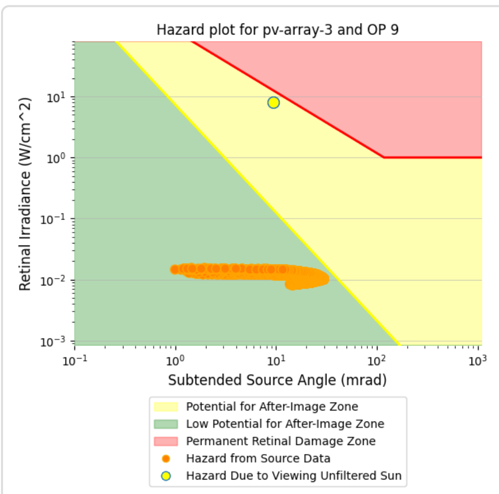
PV array 3 and OP 9

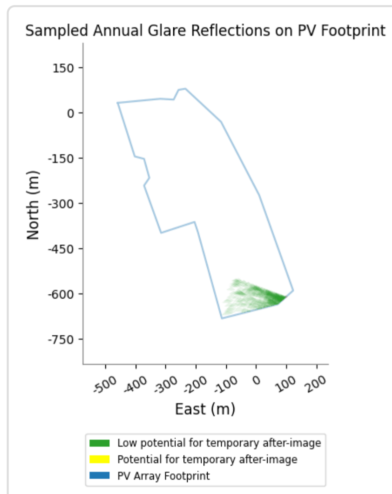
Yellow glare: none

Green glare: 2,740 min.





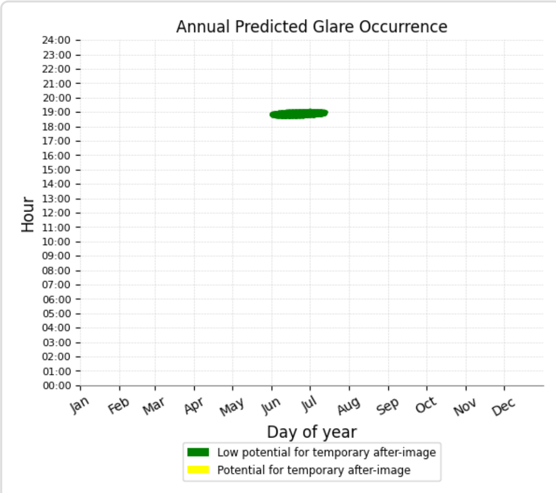


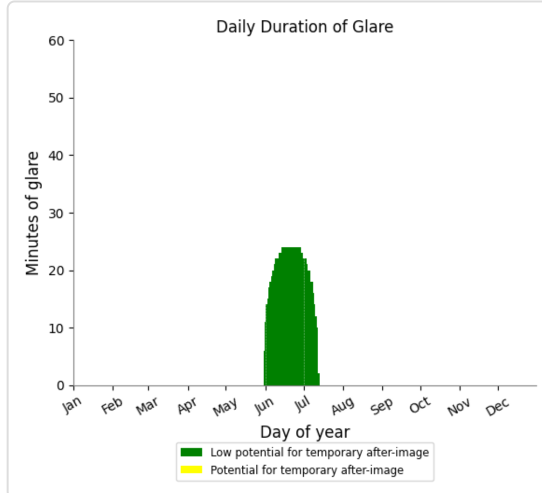


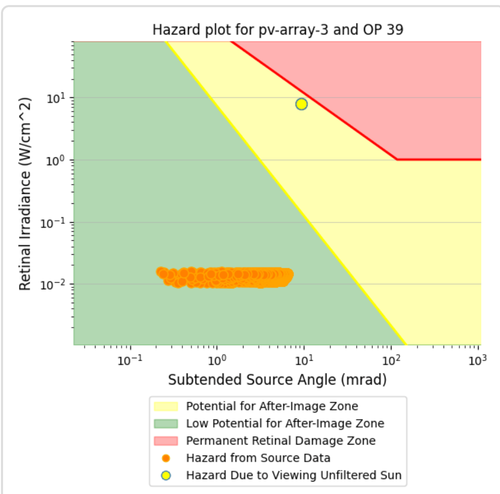
PV array 3 and OP 39

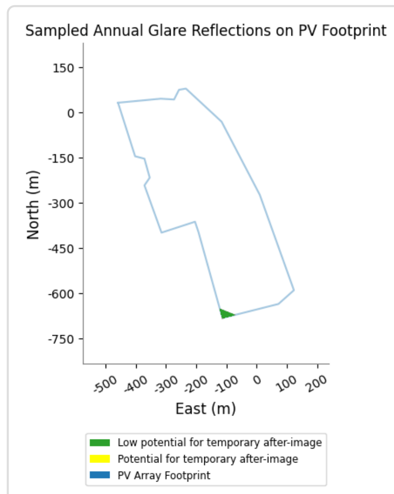
Yellow glare: none

Green glare: 877 min.



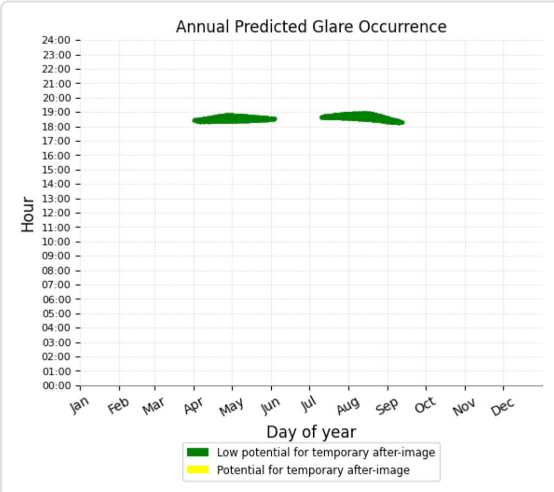


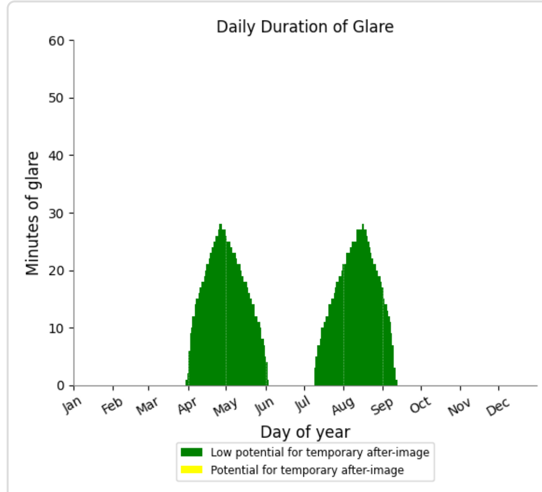


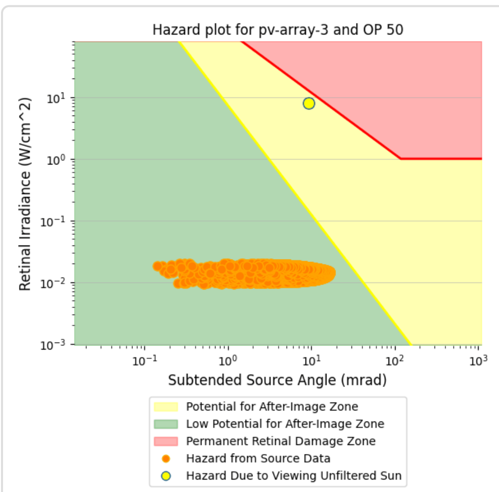


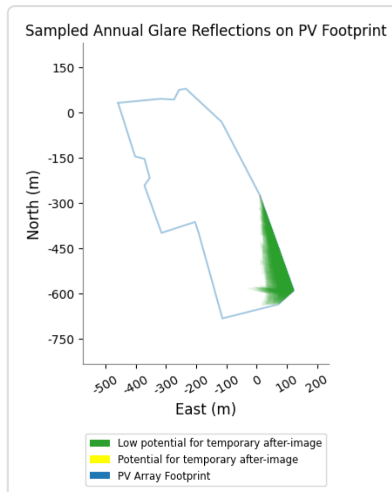
PV array 3 and OP 50

Yellow glare: none
Green glare: 2,264 min.









PV array 3 and OP 1

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 6

No glare found

PV array 3 and OP 7

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 12

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 17

No glare found

PV array 3 and OP 18

No glare found

PV array 3 and OP 19

No glare found

PV array 3 and OP 20

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 26

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 31

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 35

No glare found

PV array 3 and OP 36

No glare found

PV array 3 and OP 37

No glare found

PV array 3 and OP 38

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 51

No glare found

PV array 3 and OP 52

No glare found

PV array 3 and OP 53

No glare found

PV array 3 and OP 54

No glare found

PV array 3 and OP 55

No glare found

PV array 3 and OP 56

No glare found

PV array 3 and OP 57

No glare found

PV array 3 and OP 58

No glare found

PV array 3 and OP 59

No glare found

PV array 3 and OP 60

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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