September 17, 2025

Glare Study Narrative
CFP IL Orchard Solar LLC
Kane County, Illinois
21 MW DC (15 MW AC) Community Solar Facility

PURPOSE

This Glint and Glare Study has been prepared for the proposed Orchard Solar Project (Project). The purpose of this study is to determine the following:

- Will glint and glare be visible to off-site viewers?
- If glint and glare is visible, how long will it occur?
- What is the intensity of the glint and glare?

PROJECT LOCATION

The Project is located in Sugar Grove, IL bordered on the south by Jericho Road; on the north by Prairie Street; on the west by Route 30; and on the east by South Barnes Road.

PROPOSED ACTION

The Project includes the construction, operation, maintenance, and decommissioning of an approximately 21-megawatt (MW) direct current (MWdc) photovoltaic (PV) solar project and ancillary facilities on approximately 81.84 acres of a 277-acre site area. Photovoltaic panels are designed to absorb as much of the solar spectrum as feasible to convert solar energy into electricity. The panels would be installed on single-axis, horizontal trackers. With a horizontal tracker mounting system, the panel arrays are arranged in north-south oriented rows and drive motors would rotate the horizontally mounted solar panels from east to west to follow the sun (on a single axis) throughout the day. The highest point for a horizontal tracker would be achieved during the morning and evening hours when the trackers are tilted at their maximum angle and would be a maximum of 8.46 feet (2.58 meters) above the ground surface, in areas constructed using traditional methods, depending on the grade where the posts are installed.

When solar modules are roughly parallel to the ground, the overall height of the tracker unit would be a maximum of 6 feet (1.8 meters) above the ground surface in areas developed using traditional methods, depending on factors including the grade where the posts are installed and flood flow depths.

GLINT AND GLARE DEFINITIONS

Glint and glare may occur when direct normal irradiance ([DNI] sunlight) reflects off a surface and a receptor is exposed to it. Glint, also referred to as specular reflection, is a momentary flash of light produced as a direct reflection of the sun in the surface of an object, such as a PV panel. Glare is a continuous source of brightness relative to the ambient lighting. Glare is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Glare is significantly less intense than glint.

REFLECTIVE SURFACES

The intensity of the glare produced by reflective surfaces varies depending on the type of surface. Specular surfaces (mirror-like) create intense glare that can be visually debilitating. Albedo is a term used to quantify the way surfaces reflect DNI. Solar panels have a very low albedo, similar to water. Advancements in solar panels have increased absorption of incident radiation. The solar cells typically have anti-reflection coating (ARC) treatment to diffuse the incident rays, thereby reducing the intensity of the reflected ray.

INCIDENT SUN ANGLES AND GLARE

The incident angle of the sun's DNI changes continuously throughout the day as the sun makes its apparent movement across the sky. As the Law of Refection predicates: when its incident angle is low, the reflected angle will be equally low. Conversely, when the incident angle is high, the reflected angle will be equally high. When incident rays are lowest, after dawn and before sunset, the potential for a receptor being subjected to fugitive glare is higher. When the incident angles are high, the glare that is produced is reflected back steeply into the sky and terrestrial receptors are not affected.

GEOSPATIAL CONSIDERATIONS

A receptor's position in relation to the sun and a specular surface affects the potential to be exposed to glare. For example, a solar field with north-to-south rows of single-axis trackers, like the Project, would be more likely to create glare to receptors north of the Project. At this latitude, the sun is always in the southern sky, so the incident angle is southerly; the reflection will be northerly. Similarly, a receptor at a more topographically superior (higher) location than the specular solar array is more likely to experience glare than a receptor at an inferior (lower) topographic perspective.

GLINT AND GLARE HAZARD

Glint and glare have the potential to cause damage to retinas or an after-image temporarily blinding or distracting an individual. Glint and glare can pose a hazard to drivers and pilots. Glare from a solar field is dependent upon many factors. Critical factors include the tilt of the panels, type of panel, location of viewers, and type of screening (e.g., topography, vegetation). GlareGauge broadly categorizes glare as having a low potential for after-image, potential for after-image, and potential for permanent eye damage. A glint and glare hazard is considered to occur if there is a potential for after-image or eye damage.

Low-level glare, or glint, from a specular surface viewed from a considerable distance could be a distraction. The next level of ocular impact is called temporary after-image, sometimes referred to as flash blindness. The intensity and duration of the glare from the setting sun may induce a reaction to squint, a natural reaction to protect the retina. The most serious ocular impact is called retinal burn or photic retinopathy. This condition is rare because of the reflex of looking away from intense brightness. Optical burn could occur if one where to try to watch a solar eclipse with the naked eye. Reduced ocular acuity may be experienced until the retina is healed, which could be months or longer.

GLINT AND GLARE MODELLING TOOL

ForgeSolar's comprehensive solar glare analysis tool, called GlareGauge, is compatible with Federal Aviation Administration (FAA) glare guidelines and is a licensed Solar Glare Hazard Analysis Tool (SGHAT) application. GlareGauge is used to conduct the modeling of glint and glare at each Observation Point.

MODEL INPUTS AND ASSUMPTIONS

The solar panels would be mounted on single-axis, horizontal tilt trackers. Part of the input data needed for the model is the type of PV panel proposed for use. While the panels have not yet been purchased, they will have anti-reflective coating (ARC) The model was run assuming solar panel development in the specified area shown in the accompanying maps.

FLIGHT PATH RECEPTORS, ROADS, AND OBSERVATION POINTS

Each of the 6 runways (Runways 9, 15, 18, 27, 33, and 36) were analyzed, using a standard 2-mile flight path for each. The de facto perimeter road around the project, consisting of Jericho Road, Route 30, Prairie Street, and S. Barnes Road was similarly considered for potential impact to passing motorists. Finally, Observation Points are used in the glint and glare analysis. The model identifies the level of glint and glare at each Observation Point. For this Project, 24 Observation Points were selected, 1 of which was the Air

Traffic Control Tower at Aurora Municipal Airport, while the remaining 23 were nearby residences and residential areas.

Also considered in the analysis was the existing tree cover in relevant locations.

MODEL LIMITATIONS

GlareGauge has several limitations, generally resulting in conservative outputs:

- The proposed Project will have significant vegetative screening installed around the perimeter of the project, which is not factored into this analysis but will drastically reduce glint and glare.
- There is significant existing tree cover throughout the surrounding acreage, none of which was considered in this analysis. Consequently, the actual glint and glare will be less than shown here.
- The glint and glare from panels are modeled using a typical clear-day solar irradiance profile, which accounts for the worst-case scenario. Actual irradiance levels on a given day can be affected by cloud cover and other environmental factors.
- Backtracking control, which is used in the early morning and late afternoon to prevent panels from shading one another, is not accounted for. The model conducts an analysis every minute, resulting in a modeled incidence of glint or glare of at least one minute

RESULTS

Green glare was present at four points: in the northeast at Observation Point 19 near the intersection of Prairie Street and Gordon Road; in the east at Observation Point 4; along the southern perimeter of Jericho Road; and for runway 9. It should be reiterated that the FAA has typically accepted green glare as not enough of a hazard to pilots to adjust or prevent projects. Conversely, any glint or glare observable from an air traffic control tower would typically prevent a project. The detailed results are presented in the corresponding ForgeSolar report.

Yellow glint and glare caused by the Project would be visible by motorists along Jericho Road for 927 total minutes during summer months. Other potential instances of either green or yellow glare were mitigated by the existing tree cover at various locations throughout the immediate and adjacent acreage.

For those 927 minutes at various times in late spring through early fall, adverse effects on motorists could occur. The motorists would need to be traveling in the direction of the Project site and be looking at the solar arrays during the precise minute when glint and glare is modeled to occur. Motorists would be in motion, limiting the time period in which they could experience glint and glare. Many Observation Points along the same roadways or general area as those affected, would not experience glint and glare. The potential for an after image to be experienced by a motorist is limited due to the conservative analysis, distance, terrain, and that a motorist must be viewing the Project at the moment glint and glare occurs. The likelihood of the Project causing a hazard to motorists is low. The adverse effect would be minimized with incorporation of recommendations below.

AIR TRAFFIC

The FAA will be notified of the Project, in accordance with recommendations identified in the Technical Guidance for Evaluating Selected Solar Technologies on Airports (FAA, 2010).

RECOMMENDATIONS

In addition to the federally required submittal to the FAA, it is recommended that vegetative screening be installed around the perimeter of the project site, as is currently planned.

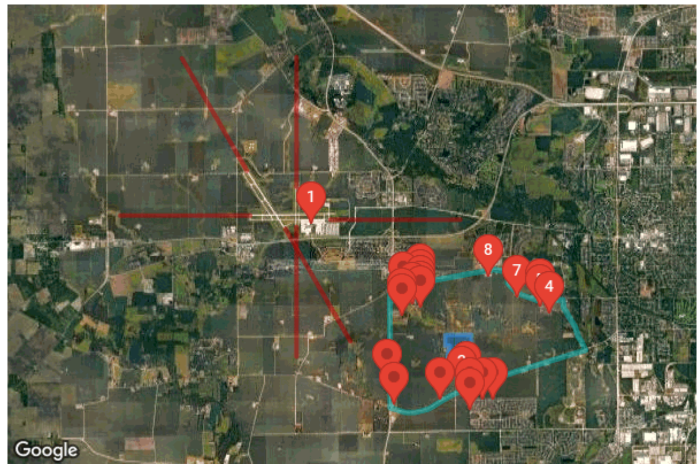
ForgeSolar

Orchard Solar

Orchard Conservative

Created Sep 11, 2025
Updated Sep 15, 2025
Time-step 1 minute
Timezone offset UTC-6
Minimum sun altitude 0.0 deg
Site ID 159191.26606

Project type Advanced
Project status: active
Category 10 MW to 100 MW



Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
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: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with potential for temporary after-image predicted

PV Name	Tilt deg	Orientation deg	"Green" Glare min	"Yellow" Glare min	Energy Produced kWh
PV array 1	SA tracking	SA tracking	1,069	927	-

Component Data

PV Array(s)

Total PV footprint area: 83.9 acres

Name: PV array 1
Description: Orchard Solar Project
Footprint area: 83.9 acres
Axis tracking: Single-axis rotation
Backtracking: Shade
Tracking axis orientation: 180.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 0.0 deg
Ground Coverage Ratio: 0.43

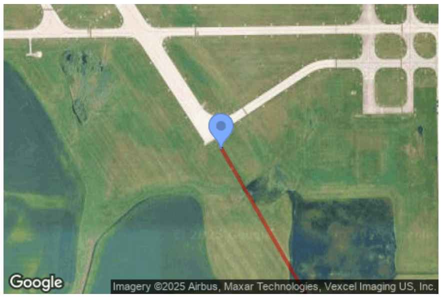
Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	41.743585	-88.427180	705.26	0.00	705.26
2	41.741248	-88.427137	692.75	0.00	692.75
3	41.741248	-88.425764	690.39	0.00	690.39
4	41.739166	-88.426451	672.88	0.00	672.88
5	41.738526	-88.426493	667.71	0.00	667.71
6	41.738622	-88.424949	670.63	0.00	670.63
7	41.738582	-88.419316	659.86	0.00	659.86
8	41.743681	-88.419380	688.37	0.00	688.37

2-Mile Flight Path Receptor(s)

Name: FP 1 Runway 33
Description:
Threshold height : 50 ft
Direction: 330.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.767234	-88.474887	695.76	50.00	745.76
2-mile point	41.742185	-88.455506	675.61	623.58	1299.19

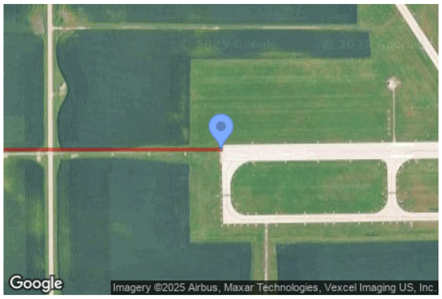


Name: FP 2 Runway 27
Description:
Threshold height : 50 ft
Direction: 270.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.769283	-88.461498	701.11	50.00	751.11
2-mile point	41.769283	-88.422687	703.76	600.78	1304.54

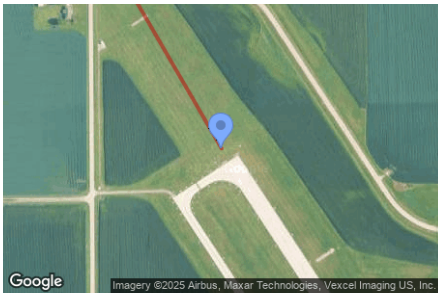
Name: FP 3 Runway 9
Description:
Threshold height : 50 ft
Direction: 90.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.770228	-88.485397	706.36	50.00	756.36
2-mile point	41.770228	-88.524208	696.08	613.71	1309.79



Name: FP 4 Runway 15
Description:
Threshold height : 50 ft
Direction: 150.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.780228	-88.486389	710.53	50.00	760.53
2-mile point	41.805267	-88.505797	729.86	584.10	1313.96



Name: FP 5 Runway 36
Description:
Threshold height : 50 ft
Direction: 360.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.767692	-88.471597	699.74	50.00	749.74
2-mile point	41.738780	-88.471591	693.85	609.32	1303.17

Name: FP 6 Runway 18
Description:
Threshold height : 50 ft
Direction: 180.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
Threshold	41.776629	-88.471578	700.05	50.00	750.05
2-mile point	41.805542	-88.471578	735.61	567.87	1303.48

Route Receptor(s)

Name: Perimeter Roads
Route type Two-way
Azimuthal view angle: 50.0 deg
Downward view angle: 0.0 deg

Vertex	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total elevation ft
1	41.751452	-88.392065	696.73	0.00	696.73
2	41.749627	-88.391807	678.73	0.00	678.73
3	41.745337	-88.388374	664.64	0.00	664.64
4	41.743224	-88.387473	668.21	0.00	668.21
5	41.741831	-88.386271	667.84	0.00	667.84
6	41.740230	-88.385284	667.68	0.00	667.68
7	41.735554	-88.405626	668.55	0.00	668.55
8	41.733817	-88.412397	668.08	0.00	668.08
9	41.731407	-88.421743	702.62	0.00	702.62
10	41.730078	-88.425543	687.08	0.00	687.08
11	41.727067	-88.432195	670.17	0.00	670.17
12	41.726298	-88.436229	659.75	0.00	659.75
13	41.726362	-88.439319	656.85	0.00	656.85
14	41.727355	-88.443591	671.69	0.00	671.69
15	41.754478	-88.443720	715.02	0.00	715.02
16	41.755310	-88.434083	696.29	0.00	696.29
17	41.757679	-88.416703	710.14	0.00	710.14
18	41.758192	-88.412859	715.34	0.00	715.34
19	41.757615	-88.408139	717.09	0.00	717.09
20	41.755150	-88.408525	711.71	0.00	711.71
21	41.753838	-88.407023	707.39	0.00	707.39
22	41.752621	-88.404725	715.72	0.00	715.72
23	41.751308	-88.399704	708.08	0.00	708.08
24	41.751452	-88.392065	696.73	0.00	696.73

Discrete Observation Receptors

Number	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total Elevation ft
1-ATCT	41.768230	-88.466991	707.52	55.00	762.52
OP 2	41.731708	-88.421929	700.58	15.00	715.58
OP 3	41.732685	-88.420566	685.40	13.00	698.40
OP 4	41.748148	-88.396014	695.62	15.00	710.62
OP 5	41.749845	-88.398589	692.26	13.00	705.26
OP 6	41.751078	-88.398696	708.72	14.00	722.72
OP 7	41.751791	-88.405617	713.85	14.00	727.85
OP 8	41.756562	-88.414115	719.58	10.00	729.58
OP 9	41.754449	-88.434456	695.38	13.00	708.38
OP 10	41.753104	-88.434456	689.75	12.00	701.75
OP 11	41.751855	-88.434456	688.24	12.00	700.24
OP 12	41.750575	-88.434456	682.39	11.00	693.39
OP 13	41.749518	-88.434456	680.43	14.00	694.43
OP 14	41.750415	-88.436946	676.92	13.00	689.92
OP 15	41.752528	-88.439692	681.11	13.00	694.11
OP 16	41.749006	-88.439950	684.16	10.00	694.16
OP 17	41.747693	-88.439950	700.37	13.00	713.37
OP 18	41.727999	-88.442482	672.43	12.00	684.43
OP 19	41.733251	-88.444327	666.41	14.00	680.41
OP 20	41.729152	-88.428534	674.03	13.00	687.03
OP 21	41.726653	-88.419779	662.46	13.00	675.46
OP 22	41.729024	-88.419694	671.23	12.00	683.23
OP 23	41.729024	-88.415917	674.88	12.00	686.88
OP 24	41.729120	-88.412741	681.06	15.00	696.06

1-ATCT map image

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	1,069	927	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1 (green)	13	46	48	75	224	288	116	71	54	51	40	0
pv-array-1 (yellow)	0	0	12	74	226	227	228	115	45	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
FP: FP 1 Runway 33	0	0
FP: FP 2 Runway 27	0	0
FP: FP 3 Runway 9	115	0
FP: FP 4 Runway 15	0	0
FP: FP 5 Runway 36	0	0
FP: FP 6 Runway 18	0	0
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	33	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0

OP: OP 19	252	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
Route: Perimeter Roads	669	927

PV array 1: FP 1 Runway 33

No glare found

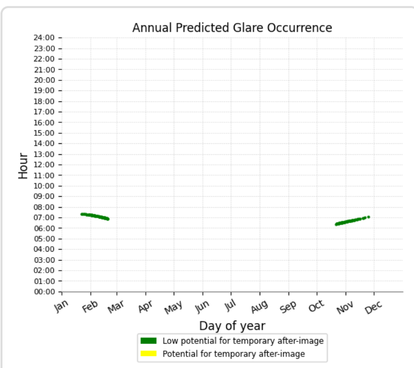
PV array 1: FP 2 Runway 27

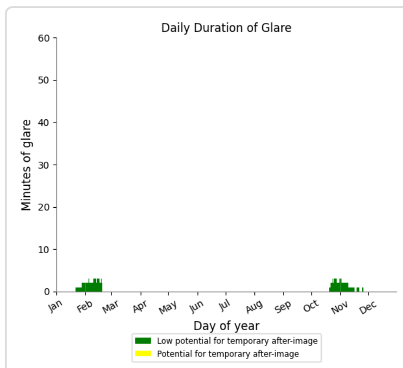
No glare found

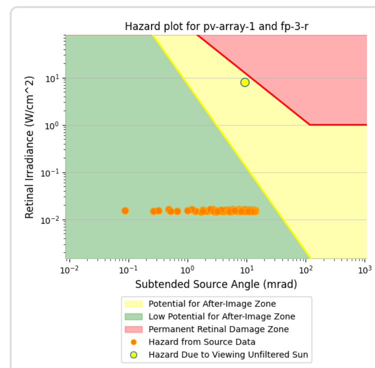
PV array 1: FP 3 Runway 9

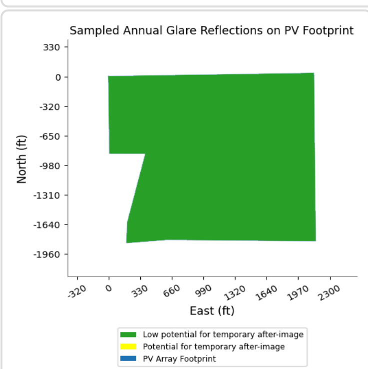
PV array is expected to produce the following glare for this receptor:

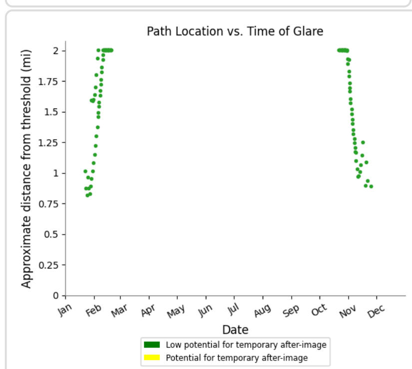
- 115 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

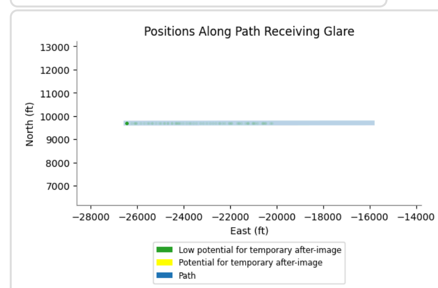












PV array 1: FP 4 Runway 15

No glare found

PV array 1: FP 5 Runway 36

No glare found

PV array 1: FP 6 Runway 18

No glare found

PV array 1: 1-ATCT

No glare found

PV array 1: OP 2

No glare found

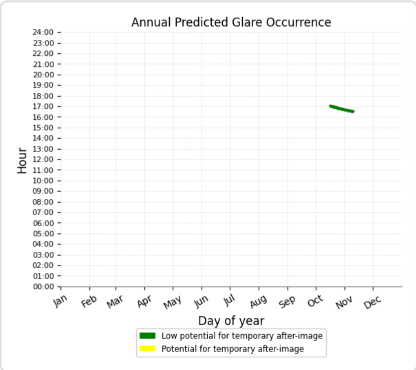
PV array 1: OP 3

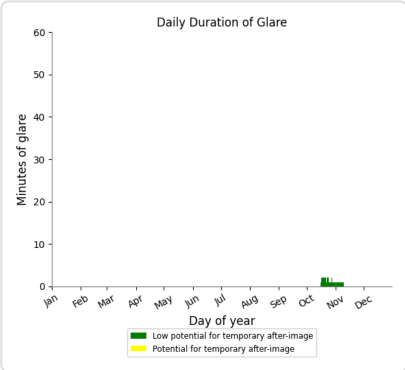
No glare found

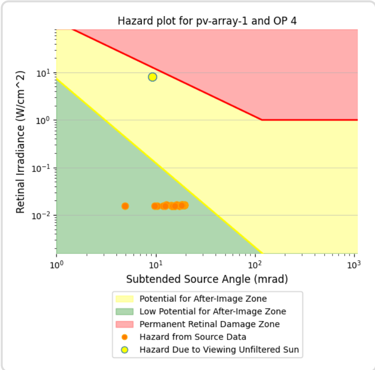
PV array 1: OP 4

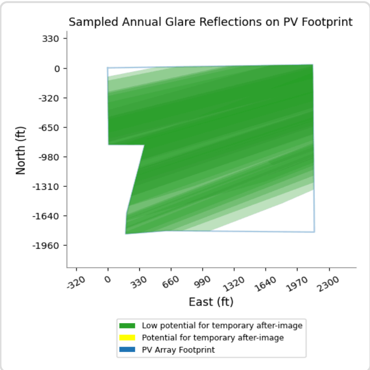
PV array is expected to produce the following glare for this receptor:

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









PV array 1: OP 5

No glare found

PV array 1: OP 6

No glare found

PV array 1: OP 7

No glare found

PV array 1: OP 8

No glare found

PV array 1: OP 9

No glare found

PV array 1: OP 10
No glare found

PV array 1: OP 11
No glare found

PV array 1: OP 12
No glare found

PV array 1: OP 13
No glare found

PV array 1: OP 14
No glare found

PV array 1: OP 15
No glare found

PV array 1: OP 16
No glare found

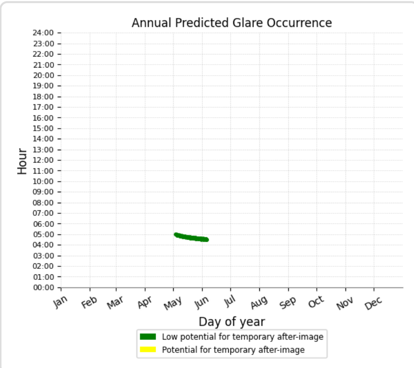
PV array 1: OP 17
No glare found

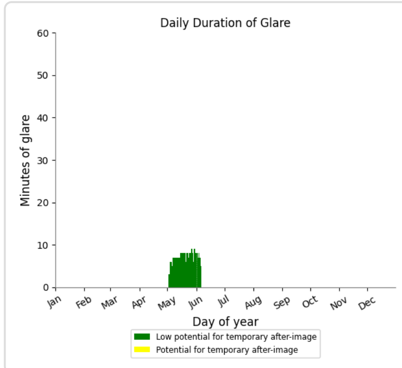
PV array 1: OP 18
No glare found

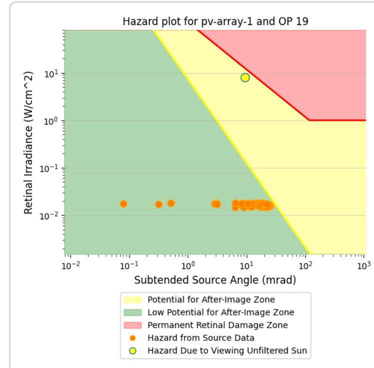
PV array 1: OP 19

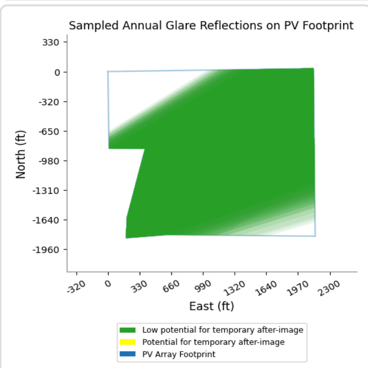
PV array is expected to produce the following glare for this receptor:

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









PV array 1: OP 20

No glare found

PV array 1: OP 21

No glare found

PV array 1: OP 22

No glare found

PV array 1: OP 23

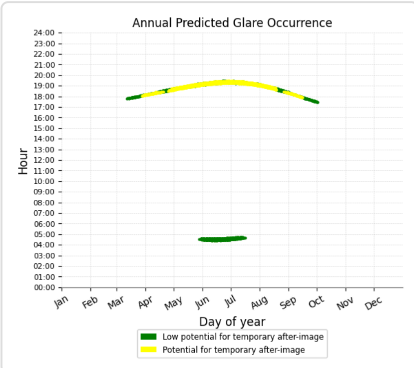
No glare found

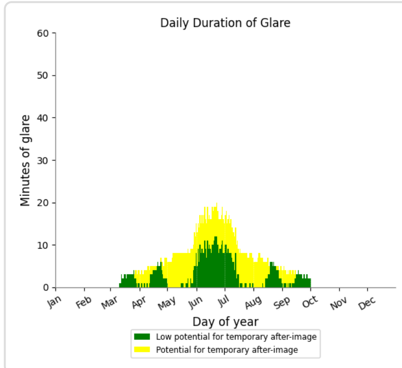
PV array 1: OP 24

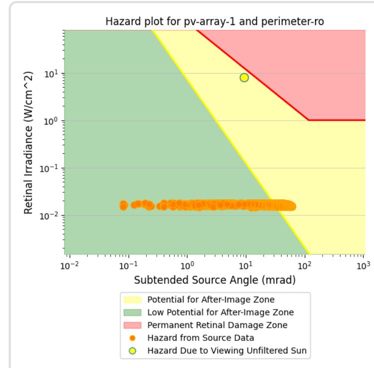
No glare found

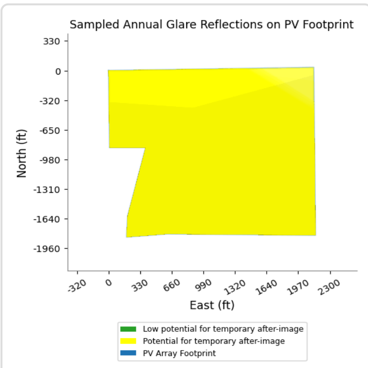
PV array 1: Perimeter Roads

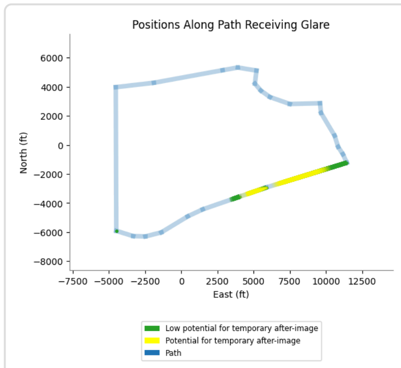
PV array is expected to produce the following glare for this receptor:
- 669 minutes of "green" glare with low potential to cause temporary after-image.
- 927 minutes of "yellow" glare with potential to cause temporary after-image.











Summary of Vertical Surface Glare Analysis

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.