Glint and Glare Analysis

High River Energy Center
Montgomery County, New York

FACILITY OPERATOR:
High River Energy Center, LLC
700 Universe Boulevard
Juno Beach, FL 33408

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1.0 GLARE

1.1 INTRODUCTION

The Project is not anticipated to emit significant glare into the existing environment. Panels are designed to absorb sunlight and will be treated with anti-reflective coatings that will absorb and transmit light rather than reflect it. In general, solar panels are less reflective than window glass or water surfaces (NYSERDA, 2019) and any reflected light from solar panels will have a significantly lower intensity than glare from direct sunlight (Mass. Department of Energy Resources, 2015).

A Glint and Glare Analysis was performed in order to identify any potential impacts on nearby residences and roads. The analysis was prepared by Capitol Airspace Group utilizing the Solar Glare Hazard Analysis Tool (SGHAT). The results of the analysis conform to, and are in accordance with, the FAA's interim policy for Solar Energy System Projects on Federally Obligated Airports (78 FR 63271, October 2013), although this policy is only applicable for projects proposing to install solar panels at federally funded airports. SGHAT is a very conservative tool in that:

- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover, and geographic obstructions;
- The glare analysis assumes clear, sunny skies for 365 days of the year and does not take into account meteorological conditions that would nullify predicted glare such as clouds, rain or snow; and,
- Although only a portion of a modeled array may have the potential to produce glare, the results are provided as if the receptor has visibility of the entire array.

As noted above, the Project proposes to install fixed, tracker, or a combination of both types of racking systems. The glare analysis has been performed assuming an all-fixed layout in order to present results that do not understate potential glare visibility.

1.2 REGULATORY THRESHOLDS

There are no applicable quantitative standards for glare, but scientific literature suggests that doubling the annual 30-hour shadow flicker standard (adopted by the Siting Board applicable to wind facilities) could be used as a benchmark, i.e. 60 hours per year (Pager Power, January 2017).

1.3 GLARE ANALYSIS

Based on the viewshed analysis included as Figure 4 in Attachment 2 of the Visual Impact Assessment (VIA), non-participating residential receptors and points along local

roadways (both referred to herein as “observation points”) identified as having visibility of the Project were assessed for glare. The overall Project array was divided into nine separate areas identified as arrays A1 through A7 and P1, P2. An additional viewshed analysis was then performed to determine which of these separate array areas are visible from each observation point with predicted visibility. Proposed landscaping was not accounted for in the viewshed analysis and, therefore, the predicted visibility is overestimated.

For residential observation points, the analysis conservatively assumed a second-story observer height of 16 feet. Twenty-five residential observation points were assessed. Similarly, for road observation points, a truck observer height of eight feet was assumed. Twelve roadway observation points were assessed.

The glare analysis was then conducted to determine the potential duration of glare that could occur at each observation point and the portion of each array area determined to have a potential to result in glare. The results of this analysis are included in Appendix 24-2. While the results indicate there is the potential for glare at a number of observation points, further analysis was required to determine if the portion of each array area determined to have the potential to create glare at an observation point is actually visible at each observation point. As noted in Section 7.1.2 in the VIA, because an area may show visibility in the viewshed analysis, it does not mean the entirety of the array area will be seen. The viewshed analysis depicts areas of visibility over a regional area. It can only predict geographically on a map, areas where some part of the solar panels might be seen. It does not and cannot determine if it is seeing a full on view or a partial view. Additionally, if visibility is occurring in an area, it may sometimes only be a result of glimpsing a portion of the Project over undulating treetops between gaps of trees, or visibility of the tops of panels and not a full view.

Therefore, for observation points that have the potential for greater than 30 hours of glare annually (eight residences and two road points), but less than 60 hours annually, a separate line of sight analysis was completed to confirm visibility of the array. Table 1 below provides a summary of this analysis.

Table 1. Glare Analysis Results

Observation Point	Type	Array(s) Assessed	Potential for Glare >30 Hours Annually	Line of Sight Analysis Results	Predicted Glare Duration
OP-2	Residence	A-1	Yes	Existing vegetation and proposed landscaping block visibility	0 hours
OP-10	Residence	A-2	Yes	Confirmed visibility	42.48 hours annually possible; additional landscape buffer to south of Array 2 should help minimize potential glare duration
OP-11	Residence	A-2 & A-3	Yes	A-2: Confirmed visibility; A-3: Existing vegetation and proposed landscaping block visibility	A-2: 38.72 hours annually possible; additional landscape buffer to south of Array 2 should help minimize potential glare duration; A-3: 0 hours
OP-14	Residence	P-1	Yes	Proposed landscaping will block array visibility	0 hours

Observation Point	Type	Array(s) Assessed	Potential for Glare >30 Hours Annually	Line of Sight Analysis Results	Predicted Glare Duration
OP-16	Residence	P-1	Yes	Proposed landscaping will block array visibility	0 hours
OP-29	Residence	A-5	Yes	Proposed landscaping will block array visibility	0 hours
OP-33	Residence	A-2	Yes	Existing vegetation blocks visibility	0 hours
OP-51	Residence	P-1 & P-2	Yes	P-1: Existing vegetation blocks visibility; P-2: Existing hedgerow vegetation blocks array visibility	P-1: 0 hours P-2: 0 hours
OP-66	Road	A-2	Yes	Existing vegetation blocks visibility	0 hours
OP-74	Road	A-2	Yes	Existing vegetation and proposed landscaping block visibility	0 hours

As indicated in Table 8 above, for those observation points with the potential for greater than 30 hours of glare annually, but less than 60 hours annually, all but two are confirmed to have existing vegetation and/or proposed landscaping that will mitigate the potential for glare. Two additional locations (OP-10 & OP-11) can likely be mitigated with the addition of a landscape buffer along the southern perimeter of array A-2.

Of the remaining 17 residential observation points not included in Table 8, five have no potential for glare and the remaining 12 observation points have the potential for glare less than 30 hours annually with the maximum duration of potential glare ranging from five to 20 minutes per day during select summer months. For the remaining 10 road observation points, six have no potential for glare and the remaining four have the potential for glare less than 30 hours annually with the maximum duration ranging from one to fifteen minutes per day during select summer months. Similar to the observation points listed in Table 8, this analysis is very conservative in that the portions of the arrays that have the potential to create glare may not be visible. Additionally, proposed landscaping is not accounted for in the viewshed analysis and, as noted above, the analysis assumes that the sun is shining 365 days per year, which means days with no glare (cloudy or rainy days) are most likely contributing to the predicted glare duration. Similarly, buildings and existing tree cover may block otherwise predicted glare duration. Proposed landscape areas in combination with existing vegetation along the perimeter of the site will further reduce the potential from glare associated with the proposed arrays.

Proposed mitigation measures in place for observation points with less than 30 hours of potential glare annually include:

- Landscaping along southernmost portion of Array A-2 and A-3
- Special Planting Area proposed along northern and western portions of Array A-7
- Landscaping along perimeter of Array P-1
- Landscaping along northern perimeter of Array A-5

Based on the results of the analysis and the proposed mitigation measures, no significant impacts from glare are expected as a result of the Project.

Refer to Attachment 1 to see the SGHAT data sheets prepared by Capitol Airspace Group.

Attachment 1

SGHAT data sheets prepared by Capitol Airspace Group

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array 1 Fixed 9Oct19

Project site configuration details and results.

Created **Oct. 9, 2019 1:11 p.m.**
Updated **Oct. 9, 2019 2:26 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31860.5043

Summary of Results

Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A1	25.0	180.0	337	5,240	-

Component Data

PV Array(s)

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Name: A1
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.908231	-74.152762	540.64	10.00	550.64
2	42.908229	-74.151962	550.66	10.00	560.66
3	42.905244	-74.148952	573.85	10.00	583.85
4	42.904425	-74.150796	569.90	10.00	579.90
5	42.902683	-74.150826	608.30	10.00	618.30
6	42.902156	-74.150652	605.26	10.00	615.26
7	42.902153	-74.149516	602.13	10.00	612.14
8	42.901968	-74.149242	597.47	10.00	607.48
9	42.901759	-74.149064	583.44	10.00	593.44
10	42.901386	-74.149243	587.17	10.00	597.17
11	42.900814	-74.150343	589.41	10.00	599.41
12	42.900815	-74.150803	598.80	10.00	608.80
13	42.901525	-74.151659	603.00	10.00	613.00
14	42.902014	-74.151940	602.25	10.00	612.25
15	42.901242	-74.153212	601.54	10.00	611.54
16	42.900318	-74.152601	601.38	10.00	611.38
17	42.900317	-74.152273	600.43	10.00	610.43
18	42.899758	-74.152277	599.35	10.00	609.35
19	42.899509	-74.152900	599.46	10.00	609.46
20	42.899426	-74.154883	604.20	10.00	614.20
21	42.897906	-74.157847	614.90	10.00	624.90
22	42.898075	-74.158320	615.79	10.00	625.80
23	42.899035	-74.159268	612.28	10.00	622.28
24	42.899699	-74.159264	609.12	10.00	619.12
25	42.900243	-74.156852	605.49	10.00	615.49
26	42.900626	-74.156854	607.96	10.00	617.96
27	42.901587	-74.157821	601.85	10.00	611.85
28	42.901989	-74.157818	594.76	10.00	604.76
29	42.902303	-74.157181	594.13	10.00	604.13
30	42.902946	-74.157178	573.91	10.00	583.91
31	42.903340	-74.156804	566.19	10.00	576.19
32	42.903338	-74.155932	574.30	10.00	584.30
33	42.902215	-74.154962	586.54	10.00	596.54
34	42.901128	-74.154963	598.70	10.00	608.70
35	42.901551	-74.154062	593.98	10.00	603.98
36	42.902316	-74.154386	584.15	10.00	594.15
37	42.903093	-74.154329	583.59	10.00	593.59
38	42.903919	-74.154918	555.88	10.00	565.88
39	42.904121	-74.154904	549.54	10.00	559.54
40	42.905104	-74.153258	541.20	10.00	551.20
41	42.906723	-74.152771	539.10	10.00	549.10

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 2	42.907694	-74.149199	572.18	16.00	588.18
OP 7	42.895080	-74.138024	656.83	16.00	672.83
OP 10	42.896538	-74.135272	617.61	16.00	633.61
OP 11	42.896899	-74.134649	608.31	16.00	624.31
OP 21	42.893908	-74.163184	668.51	16.00	684.51
OP 24	42.889587	-74.149577	803.12	16.00	819.12
OP 28	42.889113	-74.150335	815.53	16.00	831.53
OP 40	42.894156	-74.117976	629.29	16.00	645.29
OP 43	42.893775	-74.117145	644.10	16.00	660.10
OP 44	42.889212	-74.119802	856.47	16.00	872.47
OP 47	42.889832	-74.151972	774.94	16.00	790.94
OP 66	42.894854	-74.164041	650.56	8.00	658.56
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

A1 potential temporary after-image

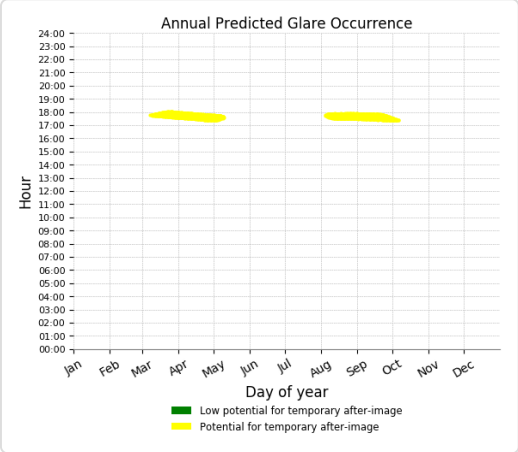
Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

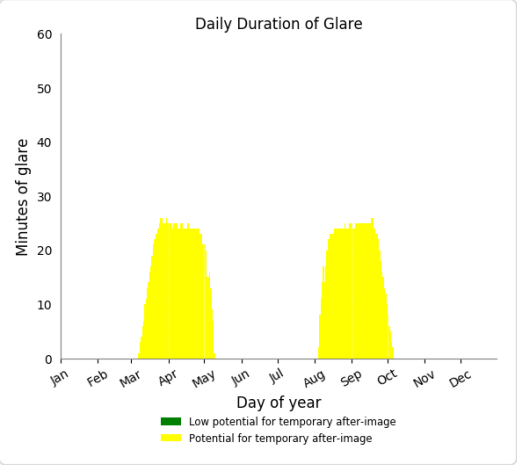
Component	Green glare (min)	Yellow glare (min)
OP: OP 2	0	2549
OP: OP 7	0	974
OP: OP 10	0	184
OP: OP 11	6	480
OP: OP 21	0	0
OP: OP 24	0	0
OP: OP 28	0	0
OP: OP 40	4	101
OP: OP 43	1	94
OP: OP 44	326	858
OP: OP 47	0	0
OP: OP 66	0	0
OP: OP 76	0	0

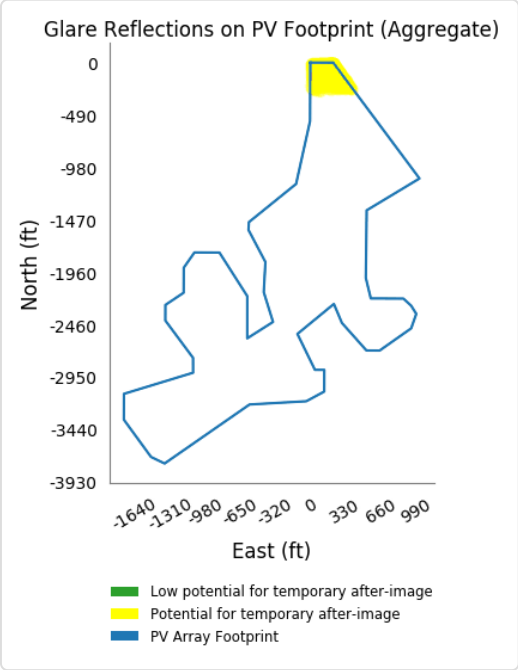
A1 - OP Receptor (OP 2)

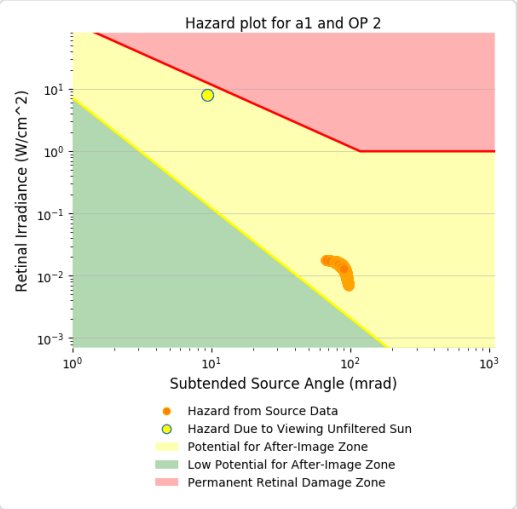
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,549 minutes of "yellow" glare with potential to cause temporary after-image.





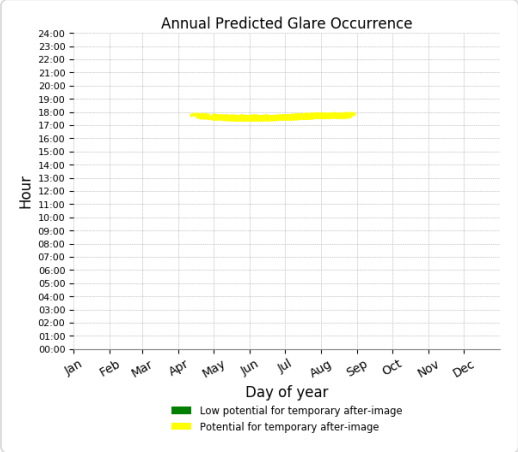


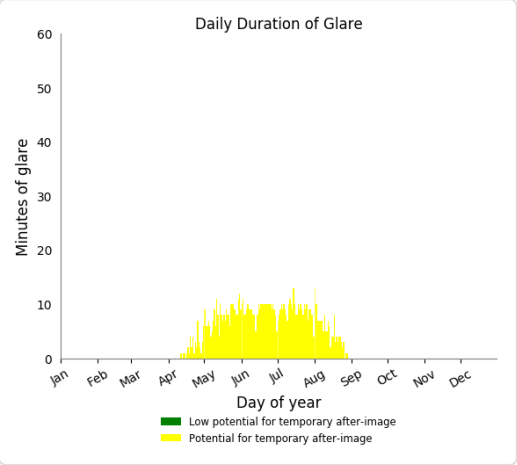


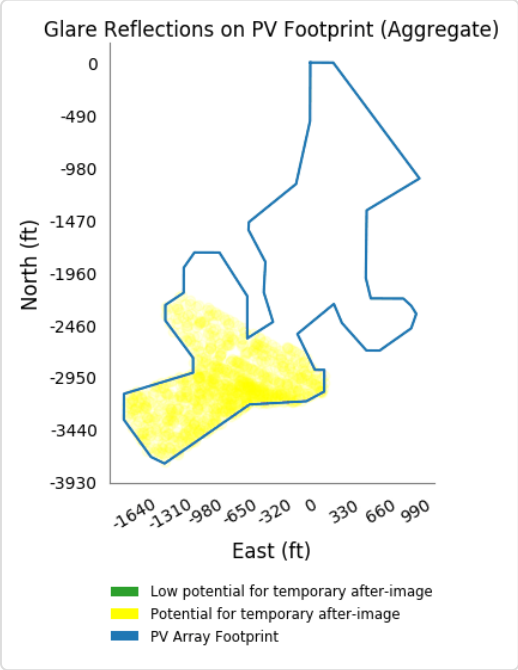
A1 - OP Receptor (OP 7)

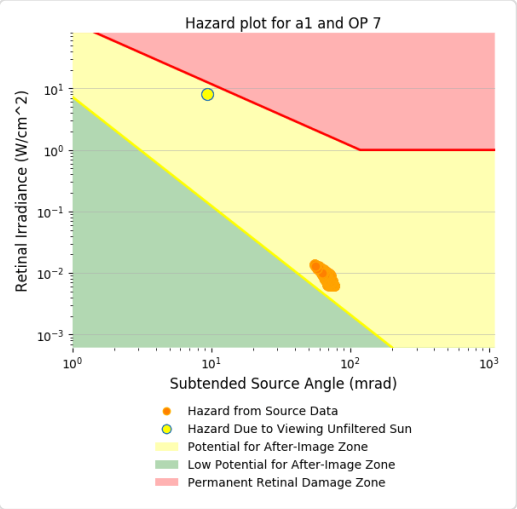
PV array is expected to produce the following glare for receptors at this location:

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





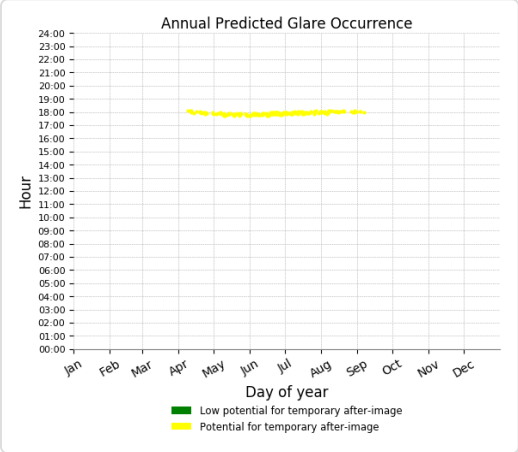


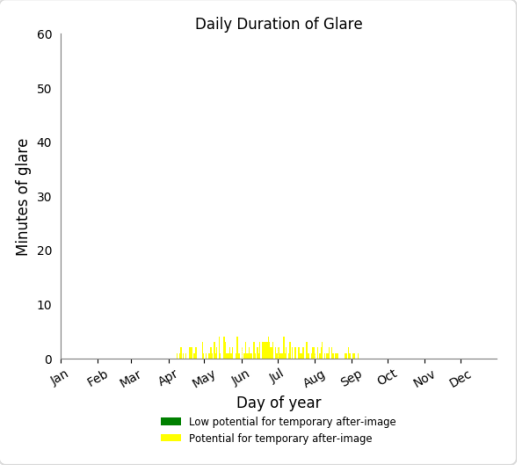


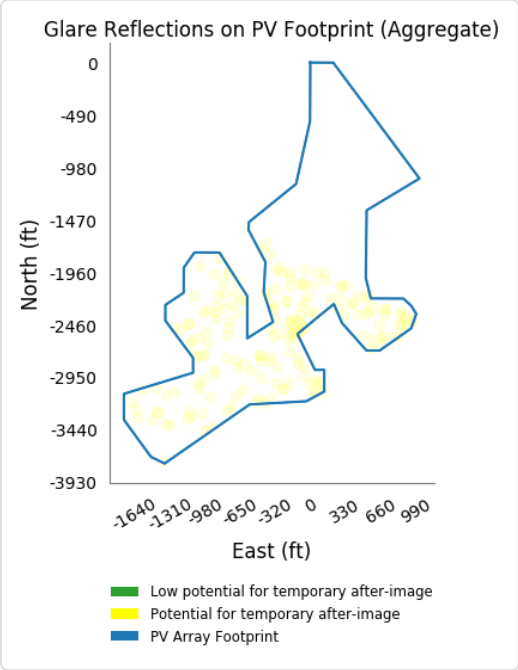
A1 - OP Receptor (OP 10)

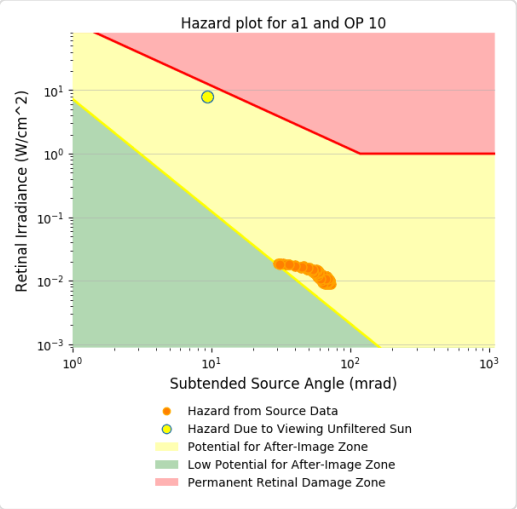
PV array is expected to produce the following glare for receptors at this location:

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





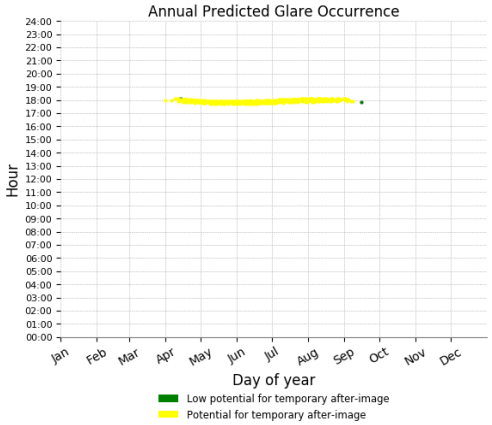


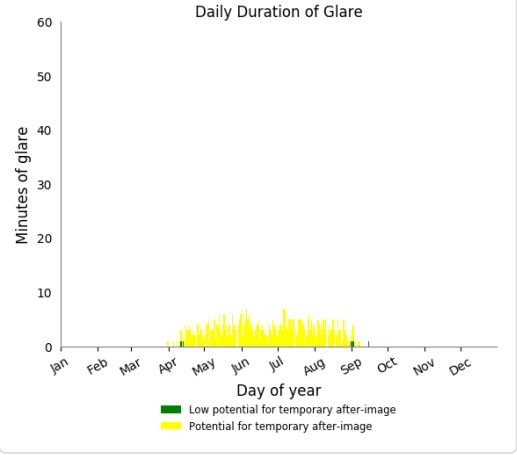


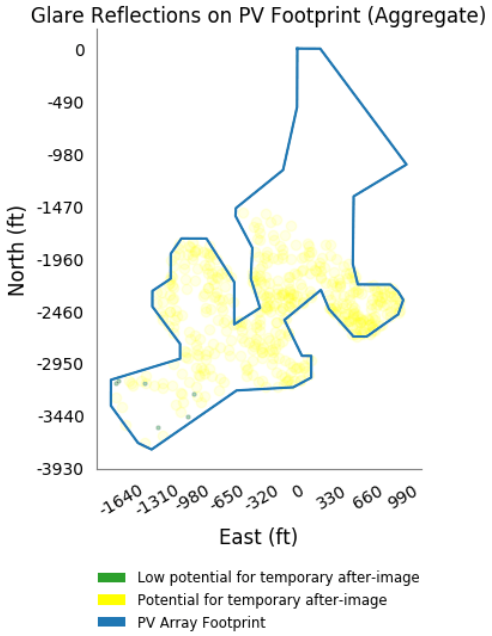
A1 - OP Receptor (OP 11)

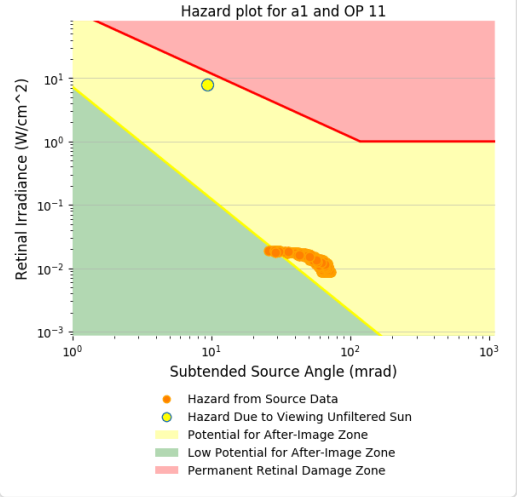
PV array is expected to produce the following glare for receptors at this location:

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









A1 - OP Receptor (OP 21)

No glare found

A1 - OP Receptor (OP 24)

No glare found

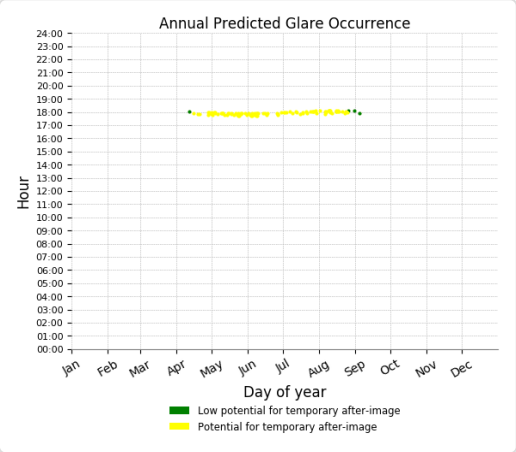
A1 - OP Receptor (OP 28)

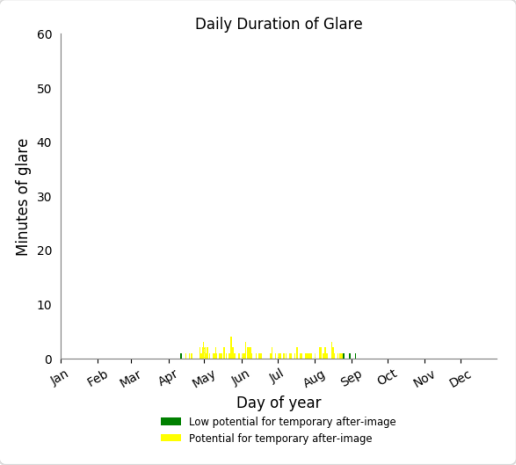
No glare found

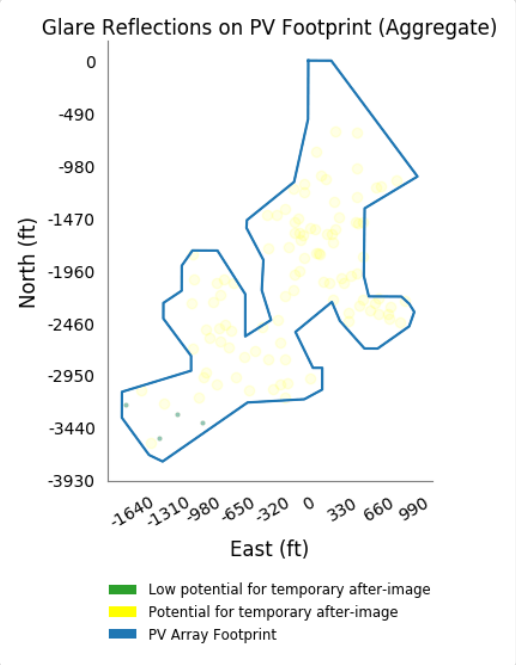
A1 - OP Receptor (OP 40)

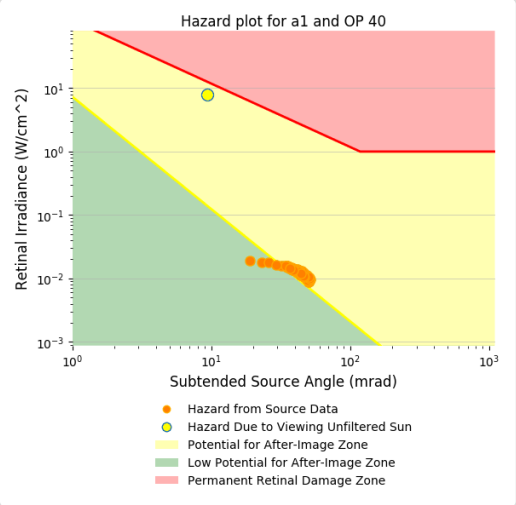
PV array is expected to produce the following glare for receptors at this location:

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





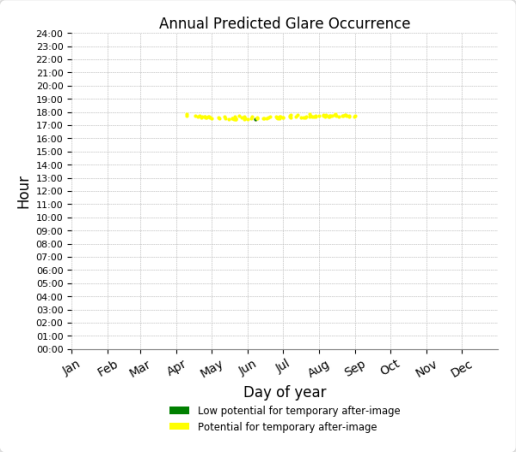


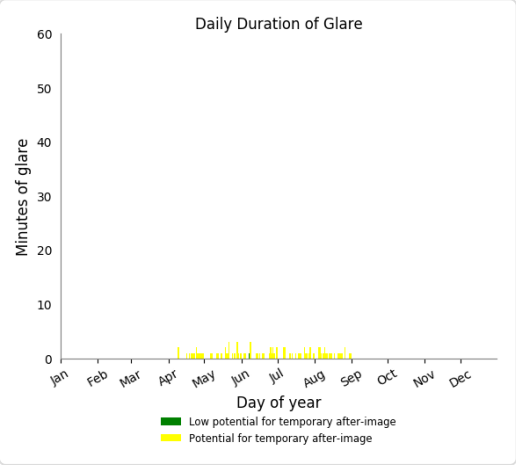


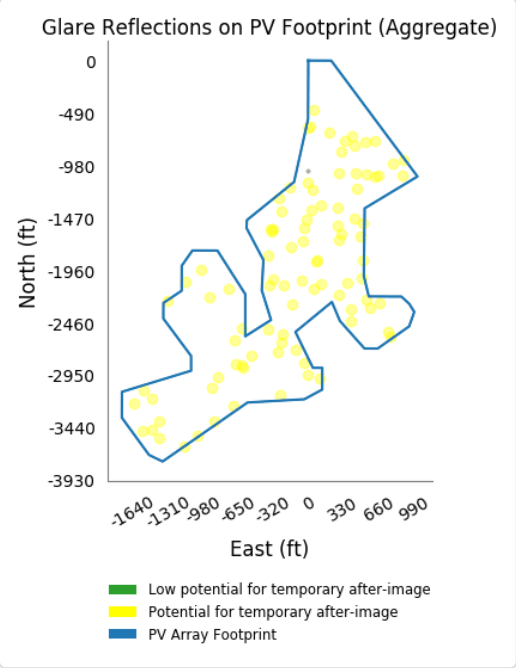
A1 - OP Receptor (OP 43)

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

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



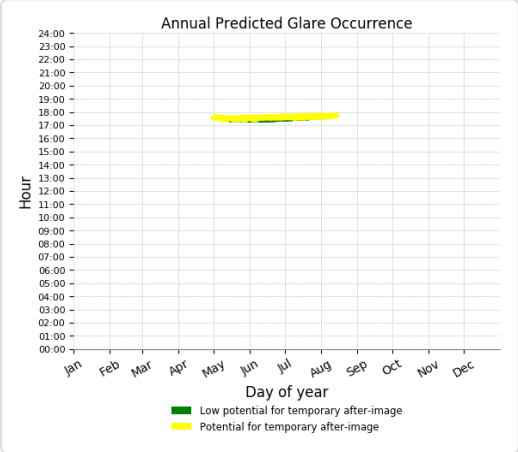


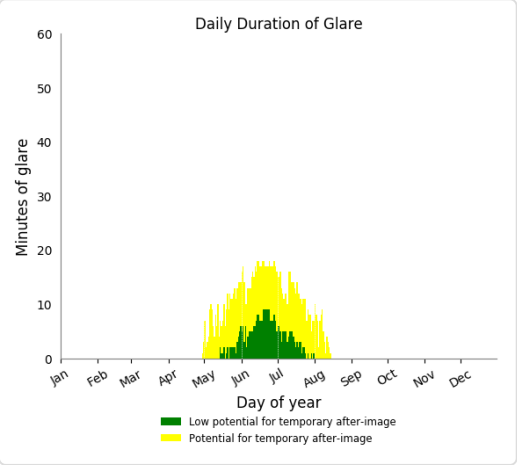


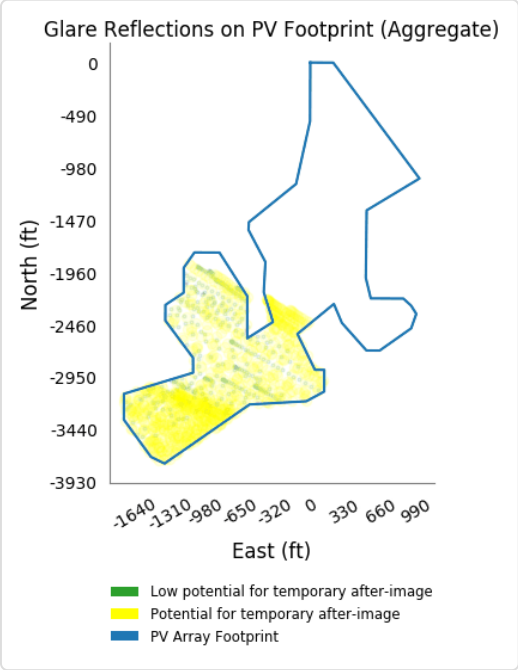
A1 - OP Receptor (OP 44)

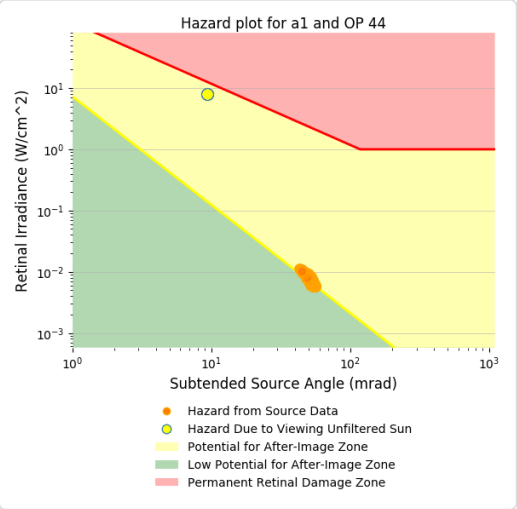
PV array is expected to produce the following glare for receptors at this location:

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









A1 - OP Receptor (OP 47)

No glare found

A1 - OP Receptor (OP 66)

No glare found

A1 - OP Receptor (OP 76)

No glare found

Assumptions

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

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array 2 Fixed 9Oct19

Project site configuration details and results.

Created **Oct. 9, 2019 1:13 p.m.**
Updated **Oct. 9, 2019 2:34 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31861.5043

Summary of Results Glare with potential for temporary after-image predicted

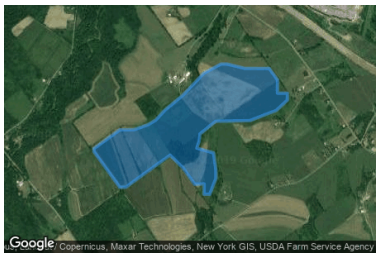
PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A2	25.0	180.0	25	18,867	-

Component Data

PV Array(s)

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Name: A2
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.904016	-74.144397	592.43	10.00	602.43
2	42.904013	-74.143792	599.38	10.00	609.38
3	42.903688	-74.141939	602.55	10.00	612.55
4	42.903680	-74.139401	602.07	10.00	612.07
5	42.902808	-74.138549	602.57	10.00	612.57
6	42.901798	-74.138556	576.57	10.00	586.57
7	42.901795	-74.137520	545.67	10.00	555.67
8	42.901267	-74.137523	541.10	10.00	551.10
9	42.900491	-74.138671	561.25	10.00	571.25
10	42.899719	-74.141395	592.06	10.00	602.06
11	42.899659	-74.144970	596.01	10.00	606.01
12	42.898701	-74.146597	602.75	10.00	612.75
13	42.898170	-74.146673	609.24	10.00	619.24
14	42.897621	-74.146920	617.61	10.00	627.61
15	42.897259	-74.145188	621.55	10.00	631.55
16	42.895944	-74.144939	643.20	10.00	653.20
17	42.895304	-74.144943	657.69	10.00	667.69
18	42.894109	-74.145582	682.85	10.00	692.85
19	42.894110	-74.146164	686.27	10.00	696.27
20	42.894896	-74.146160	669.02	10.00	679.02
21	42.894875	-74.147154	673.44	10.00	683.44
22	42.896118	-74.148365	643.74	10.00	653.74
23	42.897087	-74.149698	622.69	10.00	632.69
24	42.894643	-74.154301	657.35	10.00	667.35
25	42.894645	-74.154931	659.99	10.00	669.99
26	42.897353	-74.157607	617.43	10.00	627.43
27	42.897577	-74.157605	616.69	10.00	626.69
28	42.899004	-74.154922	606.15	10.00	616.15
29	42.899022	-74.153422	599.83	10.00	609.84
30	42.899388	-74.152010	597.63	10.00	607.63
31	42.899751	-74.151178	595.73	10.00	605.73
32	42.900490	-74.150258	589.99	10.00	599.99
33	42.901624	-74.148391	583.92	10.00	593.92
34	42.903321	-74.146189	595.96	10.00	605.96

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 6	42.895017	-74.138592	654.09	16.00	670.09
OP 7	42.895080	-74.138024	656.83	16.00	672.83
OP 8	42.895209	-74.137643	652.44	16.00	668.44
OP 9	42.895449	-74.137219	645.32	16.00	661.32
OP 10	42.896538	-74.135272	617.61	16.00	633.61
OP 11	42.896899	-74.134649	608.31	16.00	624.31
OP 24	42.889587	-74.149577	803.12	16.00	819.12
OP 28	42.889113	-74.150335	815.53	16.00	831.53
OP 29	42.888530	-74.149500	829.82	16.00	845.82
OP 33	42.895612	-74.128218	603.88	16.00	619.88
OP 40	42.894156	-74.117976	629.29	16.00	645.29
OP 43	42.893775	-74.117145	644.10	16.00	660.10
OP 44	42.889212	-74.119802	856.47	16.00	872.47
OP 47	42.889832	-74.151972	774.94	16.00	790.94
OP 66	42.894854	-74.164041	650.56	8.00	658.56
OP 72	42.889264	-74.149082	812.51	8.00	820.51
OP 74	42.895349	-74.135464	631.08	8.00	639.08
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

A2 potential temporary after-image

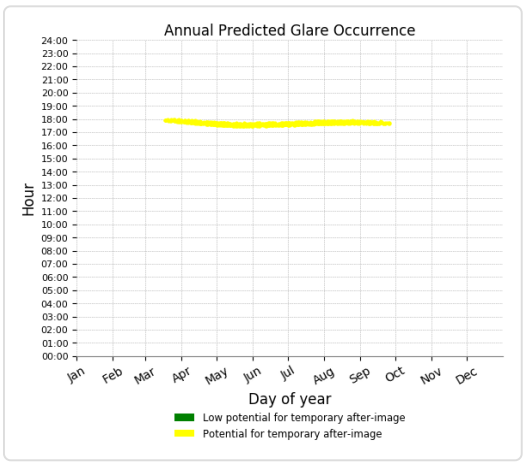
Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

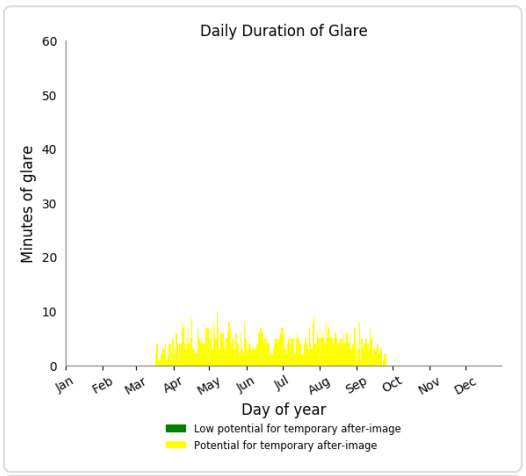
Component	Green glare (min)	Yellow glare (min)
OP: OP 6	0	846
OP: OP 7	0	1503
OP: OP 8	0	606
OP: OP 9	0	891
OP: OP 10	0	2115
OP: OP 11	0	2323
OP: OP 24	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 33	0	2230
OP: OP 40	12	1040
OP: OP 43	13	742
OP: OP 44	0	2202
OP: OP 47	0	0
OP: OP 66	0	2011
OP: OP 72	0	0
OP: OP 74	0	2073
OP: OP 76	0	285

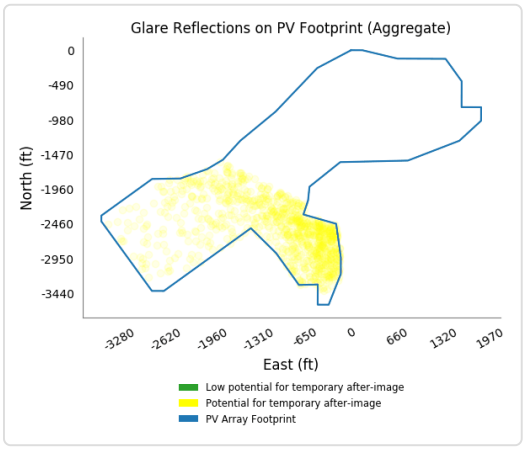
A2 - OP Receptor (OP 6)

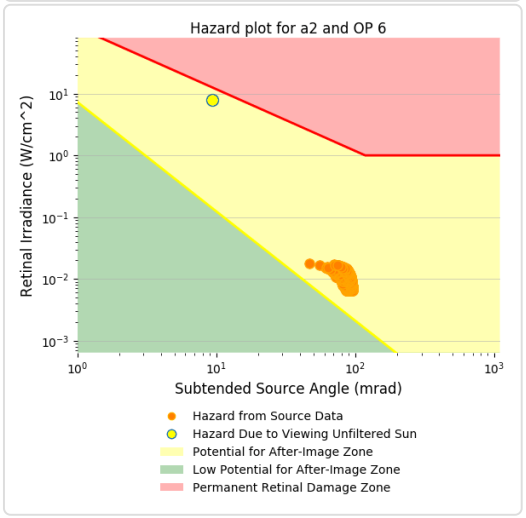
PV array is expected to produce the following glare for receptors at this location:

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





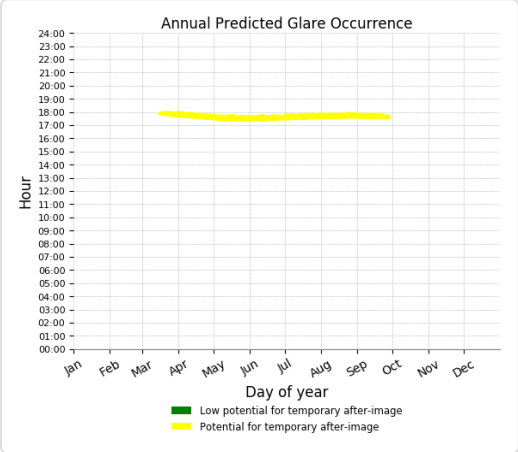


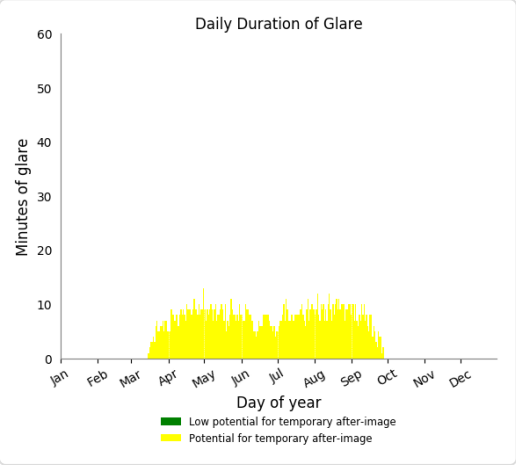


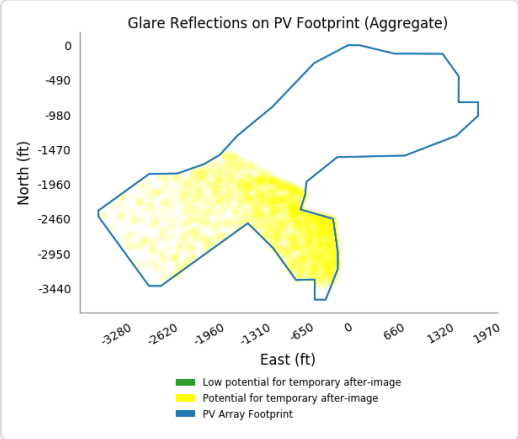
A2 - OP Receptor (OP 7)

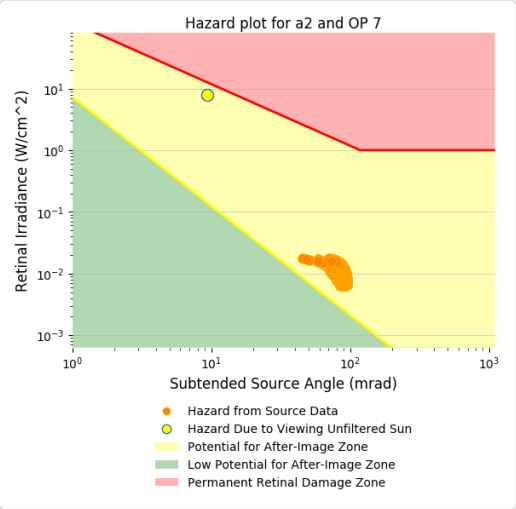
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,503 minutes of "yellow" glare with potential to cause temporary after-image.





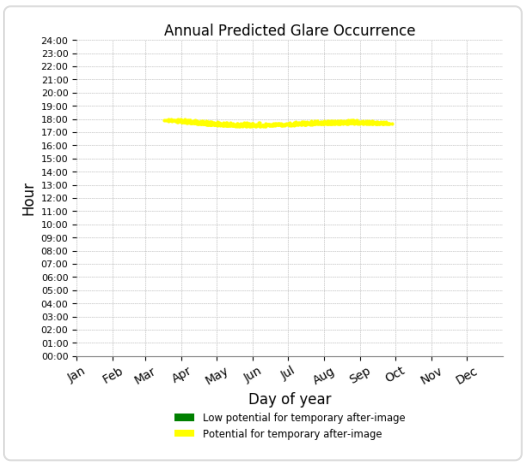


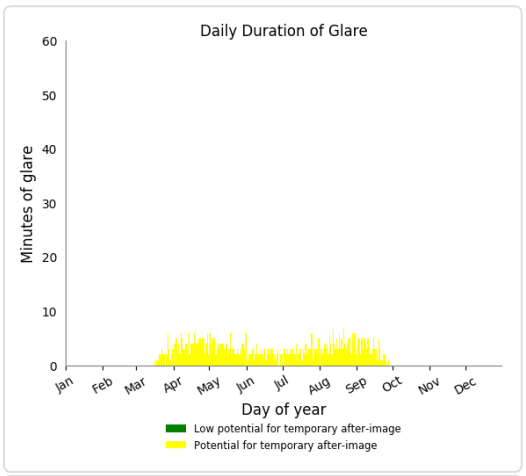


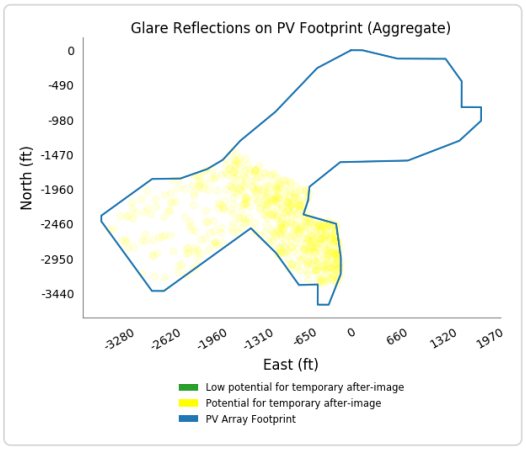
A2 - OP Receptor (OP 8)

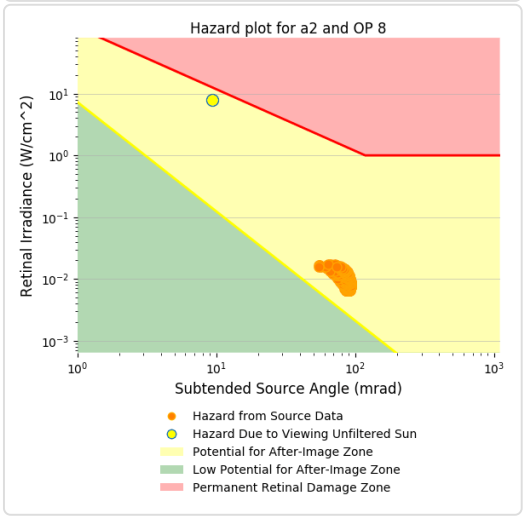
PV array is expected to produce the following glare for receptors at this location:

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





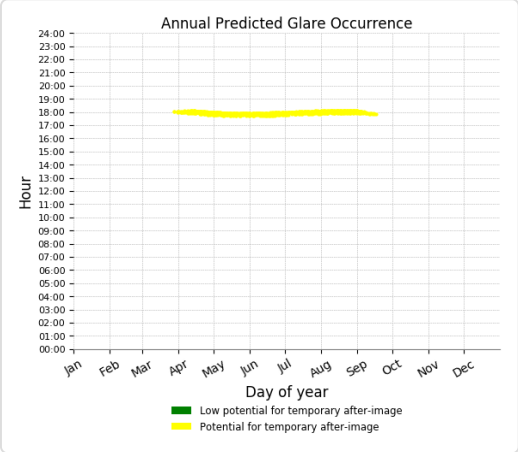


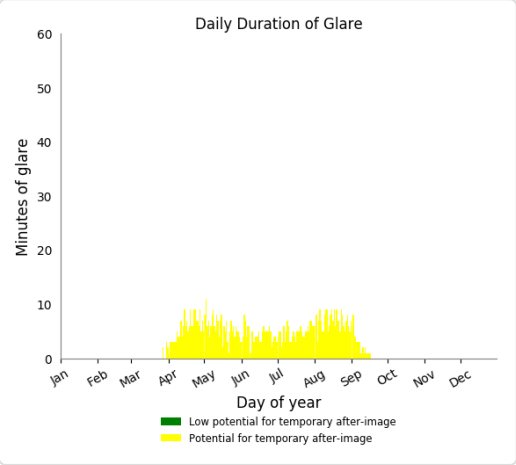


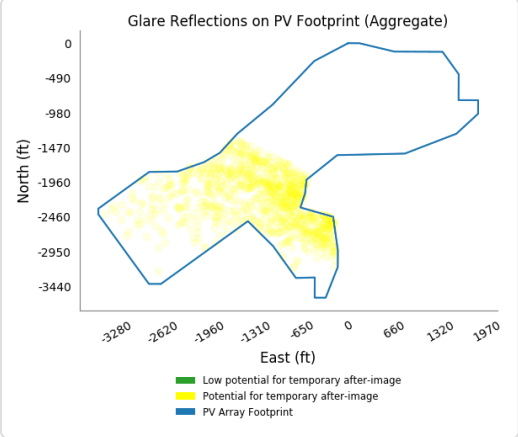
A2 - OP Receptor (OP 9)

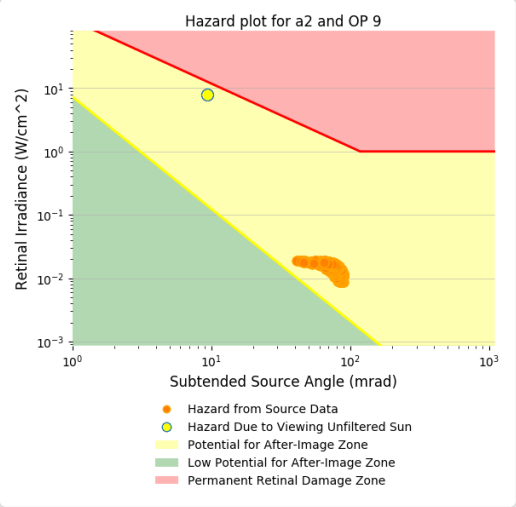
PV array is expected to produce the following glare for receptors at this location:

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





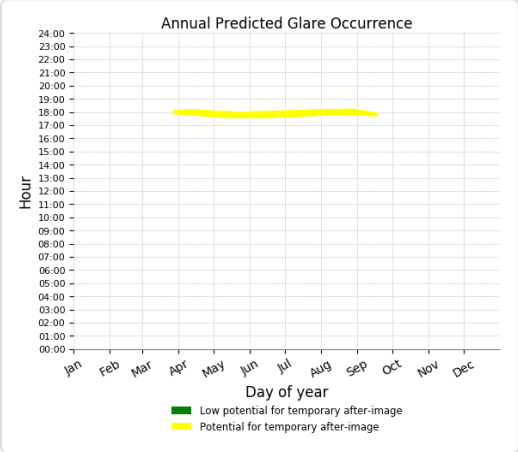


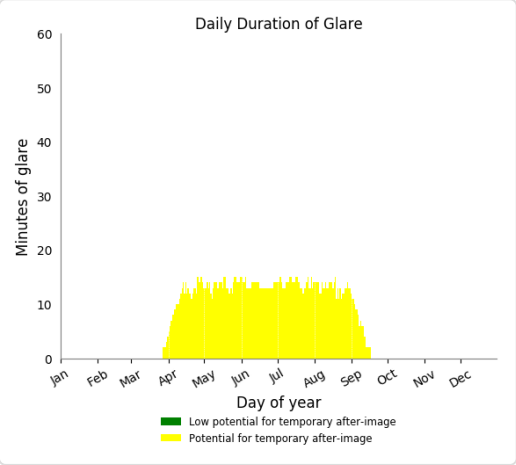


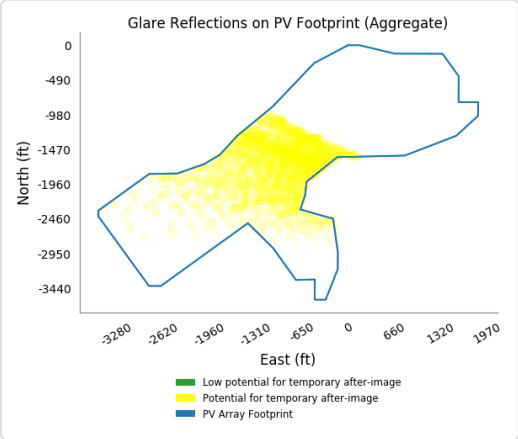
A2 - OP Receptor (OP 10)

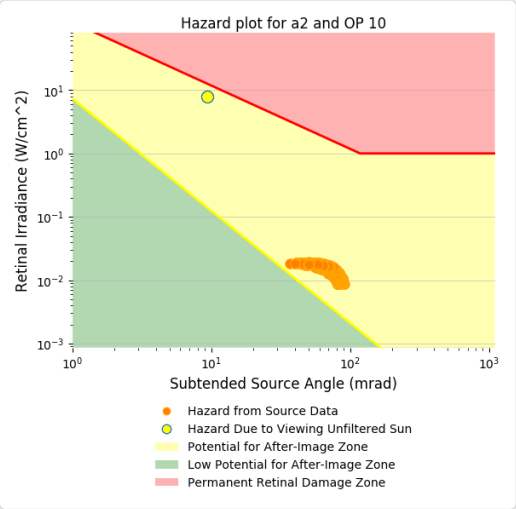
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,115 minutes of "yellow" glare with potential to cause temporary after-image.





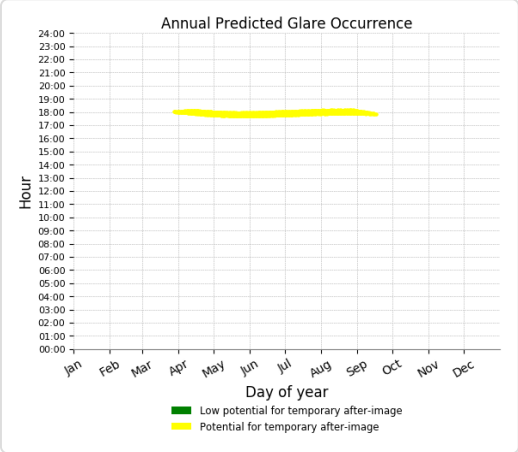


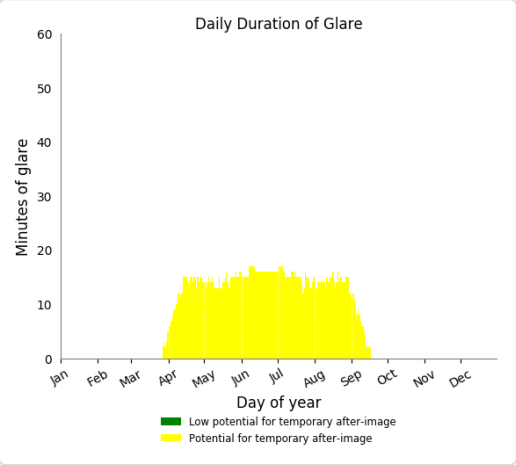


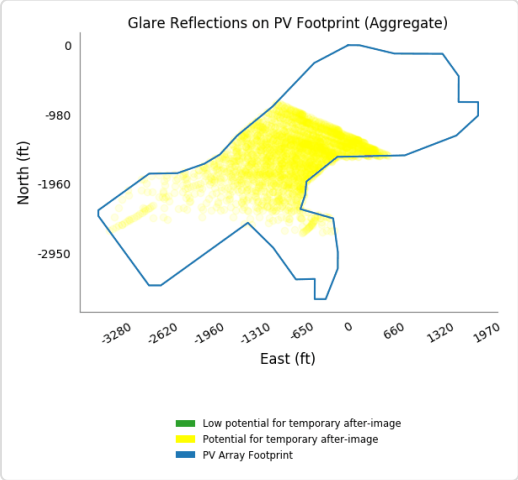
A2 - OP Receptor (OP 11)

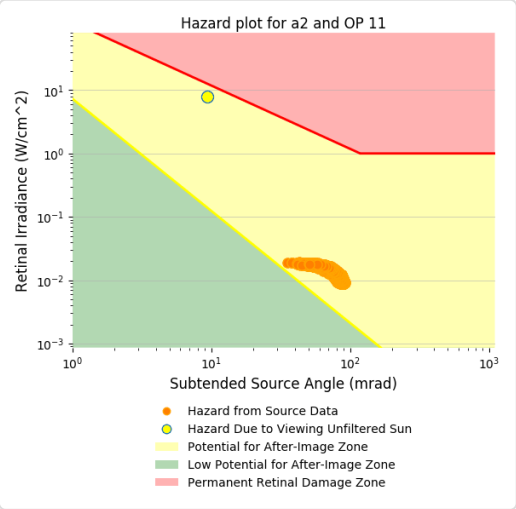
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,323 minutes of "yellow" glare with potential to cause temporary after-image.









A2 - OP Receptor (OP 24)

No glare found

A2 - OP Receptor (OP 28)

No glare found

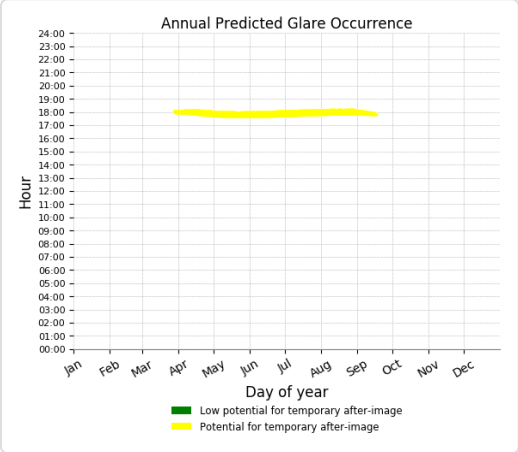
A2 - OP Receptor (OP 29)

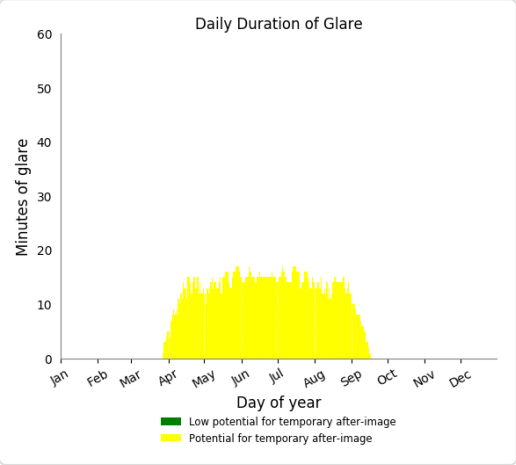
No glare found

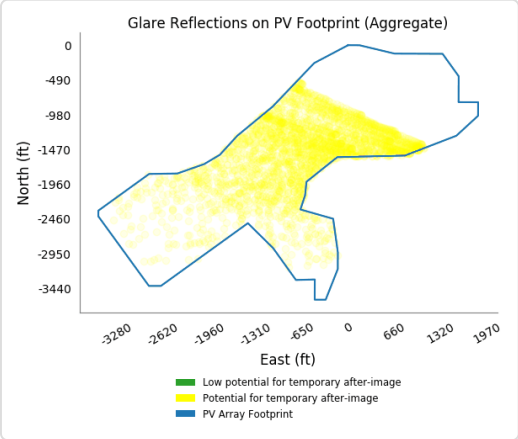
A2 - OP Receptor (OP 33)

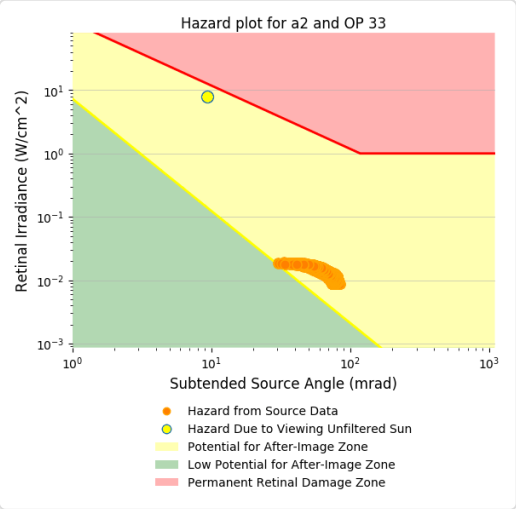
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,230 minutes of "yellow" glare with potential to cause temporary after-image.





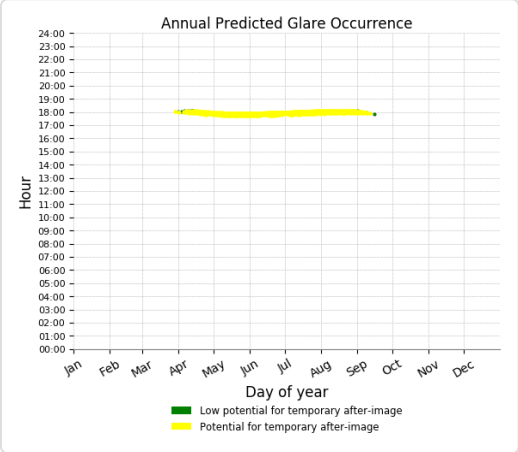


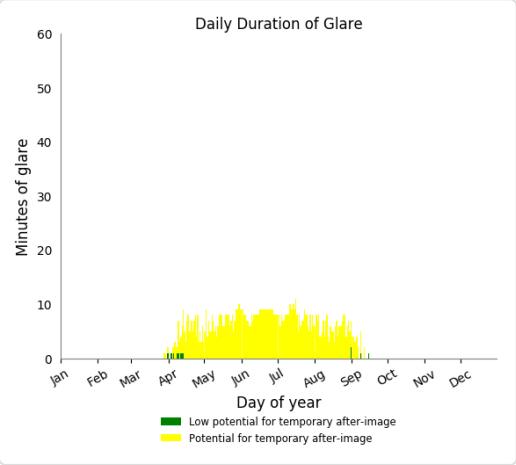


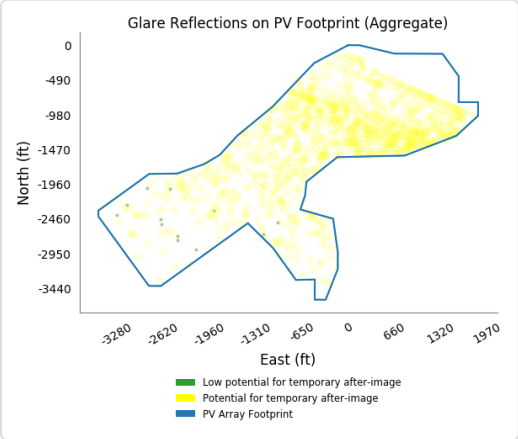
A2 - OP Receptor (OP 40)

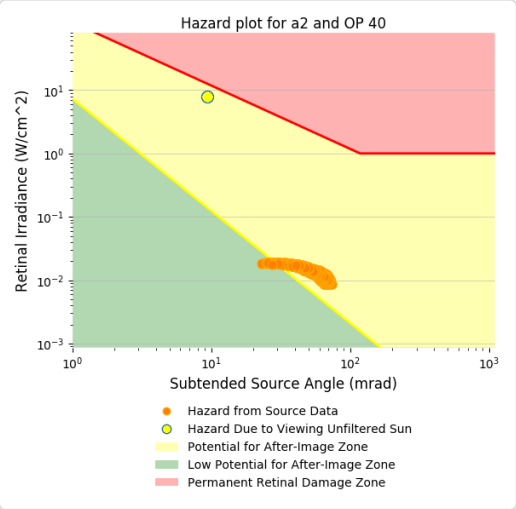
PV array is expected to produce the following glare for receptors at this location:

- 12 minutes of "green" glare with low potential to cause temporary after-image.
- 1,040 minutes of "yellow" glare with potential to cause temporary after-image.





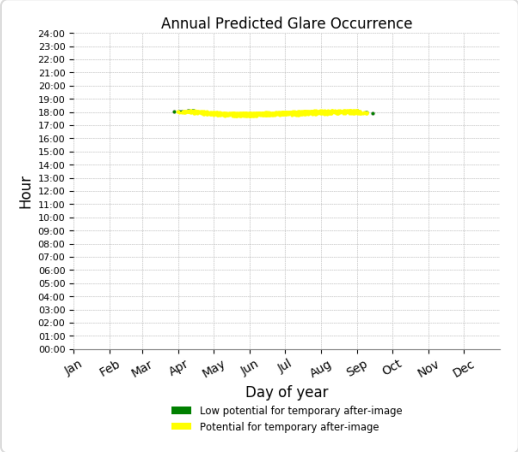


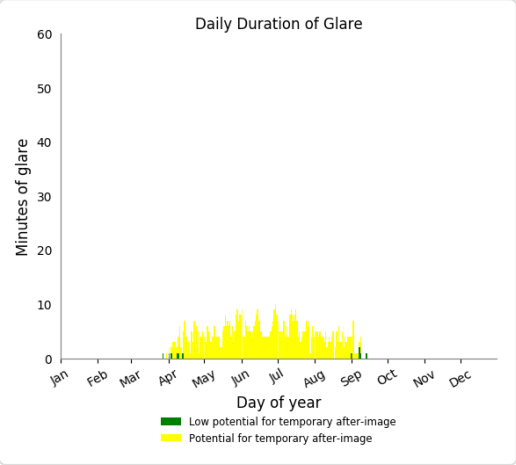


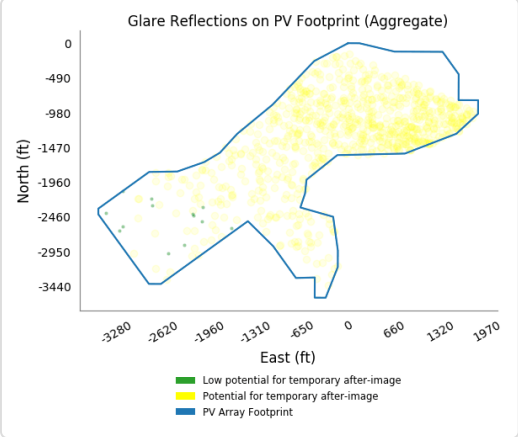
A2 - OP Receptor (OP 43)

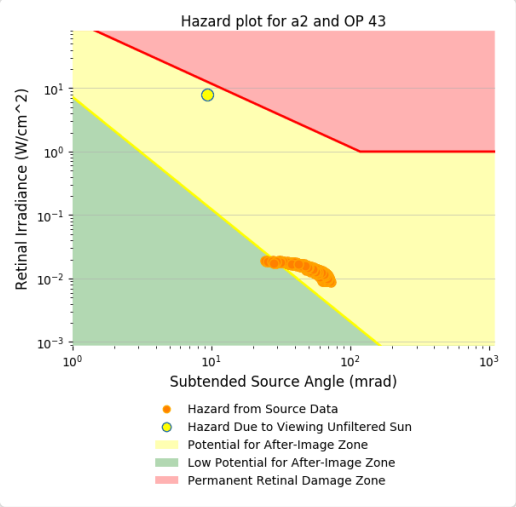
PV array is expected to produce the following glare for receptors at this location:

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





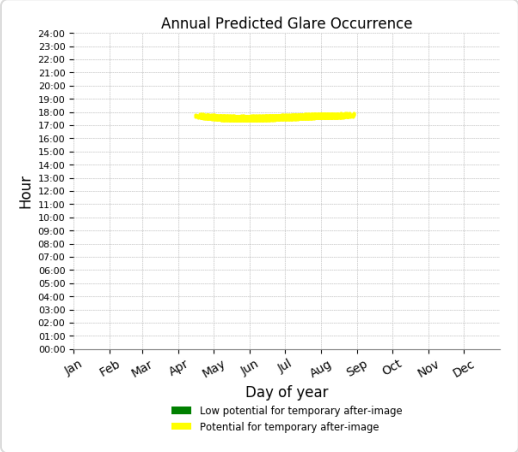


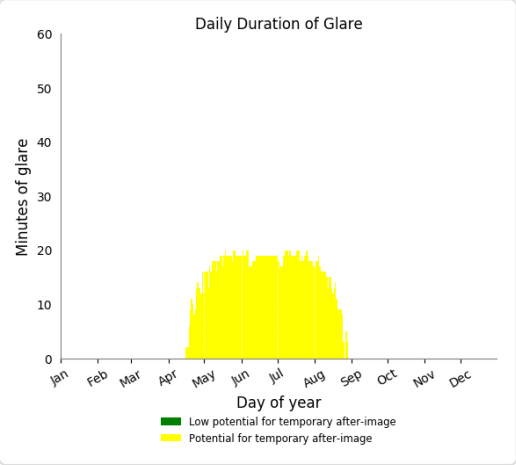


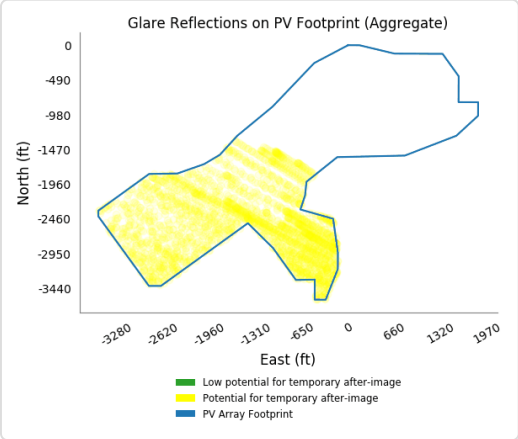
A2 - OP Receptor (OP 44)

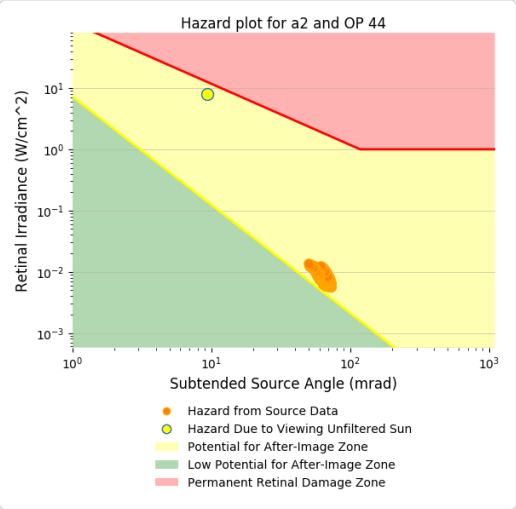
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,202 minutes of "yellow" glare with potential to cause temporary after-image.









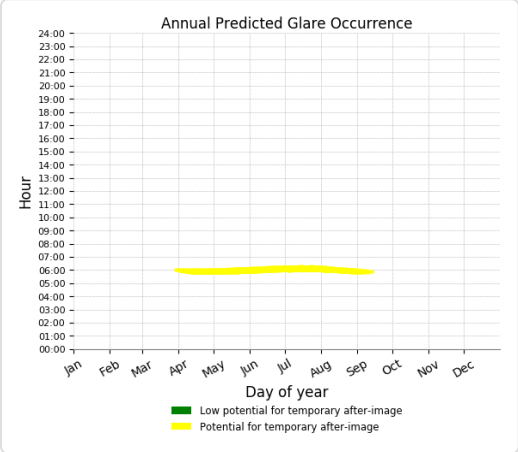
A2 - OP Receptor (OP 47)

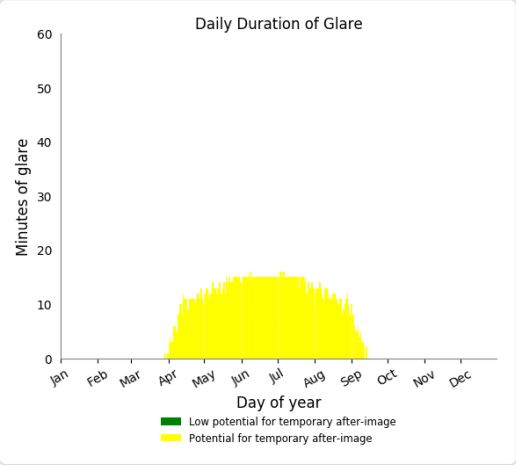
No glare found

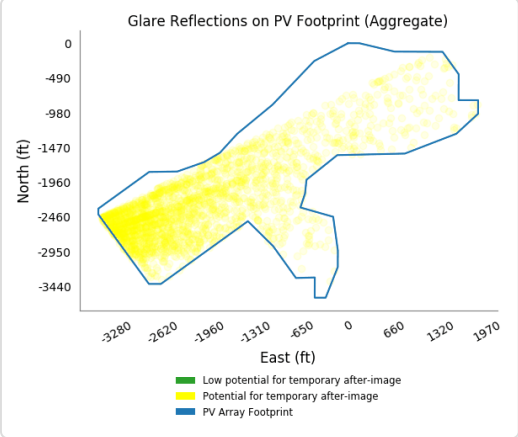
A2 - OP Receptor (OP 66)

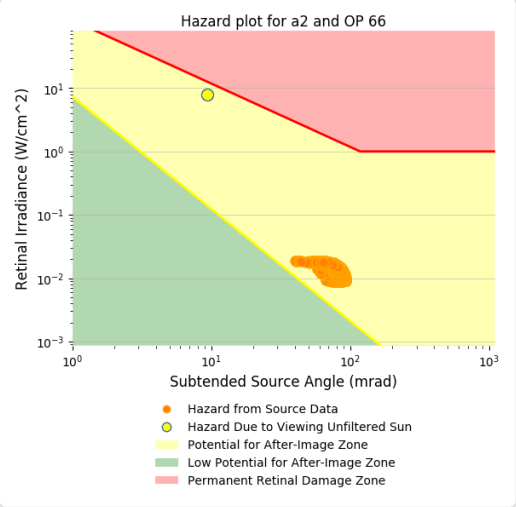
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,011 minutes of "yellow" glare with potential to cause temporary after-image.









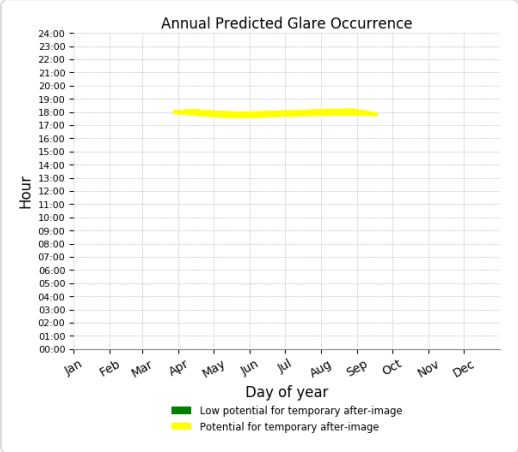
A2 - OP Receptor (OP 72)

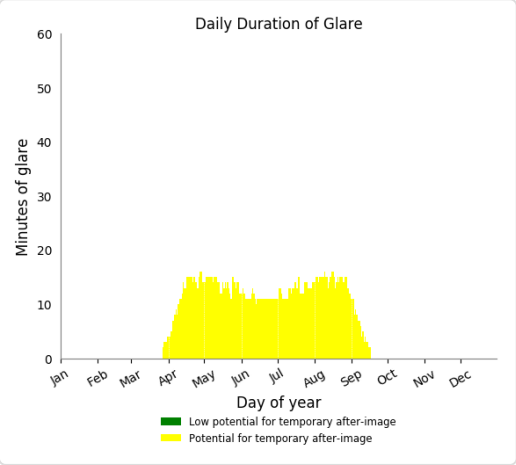
No glare found

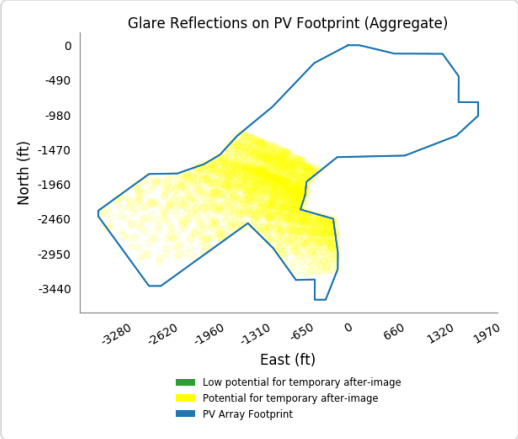
A2 - OP Receptor (OP 74)

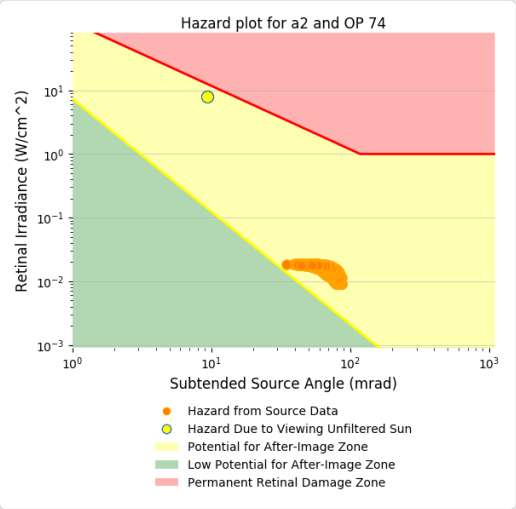
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,073 minutes of "yellow" glare with potential to cause temporary after-image.





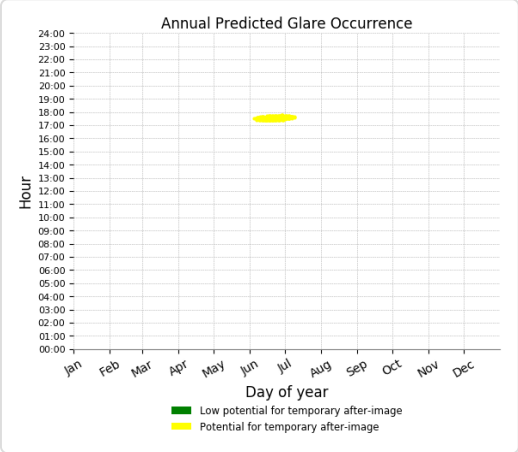


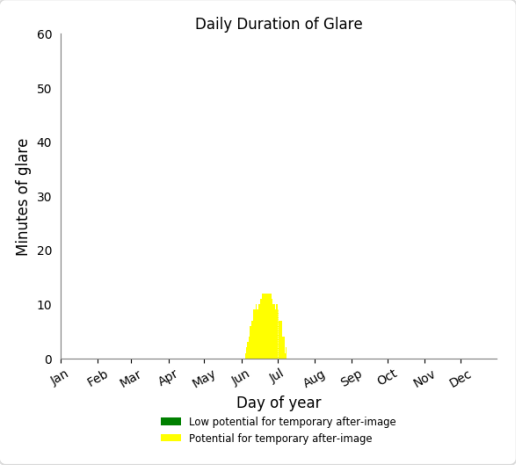


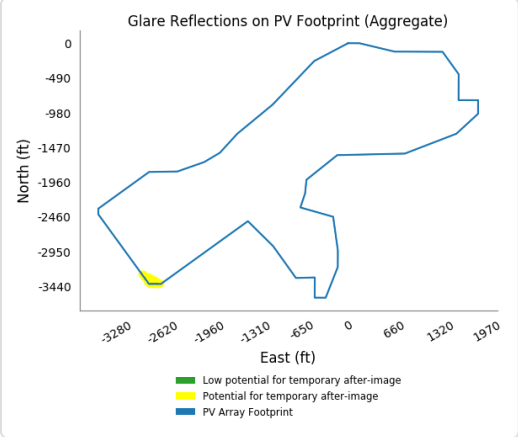
A2 - OP Receptor (OP 76)

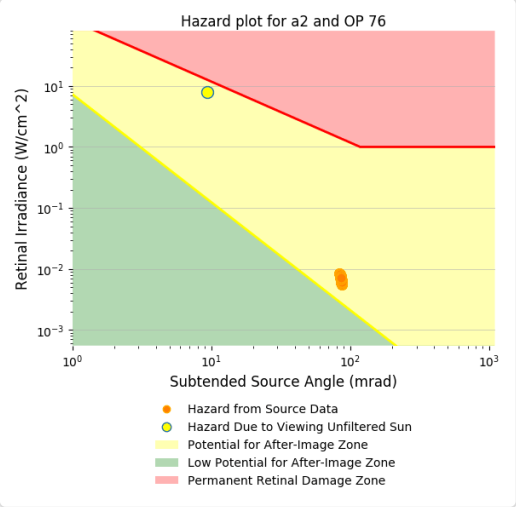
PV array is expected to produce the following glare for receptors at this location:

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









Assumptions

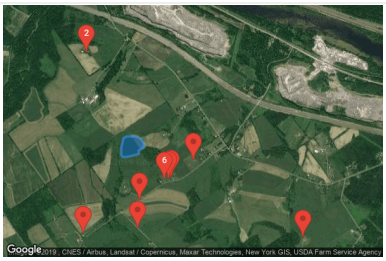
- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.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

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array 3 Fixed 9Oct19

Project site configuration details and results.



Created **Oct. 9, 2019 1:13 p.m.**
Updated **Oct. 9, 2019 3:16 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31862.5043

Summary of Results

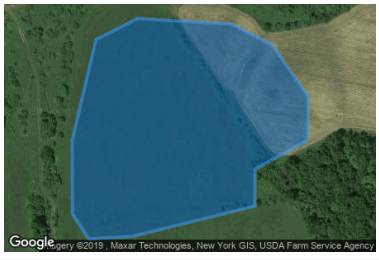
Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A3	25.0	180.0	504	3,015	-

Component Data

PV Array(s)

Name: A3
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.899311	-74.143635	590.67	10.00	600.67
2	42.899256	-74.142413	589.34	10.00	599.34
3	42.899060	-74.141895	588.50	10.00	598.50
4	42.898574	-74.141424	594.15	10.00	604.15
5	42.898157	-74.141427	597.87	10.00	607.87
6	42.897877	-74.142113	598.52	10.00	608.52
7	42.897527	-74.142115	605.67	10.00	615.67
8	42.897238	-74.143709	618.23	10.00	628.23
9	42.897215	-74.144272	620.71	10.00	630.71
10	42.897452	-74.144482	615.29	10.00	625.29
11	42.898148	-74.144487	603.91	10.00	613.91
12	42.899110	-74.144177	593.52	10.00	603.52

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 2	42.907694	-74.149199	572.18	16.00	588.18
OP 6	42.895017	-74.138592	654.09	16.00	670.09
OP 7	42.895080	-74.138024	656.83	16.00	672.83
OP 8	42.895209	-74.137643	652.44	16.00	668.44
OP 11	42.896899	-74.134649	608.31	16.00	624.31
OP 24	42.889587	-74.149577	803.12	16.00	819.12
OP 44	42.889212	-74.119802	856.47	16.00	872.47
OP 73	42.892947	-74.141994	719.25	8.00	727.25
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

A3 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 2	0	0
OP: OP 6	0	0
OP: OP 7	0	369
OP: OP 8	0	844
OP: OP 11	10	1802
OP: OP 24	0	0
OP: OP 44	494	0
OP: OP 73	0	0
OP: OP 76	0	0

A3 - OP Receptor (OP 2)

No glare found

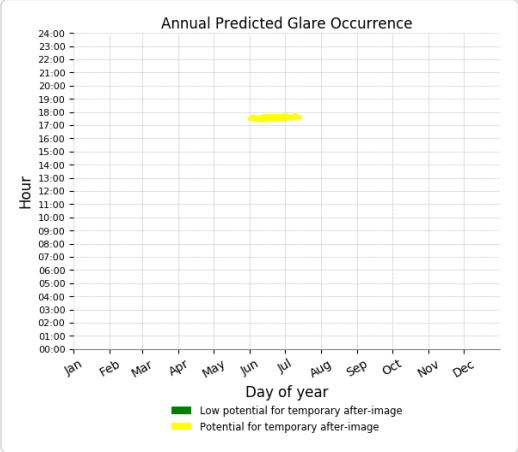
A3 - OP Receptor (OP 6)

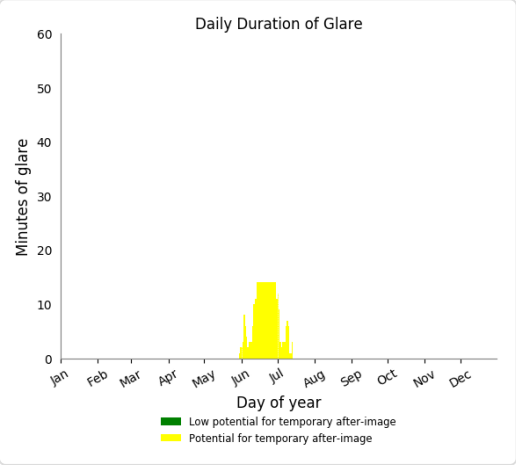
No glare found

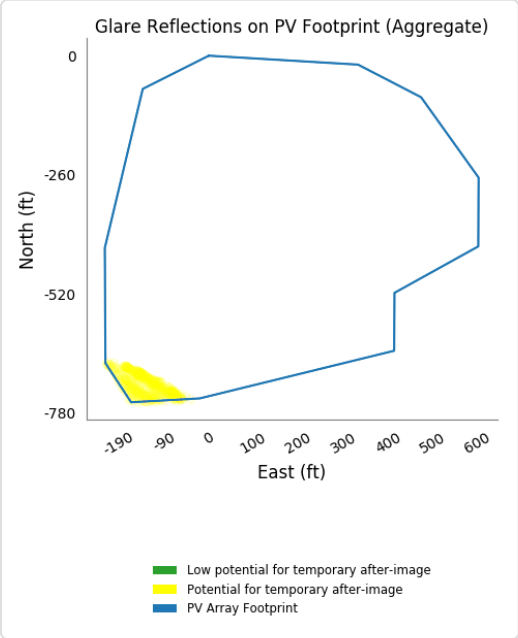
A3 - OP Receptor (OP 7)

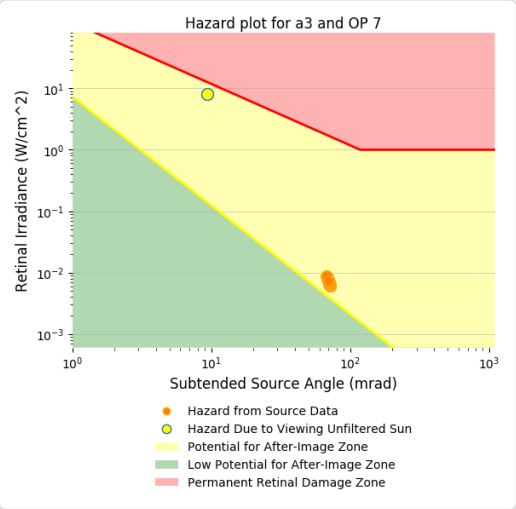
PV array is expected to produce the following glare for receptors at this location:

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





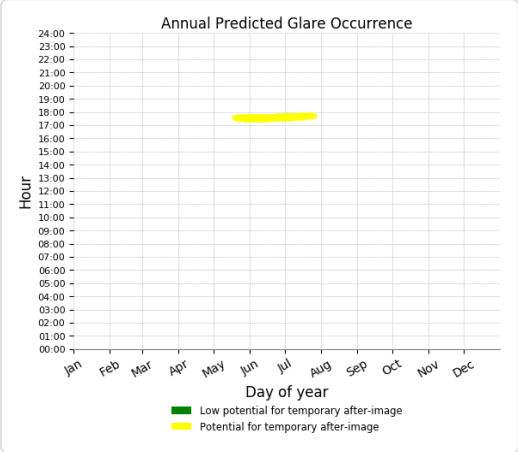


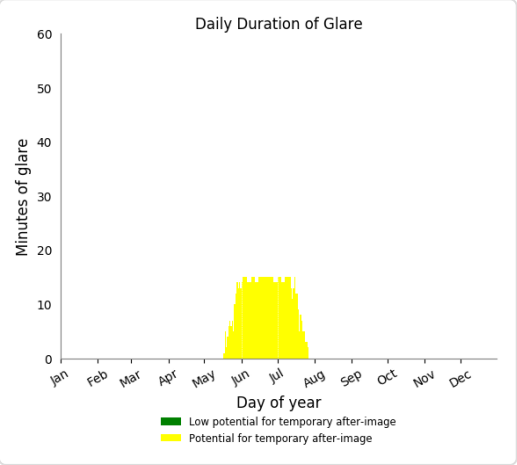


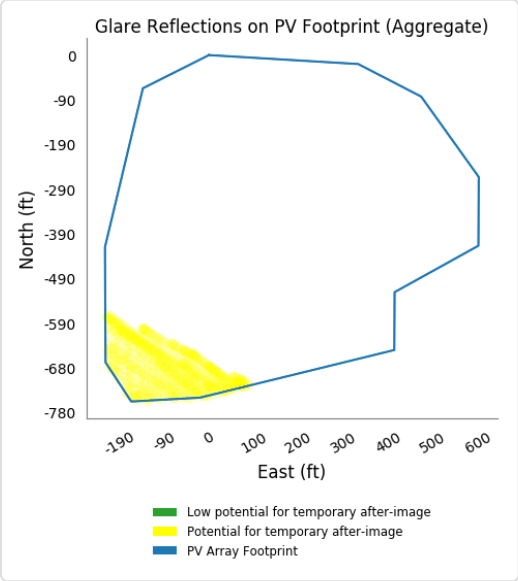
A3 - OP Receptor (OP 8)

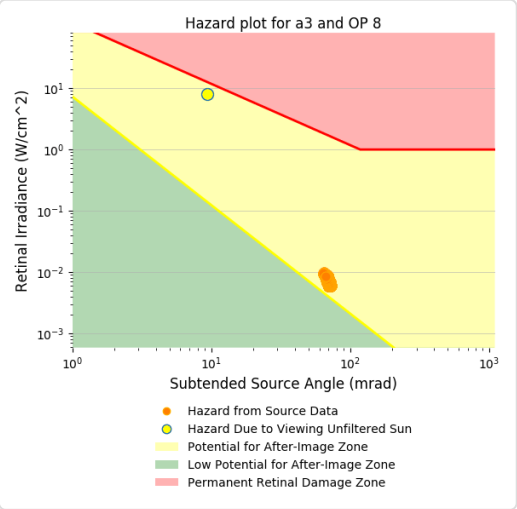
PV array is expected to produce the following glare for receptors at this location:

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





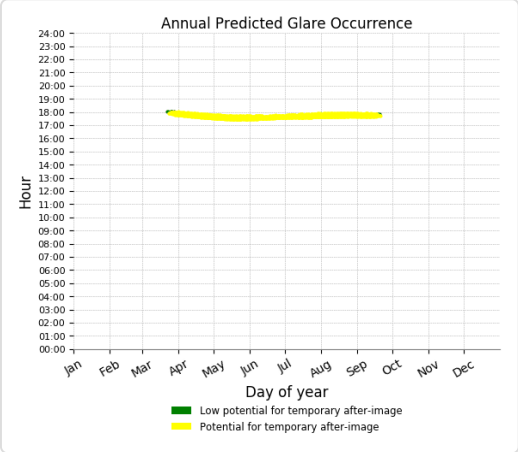


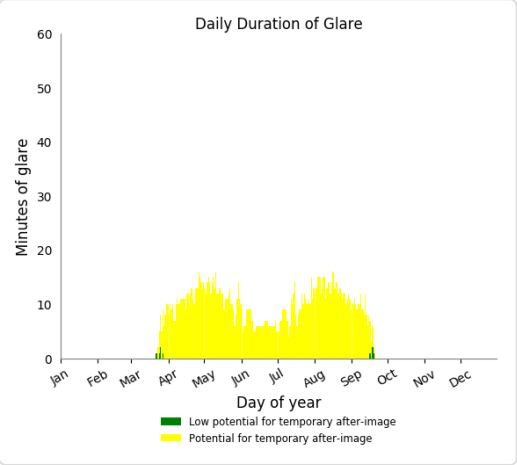


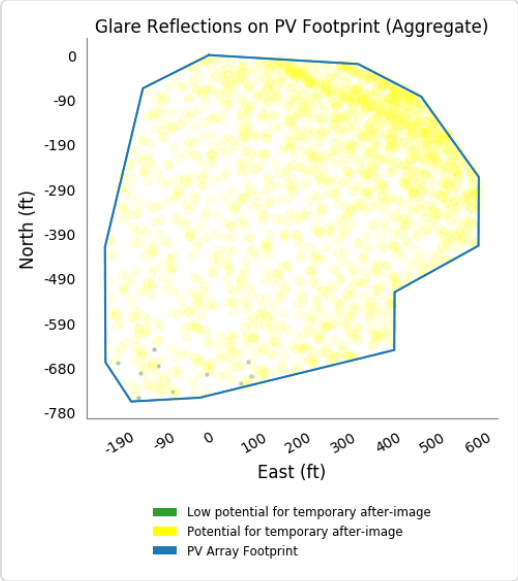
A3 - OP Receptor (OP 11)

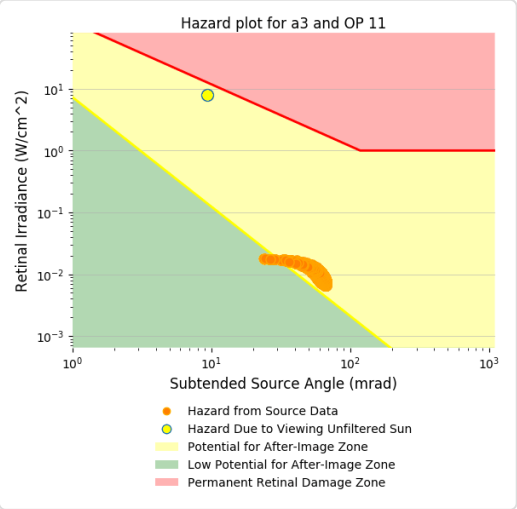
PV array is expected to produce the following glare for receptors at this location:

- 10 minutes of "green" glare with low potential to cause temporary after-image.
- 1,802 minutes of "yellow" glare with potential to cause temporary after-image.









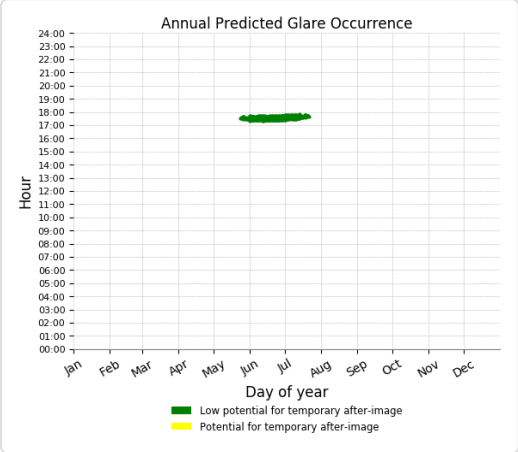
A3 - OP Receptor (OP 24)

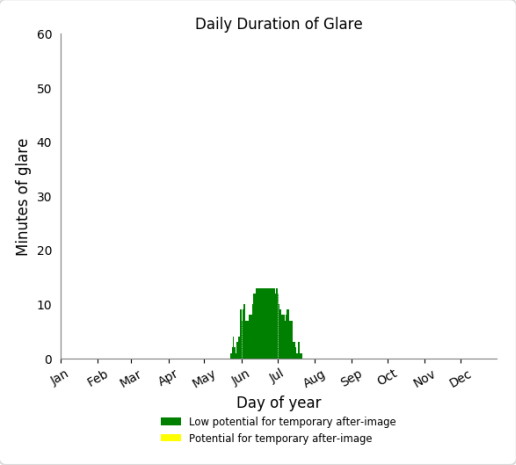
No glare found

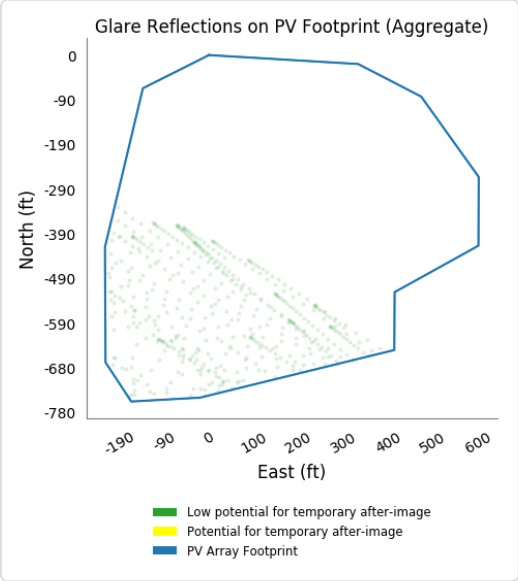
A3 - OP Receptor (OP 44)

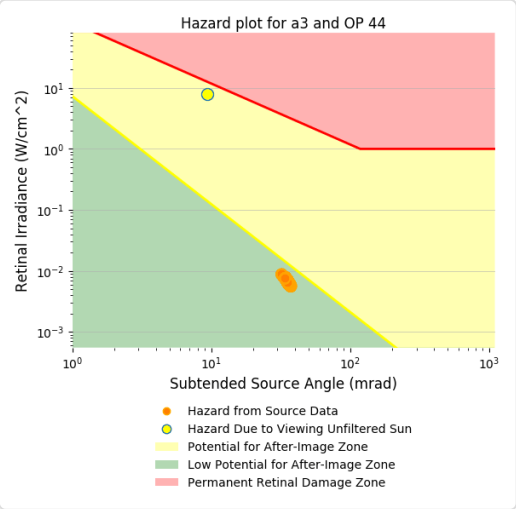
PV array is expected to produce the following glare for receptors at this location:

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









A3 - OP Receptor (OP 73)

No glare found

A3 - OP Receptor (OP 76)

No glare found

Assumptions

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

GlareGauge Glare Analysis Results

Site Configuration: Array 4 OctMod

Project site configuration details and results.

Created **Oct. 3, 2019 1 p.m.**
Updated **Oct. 3, 2019 1:03 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31696.5043

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A4	25.0	180.0	0	0	-

Component Data

PV Array(s)

Name: A4
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.888771	-74.163918	716.13	8.00	724.13
2	42.890112	-74.161322	711.28	8.00	719.28
3	42.886731	-74.158086	777.38	8.00	785.38
4	42.886278	-74.161988	741.64	8.00	749.64
5	42.886885	-74.162962	730.01	8.00	738.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 65	42.890889	-74.159770	704.69	8.00	712.69

PV Array Results

A4

Component	Green glare (min)	Yellow glare (min)
OP: OP 65	0	0

Assumptions

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

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array 5 OctMod

Project site configuration details and results.

Created **Oct. 3, 2019 4:42 p.m.**
Updated **Oct. 4, 2019 7:57 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31709.5043

Summary of Results

Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A5	25.0	180.0	0	7,080	-

Component Data

PV Array(s)

Name: A5
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.889178	-74.147575	818.86	8.00	826.86
2	42.889843	-74.146265	787.34	8.00	795.34
3	42.889838	-74.144498	796.06	8.00	804.06
4	42.889624	-74.143544	803.44	8.00	811.44
5	42.887007	-74.140208	920.86	8.00	928.86
6	42.886594	-74.140210	926.95	8.00	934.95
7	42.885374	-74.142628	912.08	8.00	920.08
8	42.885376	-74.143120	909.18	8.00	917.18
9	42.885760	-74.143476	902.24	8.00	910.24
10	42.885119	-74.145577	896.33	8.00	904.33
11	42.885465	-74.147049	887.69	8.00	895.69
12	42.886771	-74.148300	870.20	8.00	878.20
13	42.887599	-74.148296	857.62	8.00	865.62

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 24	42.889587	-74.149577	803.12	16.00	819.12
OP 28	42.889113	-74.150335	815.53	16.00	831.53
OP 29	42.888530	-74.149500	829.82	16.00	845.82
OP 72	42.889264	-74.149082	812.51	8.00	820.51
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

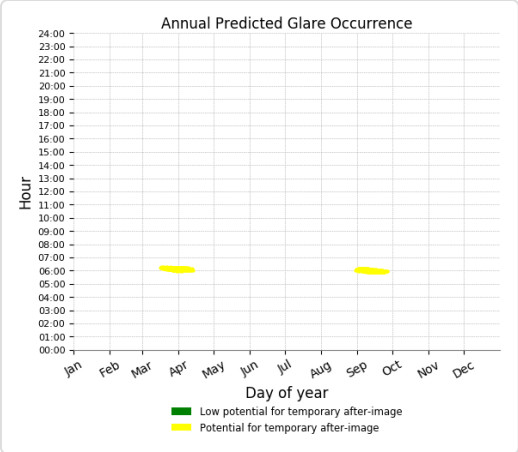
A5 potential temporary after-image

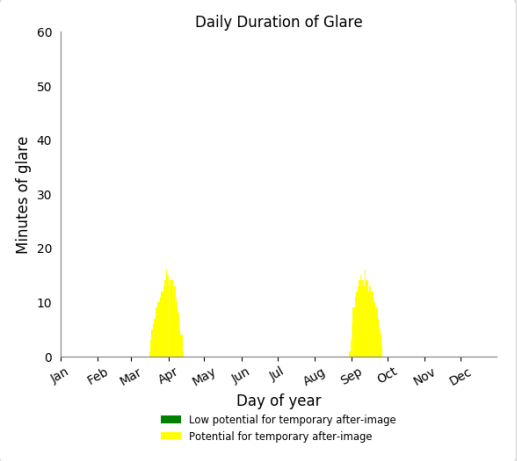
Component	Green glare (min)	Yellow glare (min)
OP: OP 24	0	559
OP: OP 28	0	1404
OP: OP 29	0	4107
OP: OP 72	0	1010
OP: OP 76	0	0

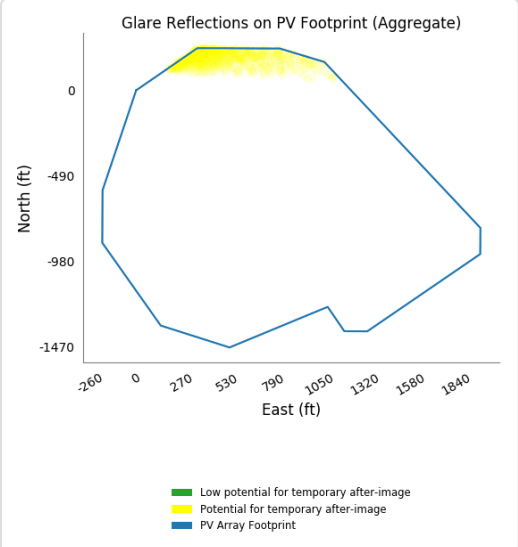
A5 - OP Receptor (OP 24)

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

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



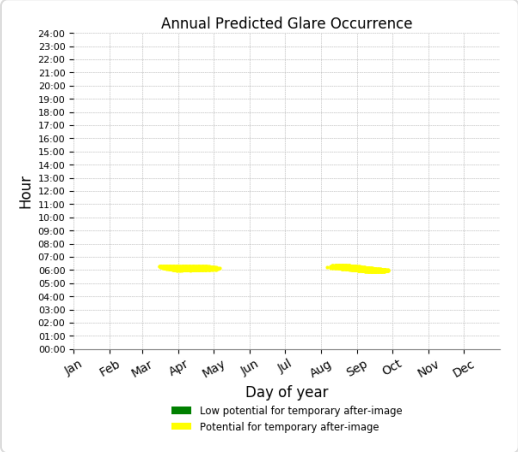


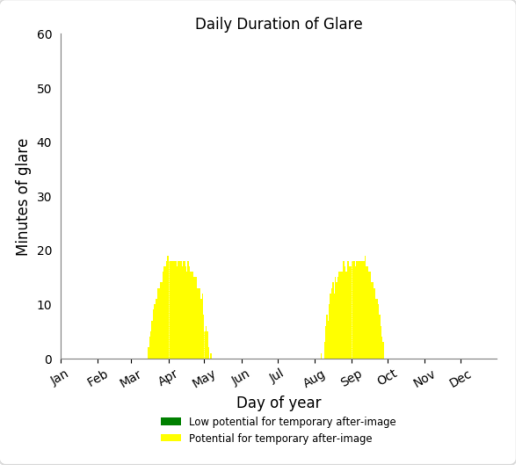


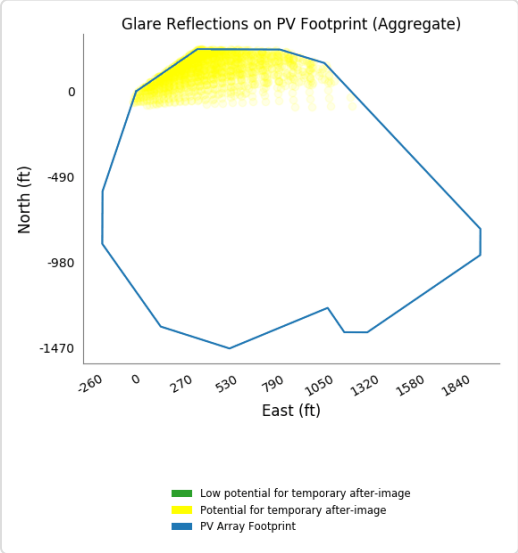
A5 - OP Receptor (OP 28)

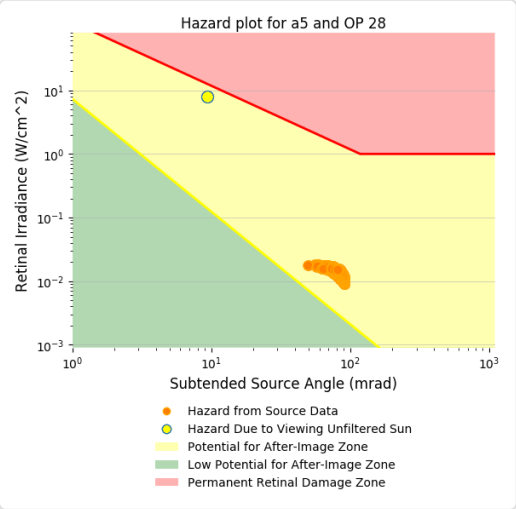
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,404 minutes of "yellow" glare with potential to cause temporary after-image.





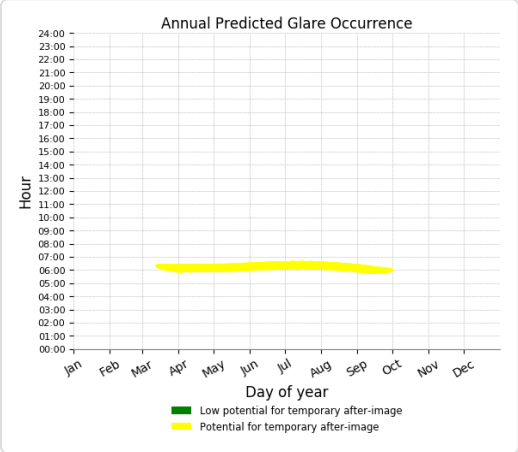


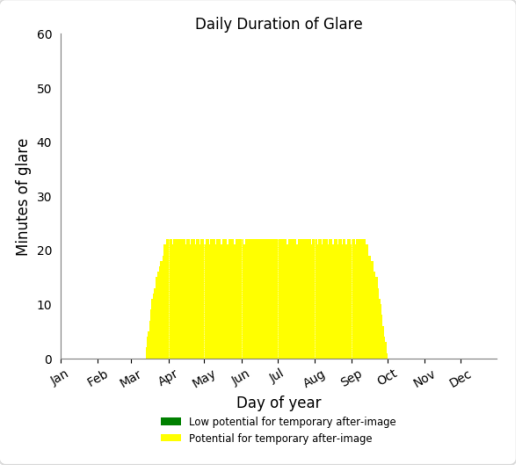


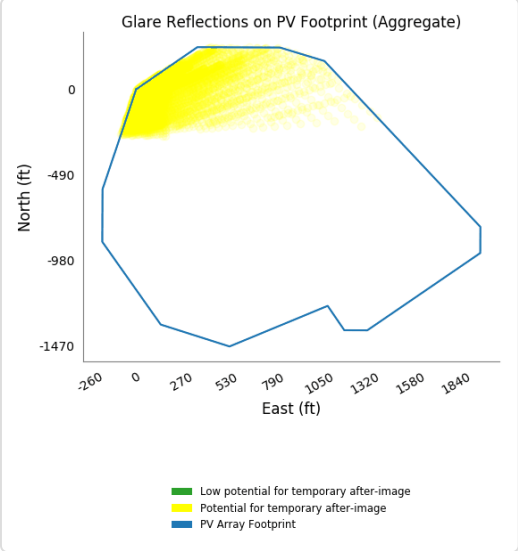
A5 - OP Receptor (OP 29)

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

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,107 minutes of "yellow" glare with potential to cause temporary after-image.



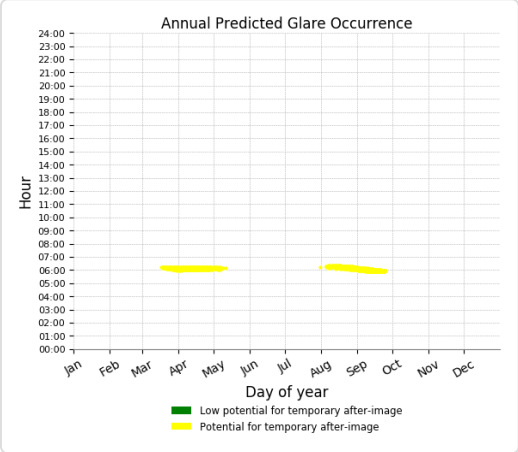


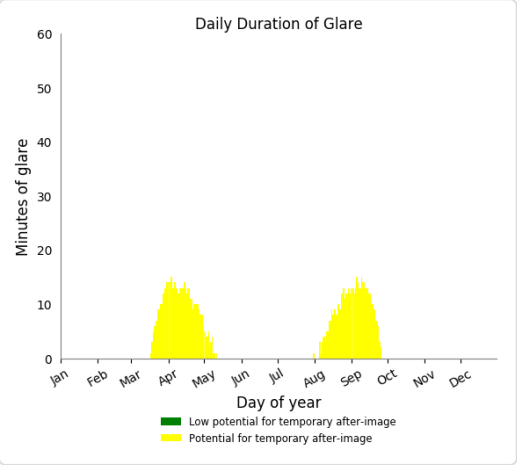


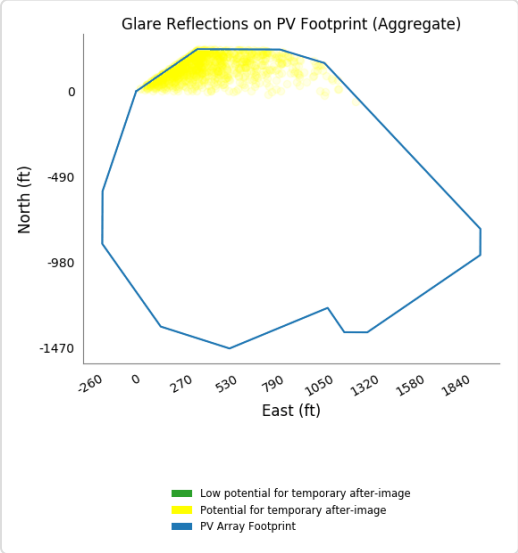
A5 - OP Receptor (OP 72)

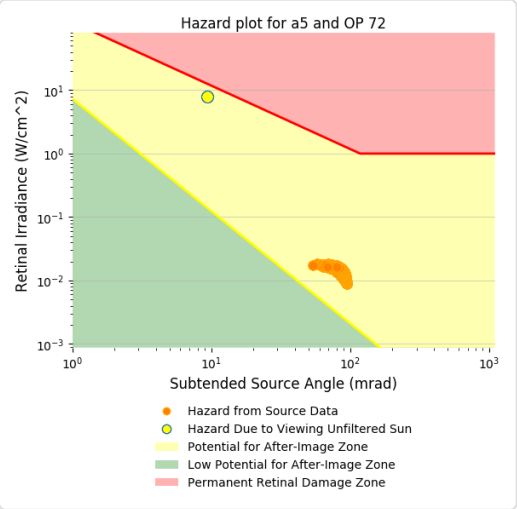
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,010 minutes of "yellow" glare with potential to cause temporary after-image.









A5 - OP Receptor (OP 76)

No glare found

Assumptions

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

GlareGauge Glare Analysis Results

Site Configuration: Array 6 OctMod

Project site configuration details and results.

Created **Oct. 3, 2019 2:38 p.m.**
Updated **Oct. 3, 2019 2:50 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31700.5043

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A6	25.0	180.0	0	0	-

Component Data

PV Array(s)

Name: A6
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.890591	-74.136290	799.34	8.00	807.34
2	42.892883	-74.131755	687.39	8.00	695.39
3	42.892878	-74.130269	681.83	8.00	689.83
4	42.891285	-74.129407	728.63	8.00	736.63
5	42.890877	-74.129427	746.77	8.00	754.77
6	42.890943	-74.130302	749.59	8.00	757.59
7	42.891124	-74.132423	756.72	8.00	764.72
8	42.889810	-74.134827	818.28	8.00	826.28
9	42.889812	-74.135389	822.49	8.00	830.49

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 10	42.896538	-74.135272	617.61	16.00	633.61
OP 11	42.896899	-74.134649	608.31	16.00	624.31
OP 18	42.897823	-74.133705	597.16	16.00	613.16
OP 67	42.895682	-74.121979	595.90	8.00	603.90
OP 74	42.895349	-74.135464	631.08	8.00	639.08

PV Array Results

A6

Component	Green glare (min)	Yellow glare (min)
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 18	0	0
OP: OP 67	0	0
OP: OP 74	0	0

Assumptions

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

GlareGauge Glare Analysis Results

Site Configuration: Array 7 OctMod

Project site configuration details and results.

Created **Oct. 3, 2019 2:38 p.m.**
Updated **Oct. 3, 2019 2:59 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31701.5043

Summary of Results

Glare with potential for temporary after-image predicted

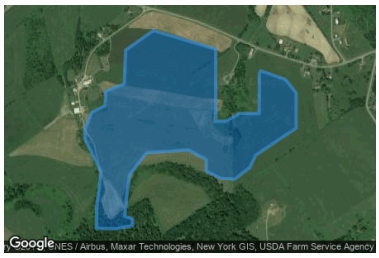
PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
A7	25.0	180.0	0	8,894	-

Component Data

PV Array(s)

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Name: A7
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.895074	-74.127174	620.63	8.00	628.63
2	42.895823	-74.125737	598.74	8.00	606.74
3	42.895115	-74.122504	607.26	8.00	615.26
4	42.892374	-74.122494	672.66	8.00	680.66
5	42.892372	-74.122002	667.04	8.00	675.04
6	42.892669	-74.121255	659.17	8.00	667.17
7	42.892666	-74.120241	663.70	8.00	671.70
8	42.894170	-74.120232	618.15	8.00	626.15
9	42.894293	-74.120164	616.27	8.00	624.27
10	42.893961	-74.118871	629.08	8.00	637.08
11	42.893444	-74.118321	644.59	8.00	652.59
12	42.892113	-74.118329	680.21	8.00	688.21
13	42.891084	-74.120422	727.68	8.00	735.68
14	42.890620	-74.120725	747.82	8.00	755.82
15	42.890176	-74.121507	757.67	8.00	765.67
16	42.890204	-74.122244	765.61	8.00	773.61
17	42.890480	-74.122992	769.32	8.00	777.32
18	42.890914	-74.122989	751.84	8.00	759.84
19	42.891278	-74.123894	742.96	8.00	750.96
20	42.891175	-74.126096	765.30	8.00	773.30
21	42.890335	-74.126974	796.68	8.00	804.68
22	42.889462	-74.127125	814.21	8.00	822.21
23	42.888762	-74.127221	844.24	8.00	852.24
24	42.888661	-74.126813	854.48	8.00	862.49
25	42.888398	-74.126815	869.15	8.00	877.15
26	42.888290	-74.127649	848.42	8.00	856.42
27	42.888293	-74.128692	835.31	8.00	843.31
28	42.889050	-74.128688	809.53	8.00	817.53
29	42.890452	-74.128446	755.31	8.00	763.31
30	42.891657	-74.129262	714.57	8.00	722.57
31	42.892045	-74.129297	703.08	8.00	711.08
32	42.892718	-74.128924	687.51	8.00	695.51
33	42.892969	-74.128233	680.97	8.00	688.97
34	42.893503	-74.128230	673.69	8.00	681.69
35	42.893791	-74.127244	669.56	8.00	677.56

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 8	42.895209	-74.137643	652.44	16.00	668.44
OP 9	42.895449	-74.137219	645.32	16.00	661.32
OP 10	42.896538	-74.135272	617.61	16.00	633.61
OP 11	42.896899	-74.134649	608.31	16.00	624.31
OP 16	42.900310	-74.132858	535.30	16.00	551.30
OP 18	42.897823	-74.133705	597.16	16.00	613.16
OP 33	42.895612	-74.128218	603.88	16.00	619.88
OP 34	42.896544	-74.126614	578.00	16.00	594.00
OP 40	42.894156	-74.117976	629.29	16.00	645.29
OP 41	42.895003	-74.118754	615.39	16.00	631.39
OP 42	42.894598	-74.117405	624.89	16.00	640.89
OP 43	42.893775	-74.117145	644.10	16.00	660.10
OP 44	42.889212	-74.119802	856.47	16.00	872.47
OP 51	42.899927	-74.128083	496.16	16.00	512.16
OP 52	42.900524	-74.127042	491.12	16.00	507.12
OP 67	42.895682	-74.121979	595.90	8.00	603.90
OP 68	42.894759	-74.118727	613.34	8.00	621.34
OP 69	42.896354	-74.124360	587.02	8.00	595.02
OP 70	42.897171	-74.128255	549.05	8.00	557.05
OP 74	42.895349	-74.135464	631.08	8.00	639.08
OP 75	42.896604	-74.133350	593.73	8.00	601.73

PV Array Results

A7 potential temporary after-image

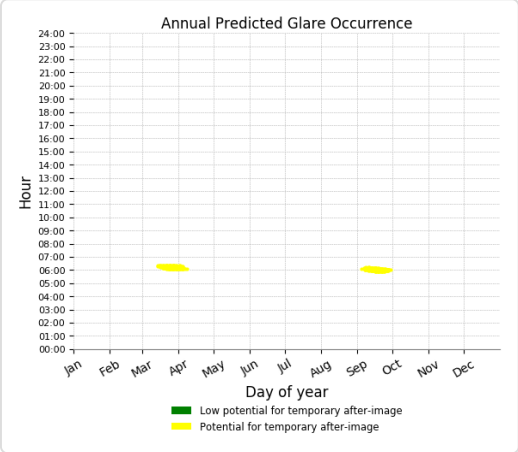
Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

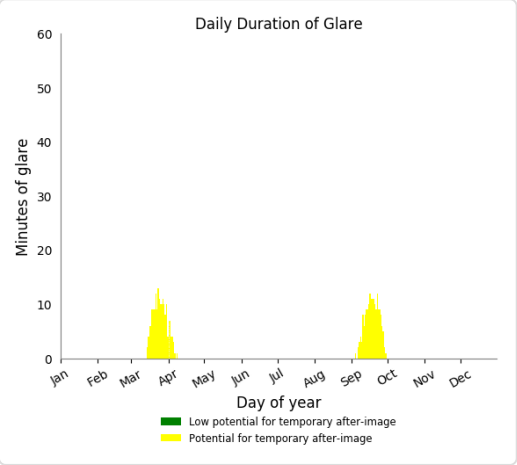
Component	Green glare (min)	Yellow glare (min)
OP: OP 8	0	359
OP: OP 9	0	320
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 16	0	0
OP: OP 18	0	0
OP: OP 33	0	688
OP: OP 34	0	0
OP: OP 40	0	1341
OP: OP 41	0	51
OP: OP 42	0	348
OP: OP 43	0	1775
OP: OP 44	0	2973
OP: OP 51	0	0
OP: OP 52	0	0
OP: OP 67	0	15
OP: OP 68	0	758
OP: OP 69	0	0
OP: OP 70	0	0
OP: OP 74	0	266
OP: OP 75	0	0

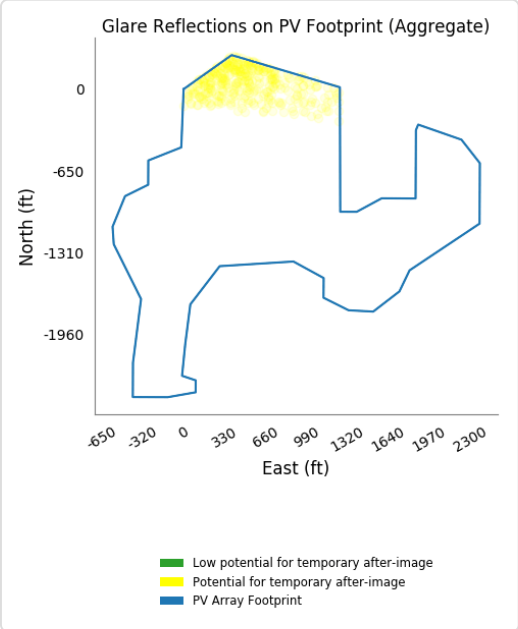
A7 - OP Receptor (OP 8)

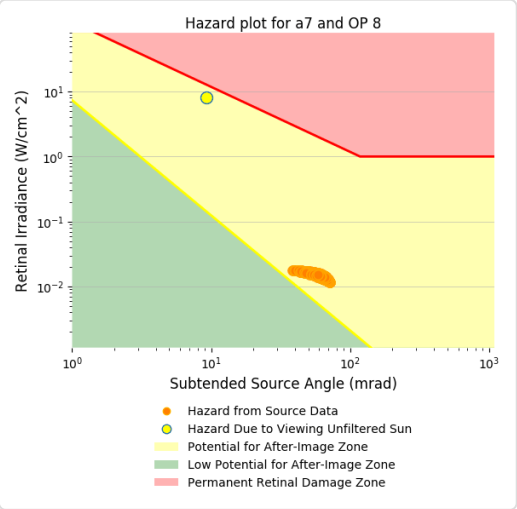
PV array is expected to produce the following glare for receptors at this location:

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





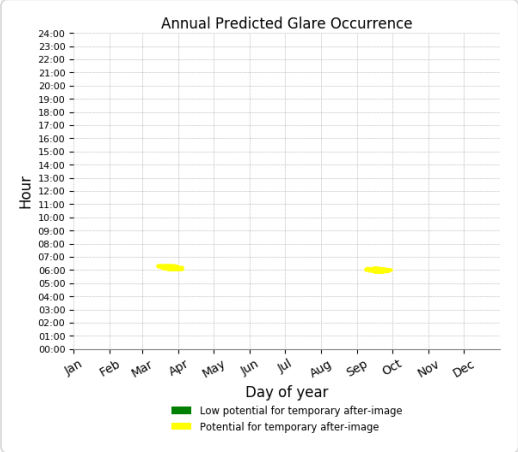


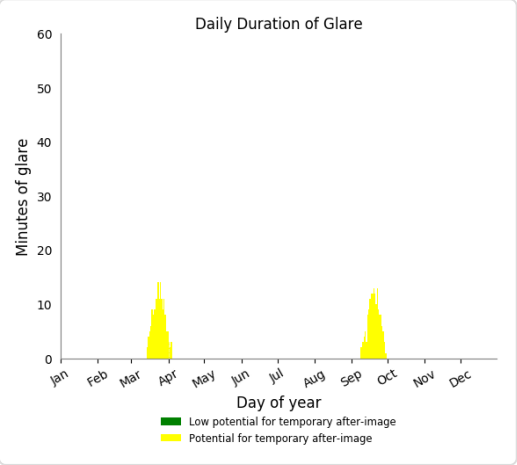


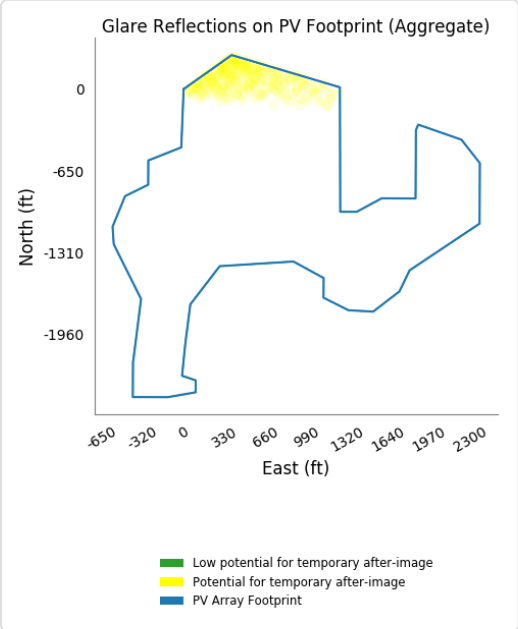
A7 - OP Receptor (OP 9)

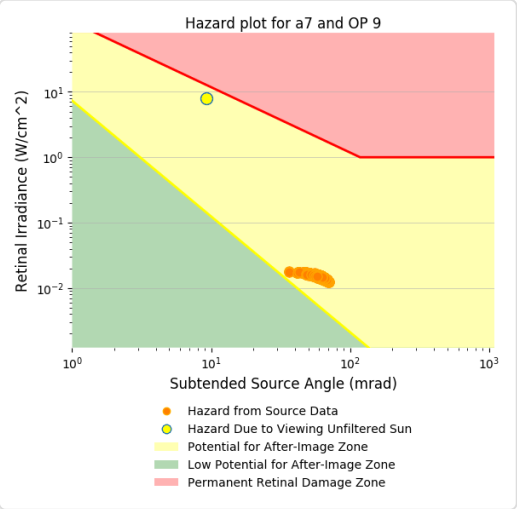
PV array is expected to produce the following glare for receptors at this location:

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









A7 - OP Receptor (OP 10)

No glare found

A7 - OP Receptor (OP 11)

No glare found

A7 - OP Receptor (OP 16)

No glare found

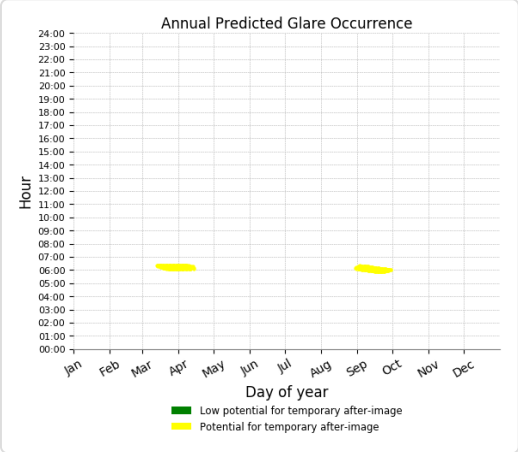
A7 - OP Receptor (OP 18)

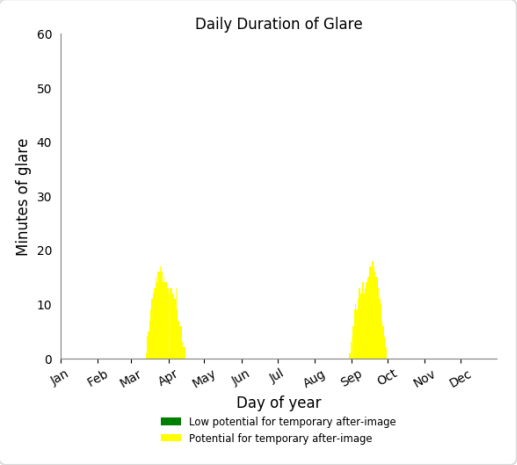
No glare found

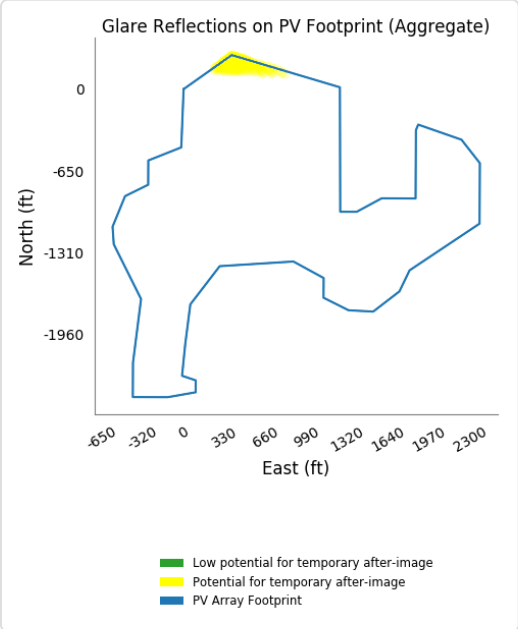
A7 - OP Receptor (OP 33)

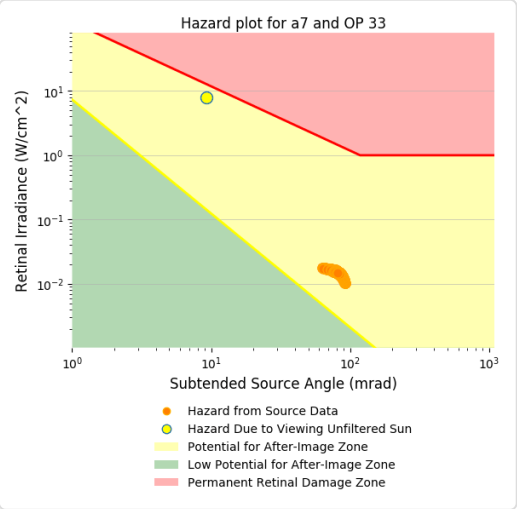
PV array is expected to produce the following glare for receptors at this location:

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









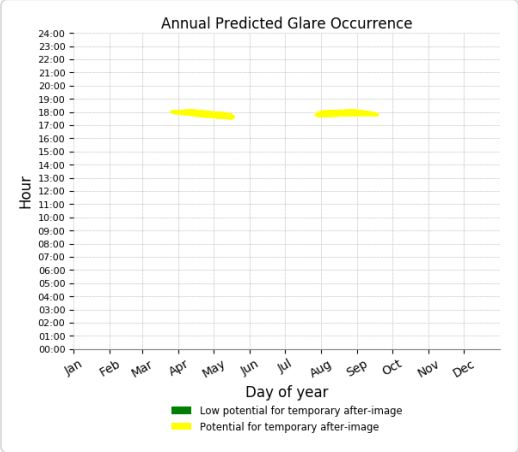
A7 - OP Receptor (OP 34)

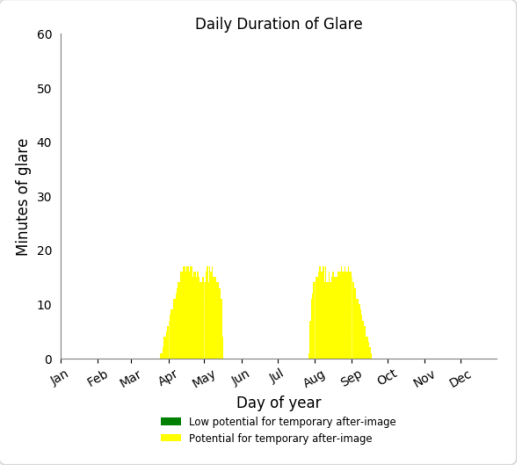
No glare found

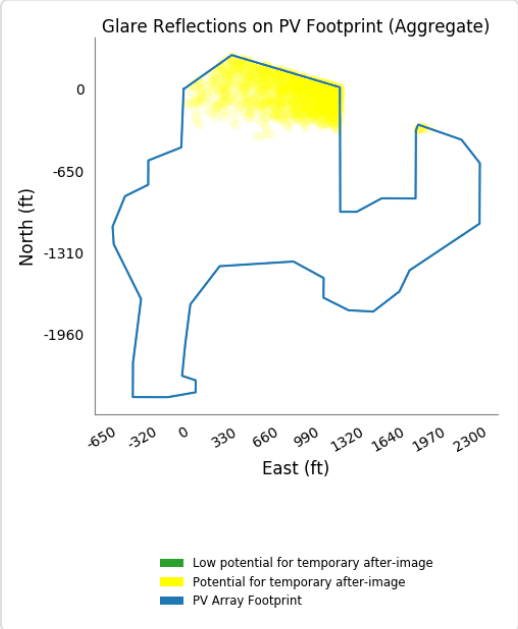
A7 - OP Receptor (OP 40)

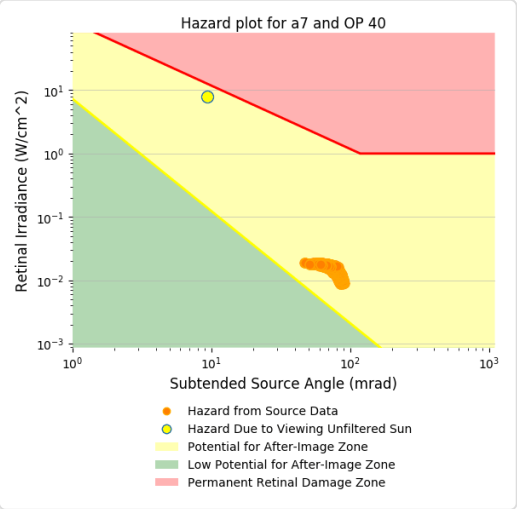
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,341 minutes of "yellow" glare with potential to cause temporary after-image.





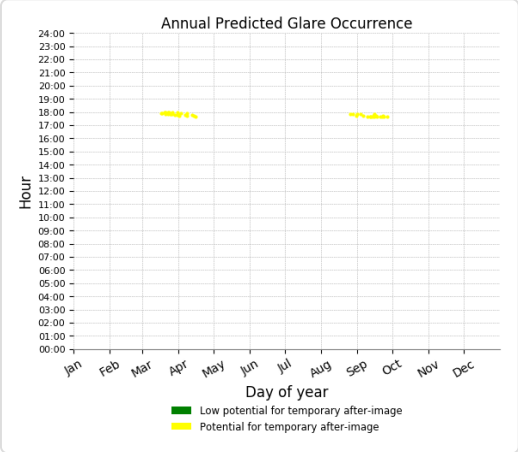


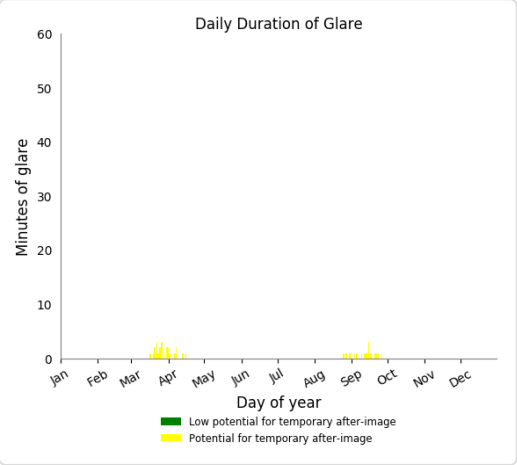


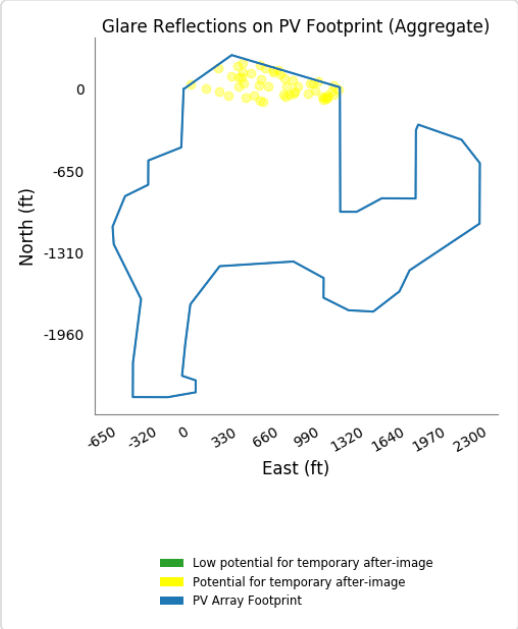
A7 - OP Receptor (OP 41)

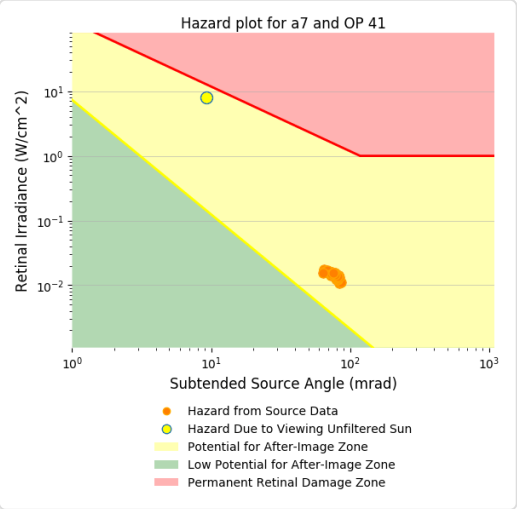
PV array is expected to produce the following glare for receptors at this location:

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





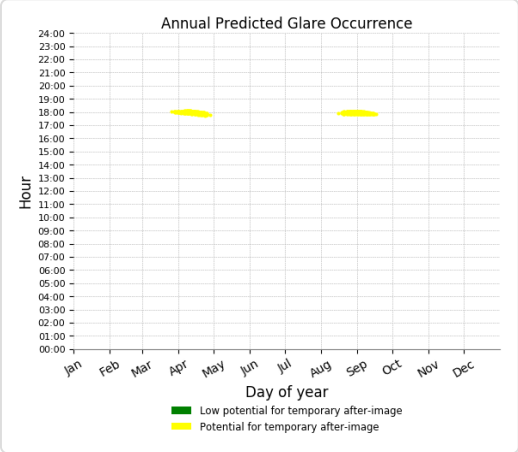


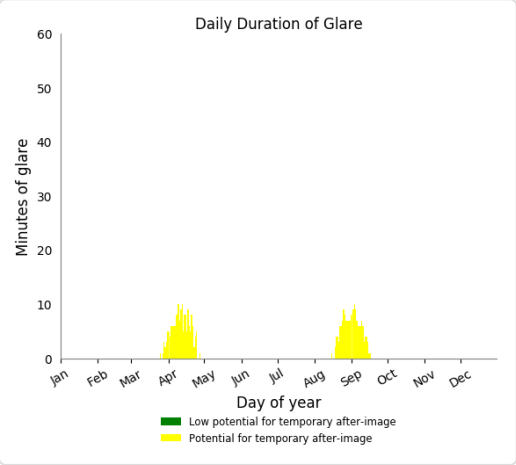


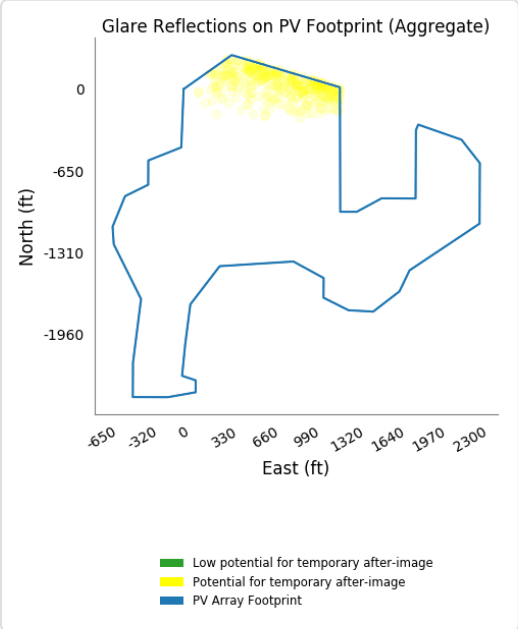
A7 - OP Receptor (OP 42)

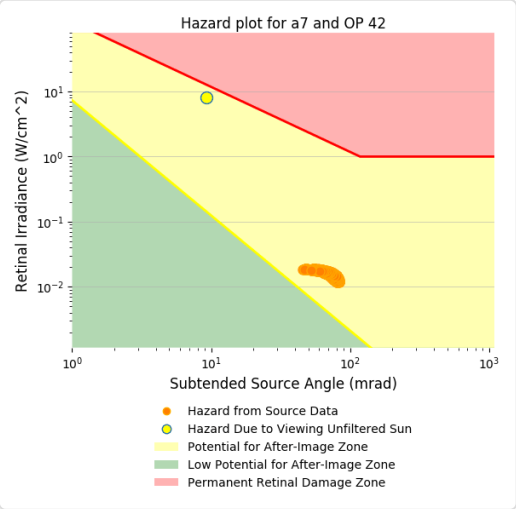
PV array is expected to produce the following glare for receptors at this location:

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





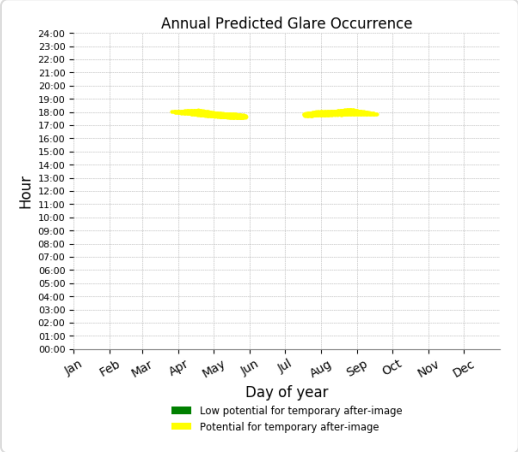


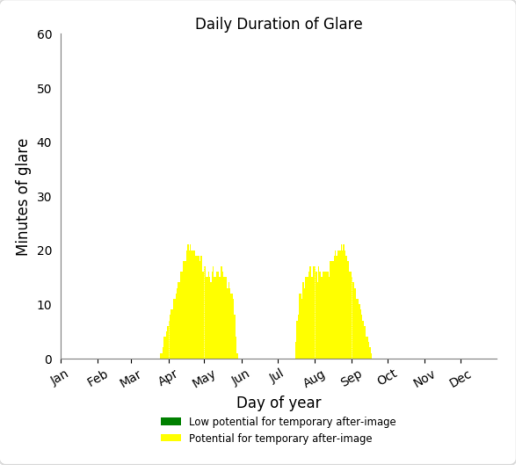


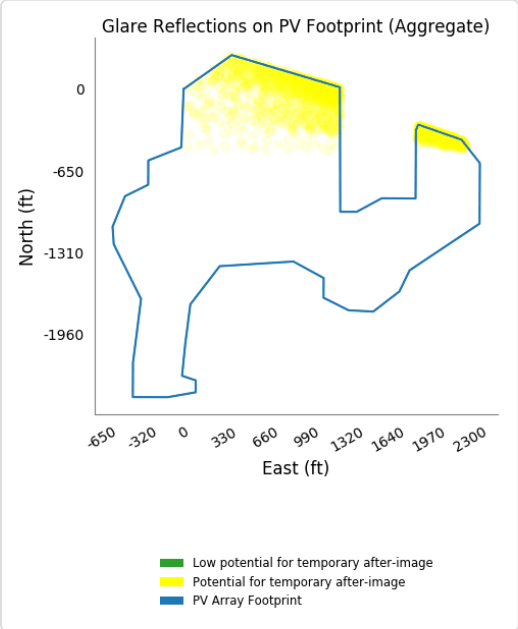
A7 - OP Receptor (OP 43)

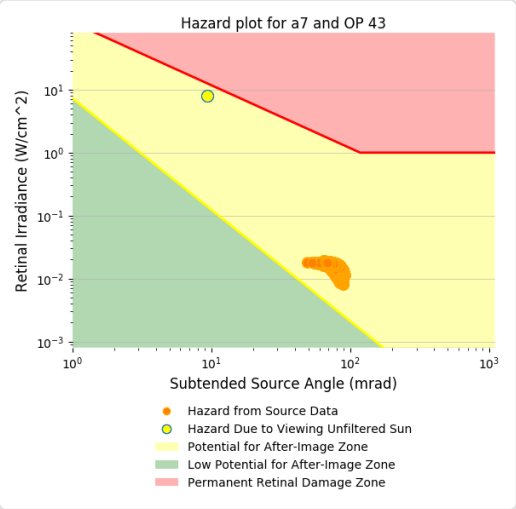
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,775 minutes of "yellow" glare with potential to cause temporary after-image.





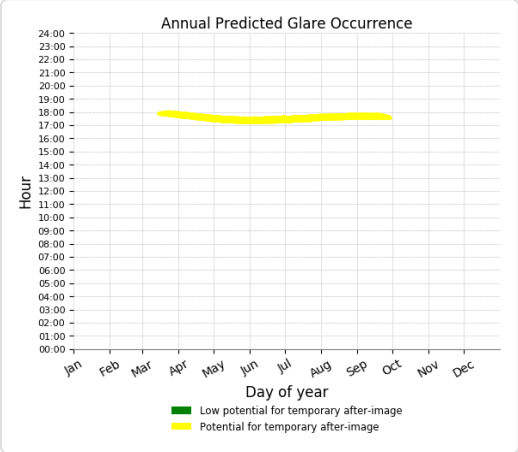


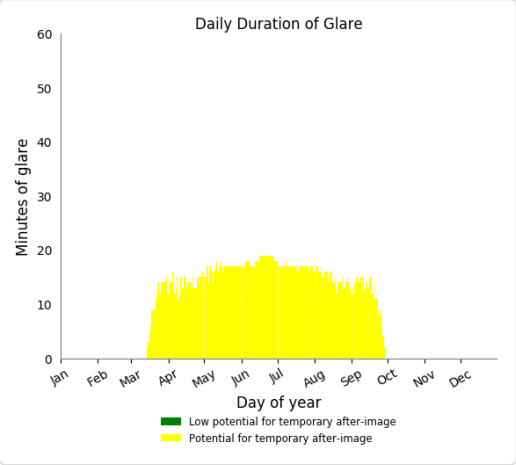


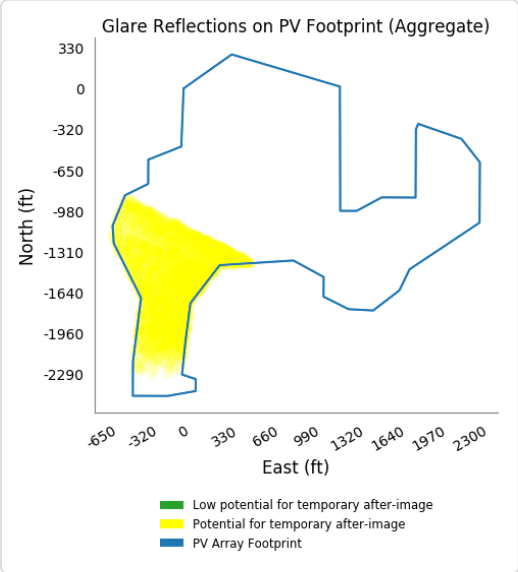
A7 - OP Receptor (OP 44)

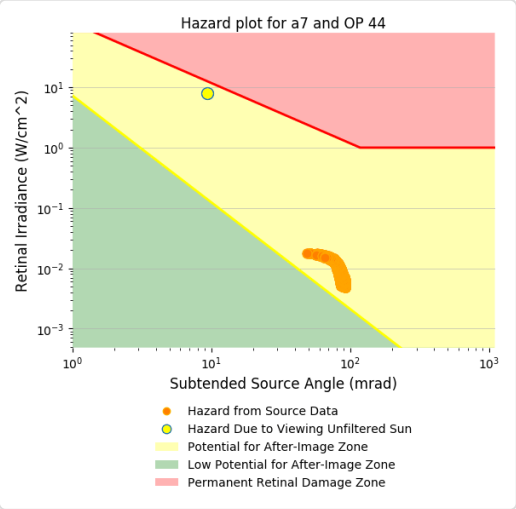
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,973 minutes of "yellow" glare with potential to cause temporary after-image.









A7 - OP Receptor (OP 51)

No glare found

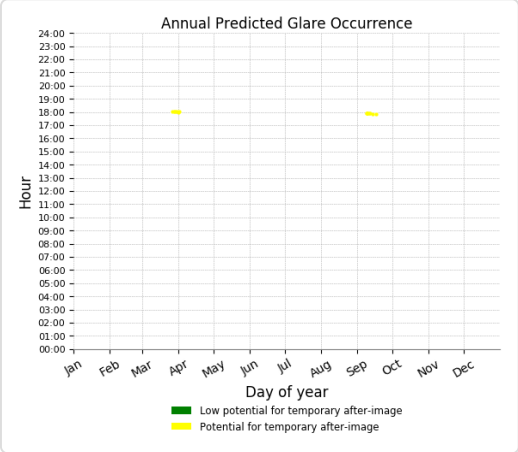
A7 - OP Receptor (OP 52)

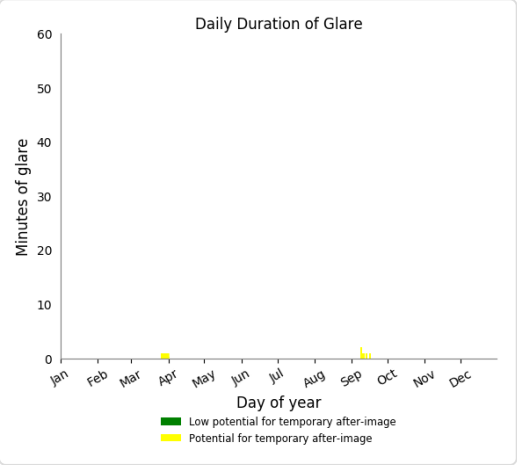
No glare found

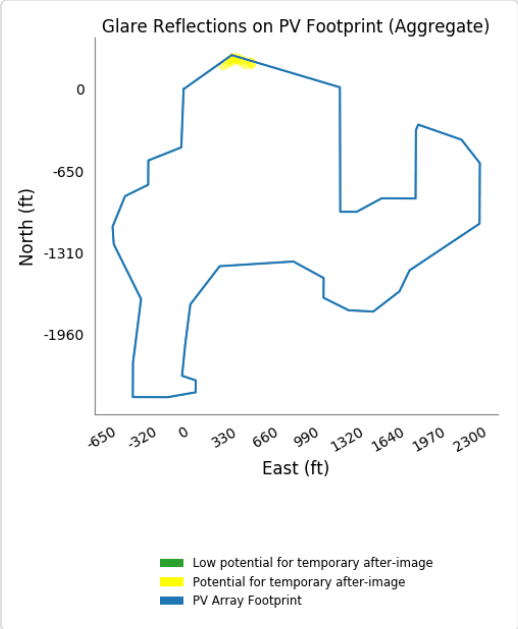
A7 - OP Receptor (OP 67)

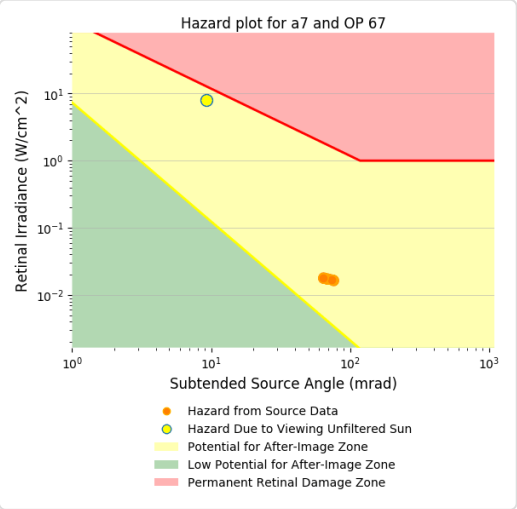
PV array is expected to produce the following glare for receptors at this location:

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





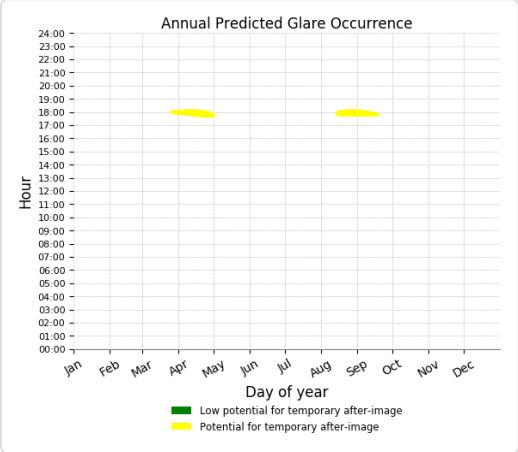


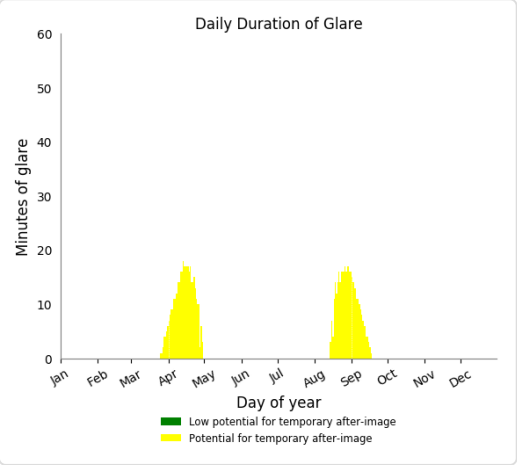


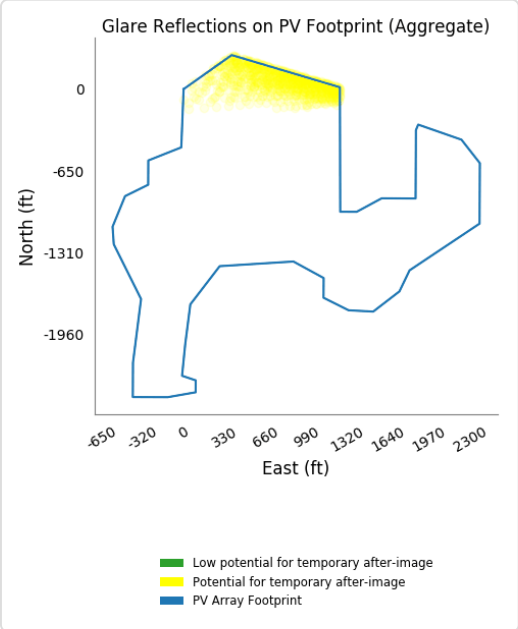
A7 - OP Receptor (OP 68)

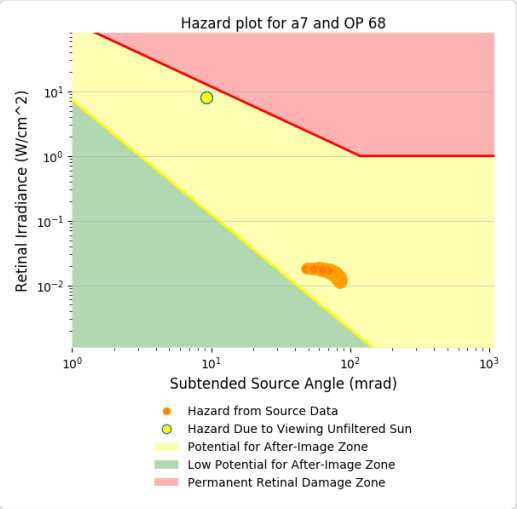
PV array is expected to produce the following glare for receptors at this location:

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









A7 - OP Receptor (OP 69)

No glare found

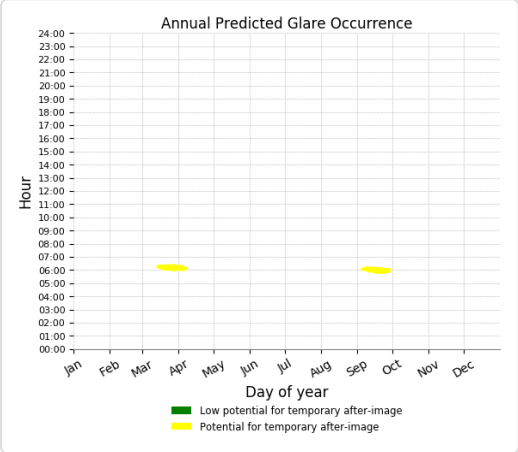
A7 - OP Receptor (OP 70)

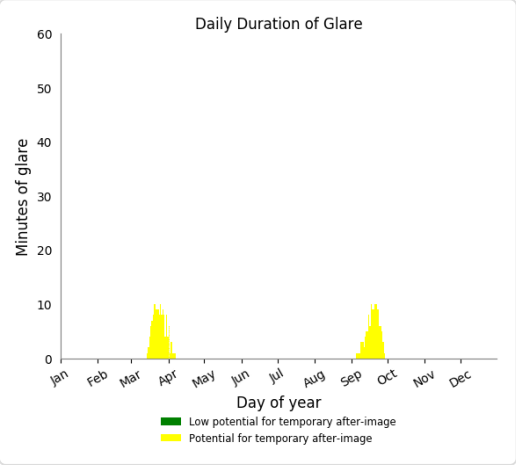
No glare found

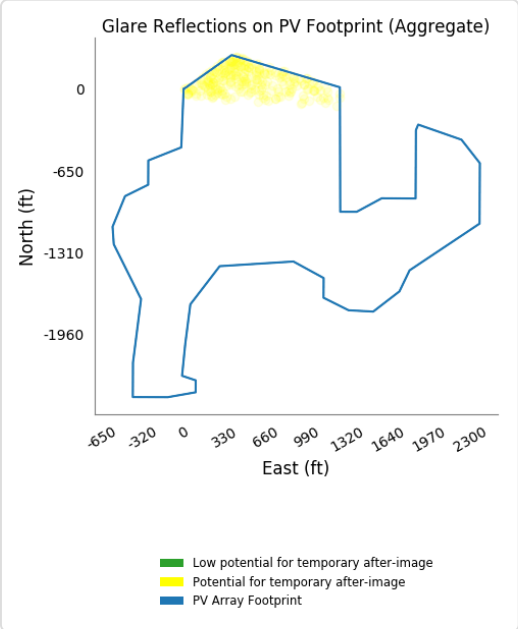
A7 - OP Receptor (OP 74)

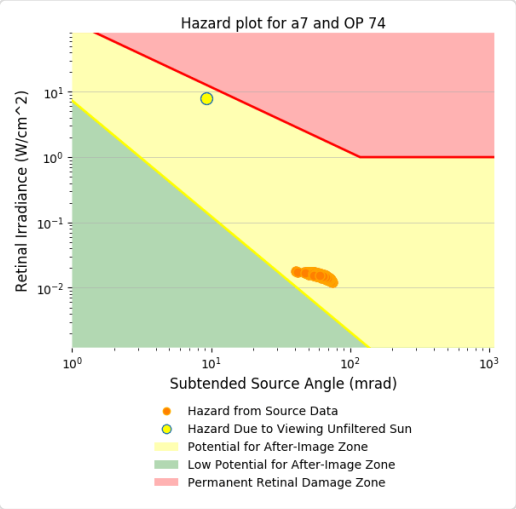
PV array is expected to produce the following glare for receptors at this location:

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









A7 - OP Receptor (OP 75)

No glare found

Assumptions

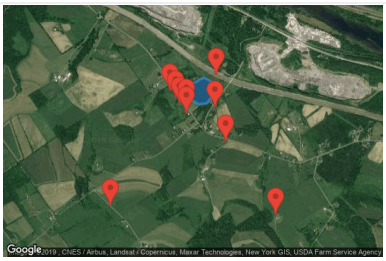
- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.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

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array P1 Fixed 9Oct19

Project site configuration details and results.



Created **Oct. 9, 2019 1:14 p.m.**
Updated **Oct. 9, 2019 3:24 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31863.5043

Summary of Results

Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
P1	25.0	180.0	0	9,002	-

Component Data

PV Array(s)

Name: P1
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.902958	-74.129574	463.80	10.00	473.80
2	42.902388	-74.128186	459.74	10.00	469.74
3	42.901084	-74.128473	477.41	10.00	487.41
4	42.900392	-74.129181	494.62	10.00	504.62
5	42.900299	-74.130252	508.85	10.00	518.85
6	42.900809	-74.131456	512.78	10.00	522.79
7	42.901852	-74.132355	505.32	10.00	515.32

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 14	42.901646	-74.134145	520.67	16.00	536.67
OP 15	42.900923	-74.133373	528.45	16.00	544.45
OP 16	42.900310	-74.132858	535.30	16.00	551.30
OP 17	42.899332	-74.131956	546.18	16.00	562.18
OP 34	42.896544	-74.126614	578.00	16.00	594.00
OP 44	42.889212	-74.119802	856.47	16.00	872.47
OP 51	42.899927	-74.128083	496.16	16.00	512.16
OP 62	42.903217	-74.127914	453.09	8.00	461.09
OP 71	42.900138	-74.131913	532.75	8.00	540.75
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

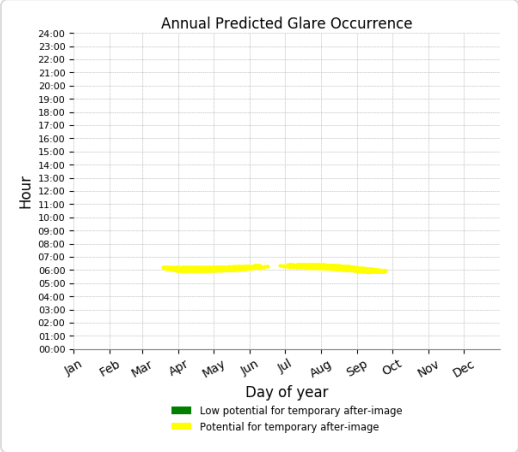
P1 potential temporary after-image

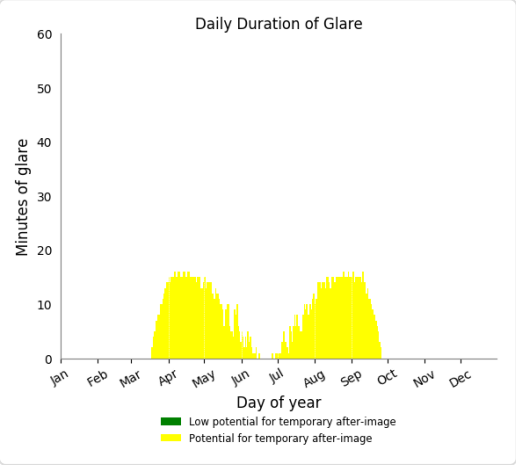
Component	Green glare (min)	Yellow glare (min)
OP: OP 14	0	1826
OP: OP 15	0	868
OP: OP 16	0	2620
OP: OP 17	0	0
OP: OP 34	0	0
OP: OP 44	0	0
OP: OP 51	0	2337
OP: OP 62	0	0
OP: OP 71	0	1351
OP: OP 76	0	0

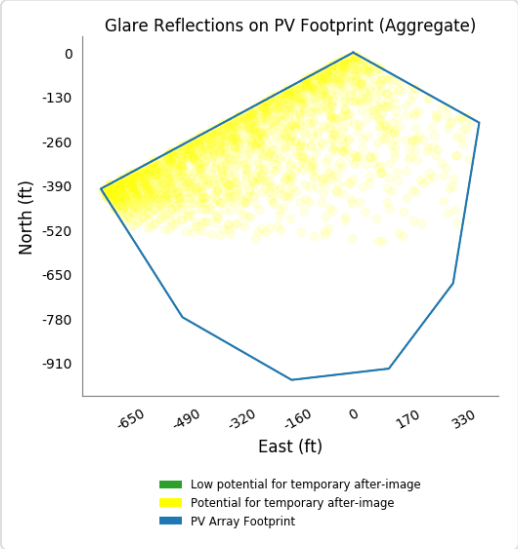
P1 - OP Receptor (OP 14)

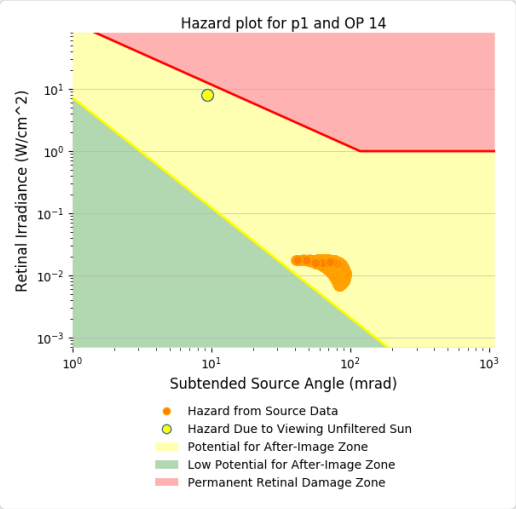
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,826 minutes of "yellow" glare with potential to cause temporary after-image.





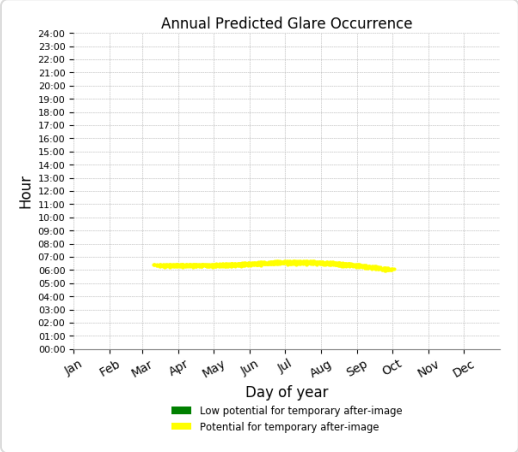


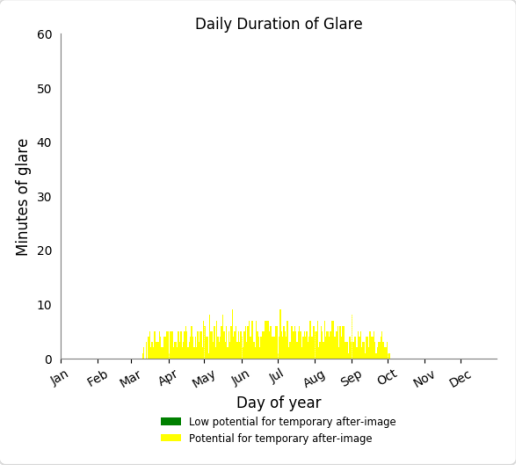


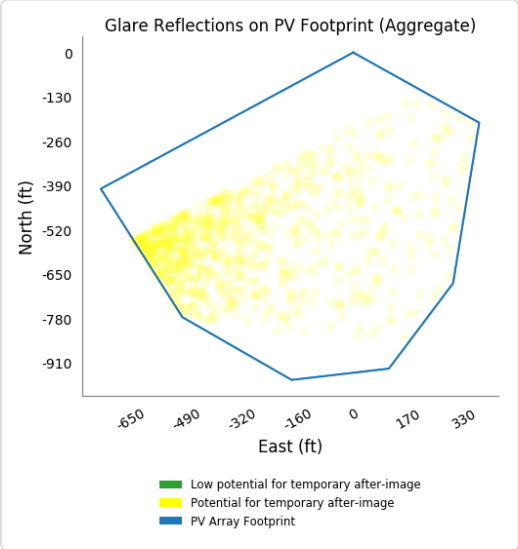
P1 - OP Receptor (OP 15)

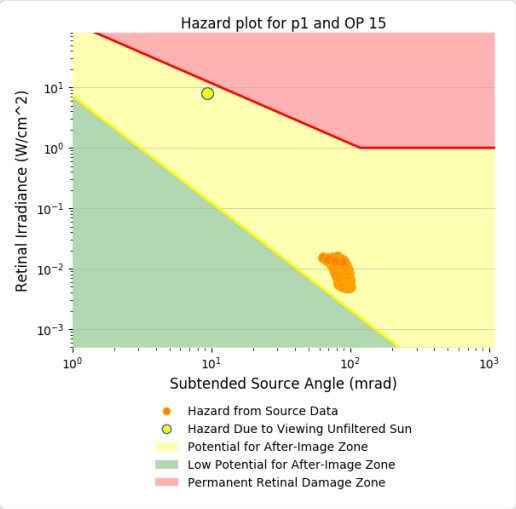
PV array is expected to produce the following glare for receptors at this location:

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





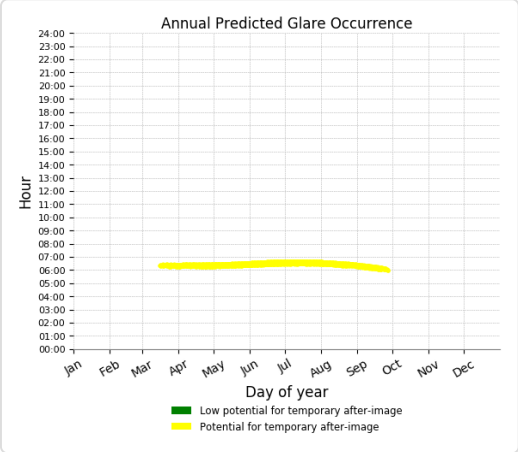


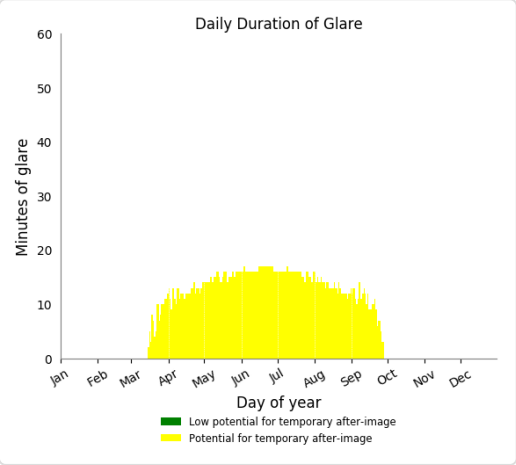


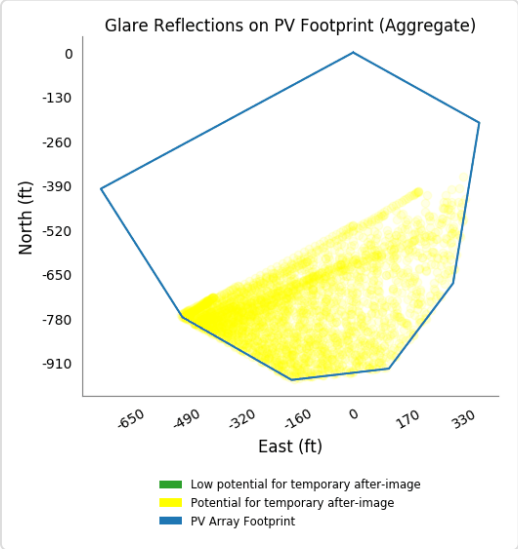
P1 - OP Receptor (OP 16)

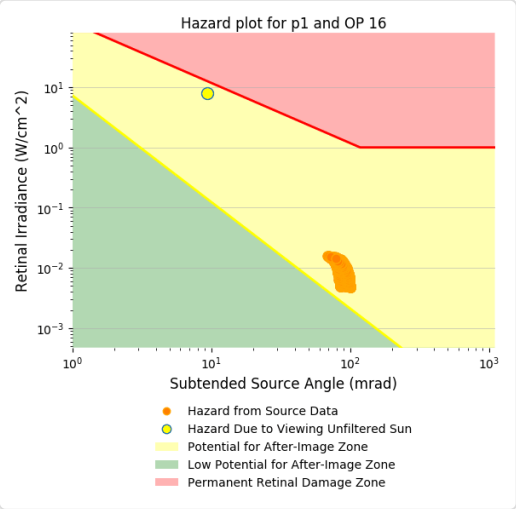
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,620 minutes of "yellow" glare with potential to cause temporary after-image.









P1 - OP Receptor (OP 17)

No glare found

P1 - OP Receptor (OP 34)

No glare found

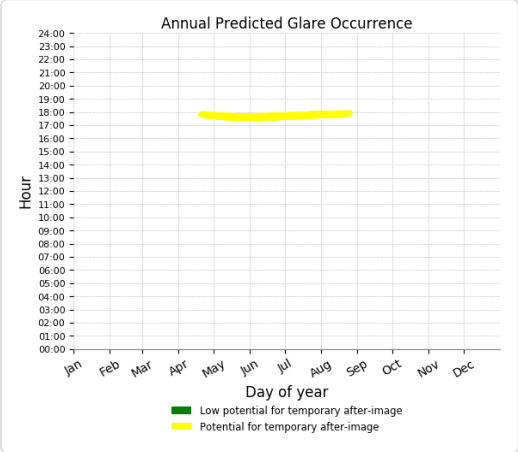
P1 - OP Receptor (OP 44)

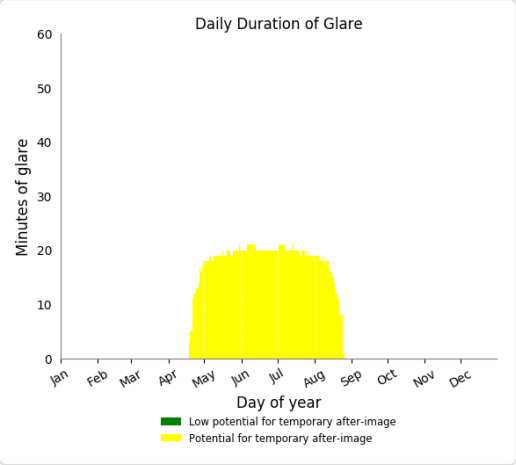
No glare found

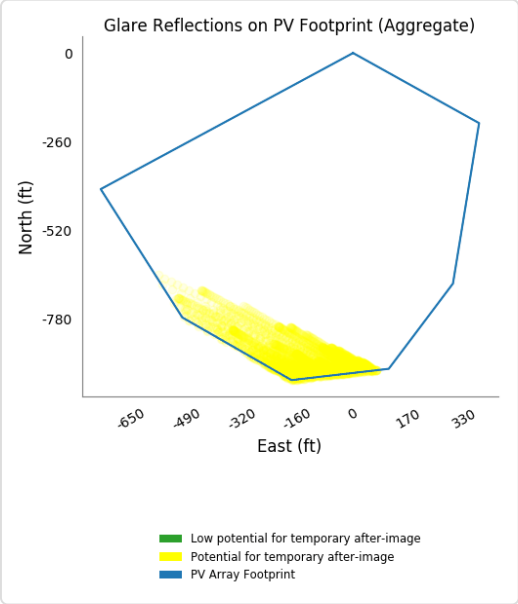
P1 - OP Receptor (OP 51)

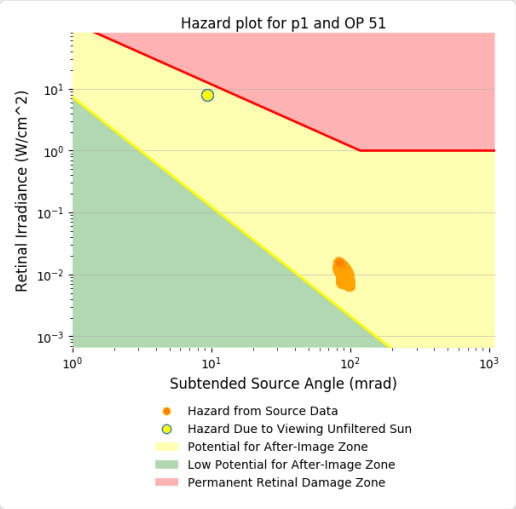
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 2,337 minutes of "yellow" glare with potential to cause temporary after-image.









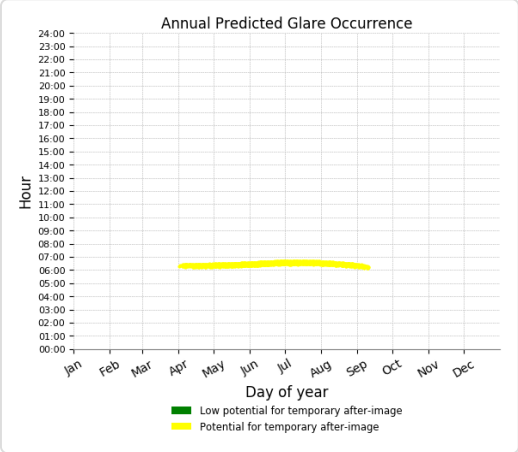
P1 - OP Receptor (OP 62)

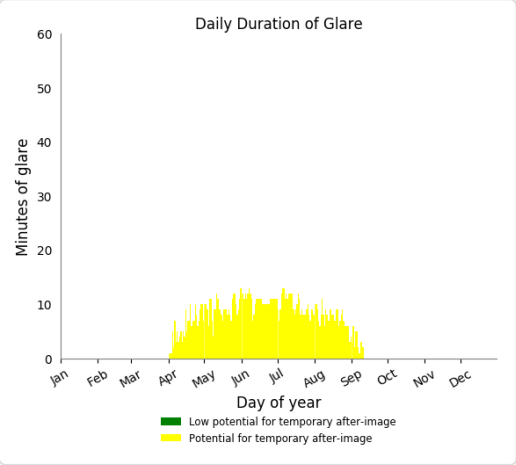
No glare found

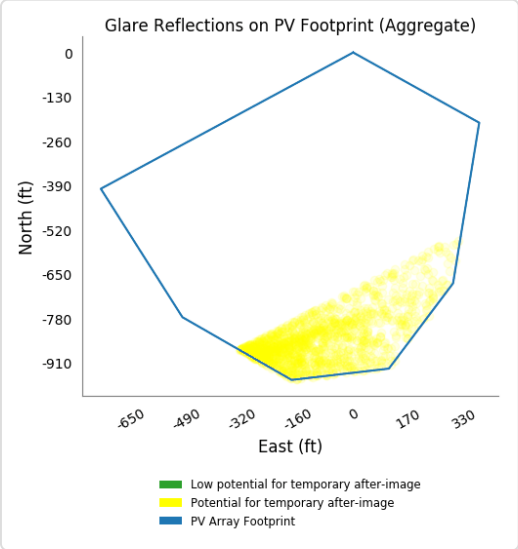
P1 - OP Receptor (OP 71)

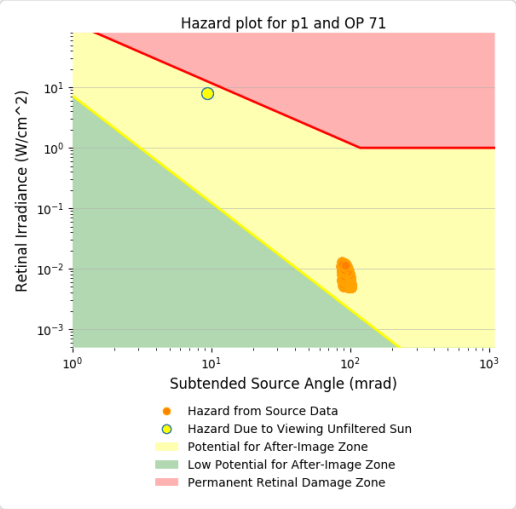
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,351 minutes of "yellow" glare with potential to cause temporary after-image.









P1 - OP Receptor (OP 76)

No glare found

Assumptions

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

ForgeSolar
PV planning & glare analysis

GlareGauge Glare Analysis Results

Site Configuration: Array P2 Fixed 9Oct19

Project site configuration details and results.

Created **Oct. 9, 2019 1:14 p.m.**
Updated **Oct. 9, 2019 3:33 p.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC-5**
Site Configuration ID: 31864.5043

Summary of Results Glare with potential for temporary after-image predicted

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
P2	25.0	180.0	1	3,557	-

Component Data

PV Array(s)

Name: P2
Axis tracking: Fixed (no rotation)
Tilt: 25.0 deg
Orientation: 180.0 deg
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	42.901190	-74.125707	475.14	10.00	485.14
2	42.899685	-74.123603	502.59	10.00	512.59
3	42.898480	-74.122625	529.15	10.00	539.15
4	42.897866	-74.125275	553.18	10.00	563.18
5	42.900587	-74.126642	490.68	10.00	500.68
6	42.900839	-74.126375	483.09	10.00	493.09

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
OP 14	42.901646	-74.134145	520.67	16.00	536.67
OP 15	42.900923	-74.133373	528.45	16.00	544.45
OP 33	42.895612	-74.128218	603.88	16.00	619.88
OP 51	42.899927	-74.128083	496.16	16.00	512.16
OP 63	42.902367	-74.125263	458.61	8.00	466.62
OP 76	42.890096	-74.142190	830.22	8.00	838.22

PV Array Results

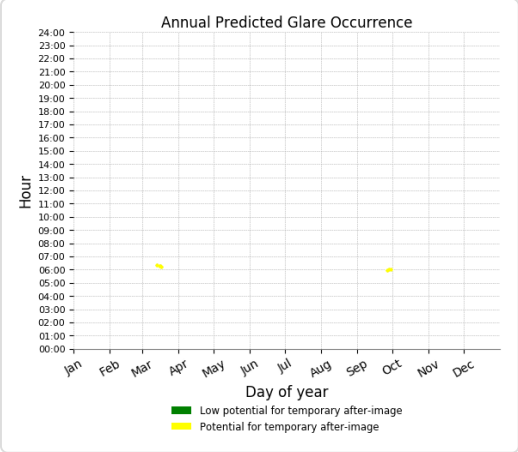
P2 potential temporary after-image

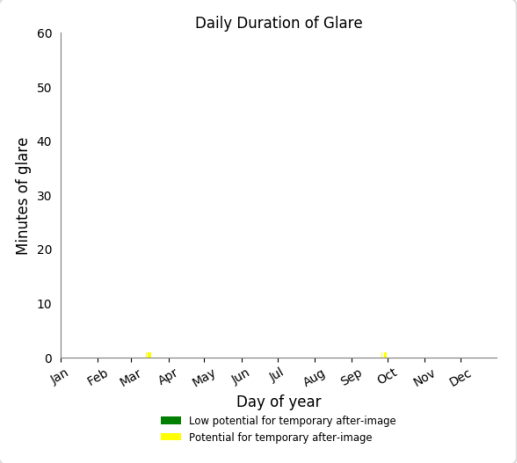
Component	Green glare (min)	Yellow glare (min)
OP: OP 14	0	7
OP: OP 15	1	379
OP: OP 33	0	0
OP: OP 51	0	3171
OP: OP 63	0	0
OP: OP 76	0	0

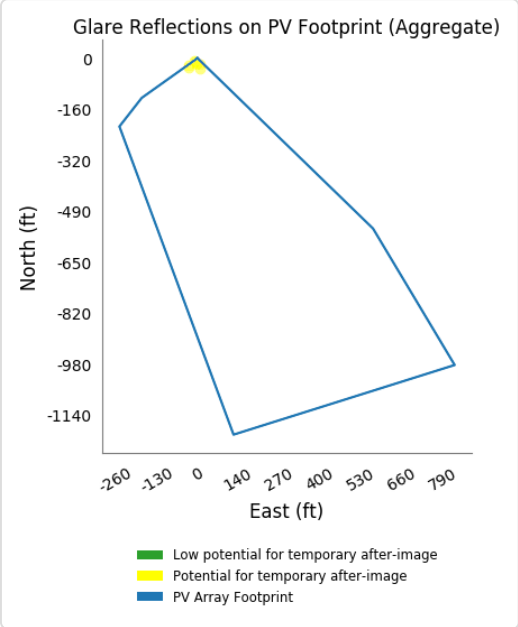
P2 - OP Receptor (OP 14)

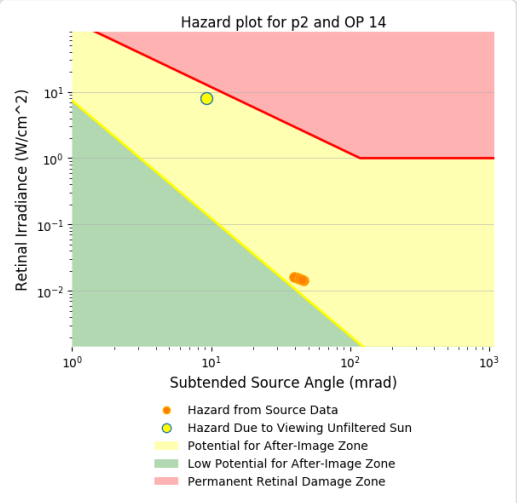
PV array is expected to produce the following glare for receptors at this location:

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





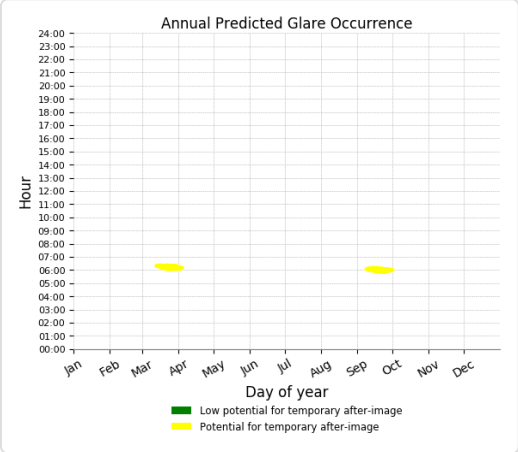


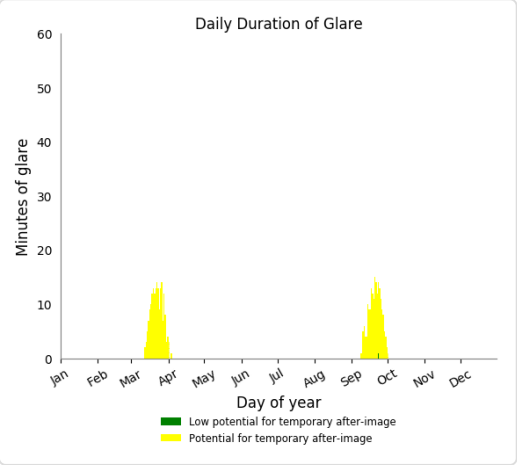


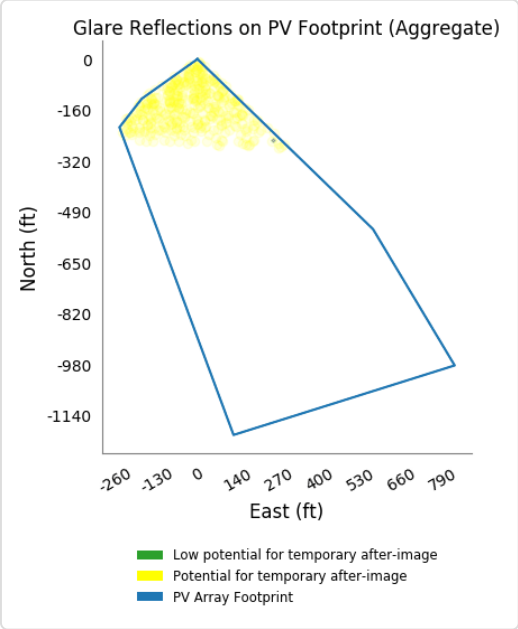
P2 - OP Receptor (OP 15)

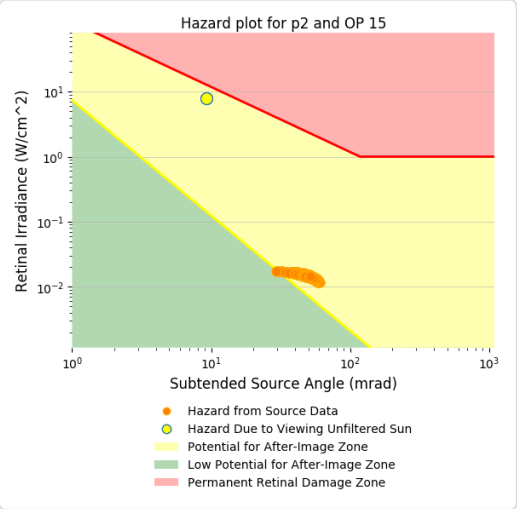
PV array is expected to produce the following glare for receptors at this location:

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









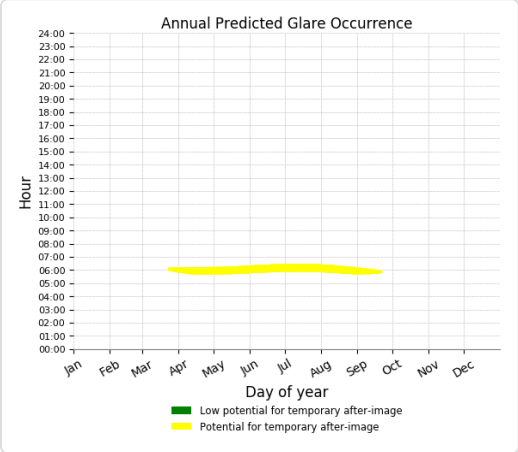
P2 - OP Receptor (OP 33)

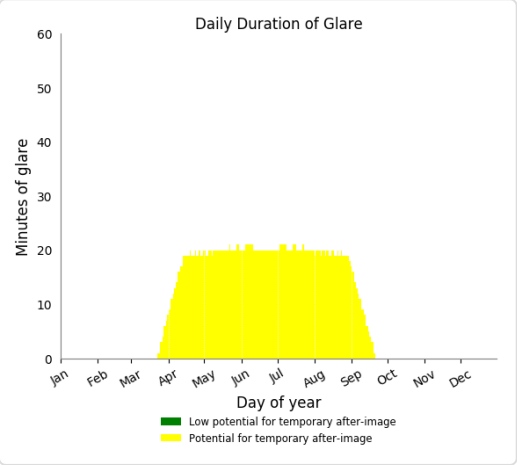
No glare found

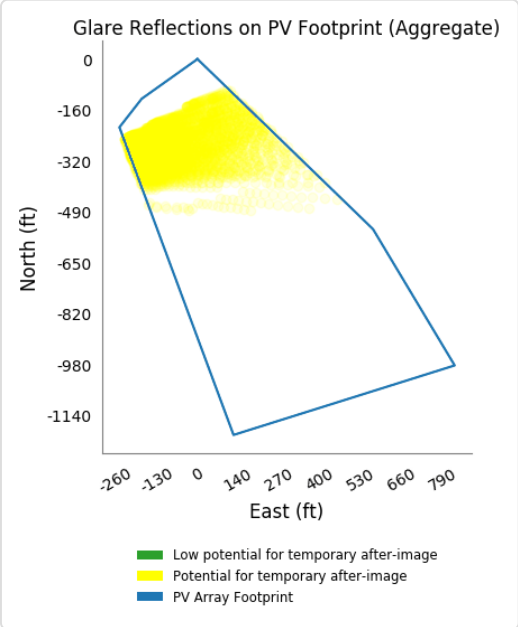
P2 - OP Receptor (OP 51)

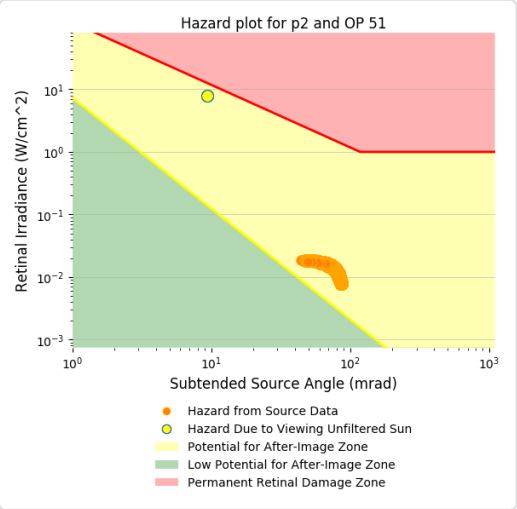
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 3,171 minutes of "yellow" glare with potential to cause temporary after-image.









P2 - OP Receptor (OP 63)

No glare found

P2 - OP Receptor (OP 76)

No glare found

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