APPENDIX D
GLINT AND GLARE IMPACT ASSESSMENT

VALUE THROUGH INTEGRATION

7 March, 2022

LMS Energy Pty Ltd
199 Churchill Road
PROSPECT, SA, 5082

ATTENTION: FIONA LAMBERT

ENVIRONMENTAL ETHOS

ABN: 65 054 076 046

Our Reference: *21010 NILLUMBIKSF GLARE DELWP RESPONSE 2022 03 07.DOCX*

Dear Fiona,

RE: RESPONSE TO DELWP REGARDING CHANGES TO THE GLINT AND GLARE ASSESSMENT AS A RESULT OF THE REDUCED SIZE OF THE PROPOSED NILLUMBIK SOLAR ENERGY FACILITY FROM 2.8MW TO 1.2MW

Environmental Ethos on behalf of LMS Energy Pty Ltd has prepared this response for the Department of Environment, Land, Water and Planning (DELWP) in regard to potential changes to the findings of the Glint and Glare Impact Assessment dated October 2021 (the original assessment), for Nillumbik Solar Energy Facility (the Project), resulting from the proposed decrease in size of the solar farm from 2.8MW to 1.2MW.

The revised solar farm layout as shown in LMS Energy's Solar Facility Layout Plan (Drawing Number 30032-GA-121, dated 20/08/21) has been tested in the Project glare modelling (refer *Attachment A*).

The glare modelling utilised the Solar Glare Hazard Analysis Tool (SGHAT) with the same input parameters and sensitive receptors as previously used for the original assessment. The input data used in the glare modelling is outlined below:

Table 1. Input data for SGHAT Analysis – Fixed Frame System

SGHAT Model Parameters	Values
Time Zone	UTC +10
Axis Tracking	Fixed (no rotation)
Tilt	15 degrees
Orientation	0 degrees
Module Surface material	Smooth glass without anti-reflective coating (ARC)
Reflectivity	Vary with sun
Correlate slope error with surface type?	Yes
Slope error	6.55mrad
Height of panels above ground	1.3 m maximum height

The results of the revised SGHAT modelling based on the smaller project footprint, compared to the original assessment are as follows:

Table 2. SGHAT Assessment Results – Fixed Frame System – Revised modelling

Original Assessment – Glare Impacts	Revised Assessment – Glare Impacts
10 Observation Points - impacted by potential glare Residential Dwellings at OP1, OP2, OP4, OP5, OP13, OP14, OP15, OP28, OP32 Non-residential building at OP3	5 Observation Points - impacted by potential glare Residential Dwellings at OP2, OP4, OP5, OP13, Non-residential building at OP3
Yan Yean Road - impacted by potential glare	Yan Yean Road – glare potential reduced slightly from 6286 minutes per year to 5881 minutes per year
Heard Ave - impacted by potential glare	Heard Avenue – glare potential reduced slightly from 9222 minutes per year to 6637 minutes per year
Faneco Rd & Seymour Dr - impacted by potential glare	No Glare

Based on the assumptions and parameters of the revised glare modelling, the proposed decrease in size of the Project results in the following:

- The number of dwellings potentially affected by glare reduces from nine (9) to four (4).
- Potential glare affecting dwellings at OP2 and OP4 reduces in duration.
- Potential glare impacts to the non-residential building at OP3 also reduce in duration.
- Potential glare impacts to dwellings at OP5 and OP13 remain relatively unchanged.
- Glare hazard identified as potentially affecting Franeco Road and Seymore Drive no longer applies.
- Glare hazard identified as potentially affecting Yan Yean Road is slightly reduced.
- Glare hazard identified as potentially affecting Heard Avenue is also slightly reduced.

These results do not take into consideration existing and proposed vegetation screening as detailed in the original assessment.

In summary, the decrease in size of the proposed Nillumbik Solar Energy Facility from 2.8MW to 1.2MW results in no additional glare potential beyond that previously identified in the original Glint and Glare Assessment. The revised glare modelling demonstrates an overall reduction in the extent and duration of potential glare affecting sensitive receptors. The relevant standards/provisions applicable to the original Glint and Glare Assessment, previously assessed as part of the original planning application, remain relevant.

Yours sincerely,
for Environmental Ethos

Sian Crawford – Director

Attachment 1: Nillumbik Stage 1-Update SGHAT Results

ForgeSolar

NillumbikSF

Nillumbik_Stage 1_update

Created March 6, 2022
Updated March 6, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 65716.10045

Project type Advanced
Project status: active
Category 500 kW to 1 MW

Misc. Analysis Settings

DNI: **varies (2,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

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
PV array Stage 1	15.0	0.0	0	28,708	-

Component Data

PV Array(s)

Total PV footprint area: 15,677 m^2

Name: PV array Stage 1
Description: Stage 1
Footprint area: 15,677 m^2
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 0.0 deg

Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.652031	145.126469	135.13	1.30	136.43
2	-37.651950	145.126467	134.63	1.30	135.93
3	-37.651956	145.126949	135.27	1.30	136.57
4	-37.652007	145.126948	135.51	1.30	136.81
5	-37.652113	145.126945	136.27	1.30	137.57
6	-37.652196	145.126944	136.50	1.30	137.80
7	-37.652198	145.127033	136.58	1.30	137.88
8	-37.652302	145.127030	136.87	1.30	138.17
9	-37.652303	145.127218	136.71	1.30	138.01
10	-37.652375	145.127215	136.88	1.30	138.18
11	-37.652377	145.127387	136.34	1.30	137.64
12	-37.652451	145.127381	136.76	1.30	138.06
13	-37.652440	145.126531	137.18	1.30	138.48
14	-37.652608	145.126528	138.03	1.30	139.33
15	-37.652619	145.127829	135.07	1.30	136.37
16	-37.652799	145.127824	135.84	1.30	137.14
17	-37.652802	145.128002	135.11	1.30	136.41
18	-37.652827	145.128001	135.10	1.30	136.40
19	-37.652850	145.128002	135.08	1.30	136.38
20	-37.652892	145.128000	135.42	1.30	136.72
21	-37.652922	145.127998	135.67	1.30	136.97
22	-37.652959	145.127994	135.85	1.30	137.15
23	-37.653005	145.127993	135.89	1.30	137.19
24	-37.653003	145.127801	136.57	1.30	137.87
25	-37.653172	145.127793	136.95	1.30	138.25
26	-37.653193	145.127793	136.93	1.30	138.23
27	-37.653219	145.127793	136.99	1.30	138.29
28	-37.653218	145.127620	137.64	1.30	138.94
29	-37.653213	145.127078	138.77	1.30	140.07
30	-37.653203	145.126456	138.35	1.30	139.65
31	-37.652733	145.126464	138.35	1.30	139.65
32	-37.652731	145.126011	138.12	1.30	139.42
33	-37.652731	145.125622	137.59	1.30	138.89
34	-37.652588	145.125626	137.50	1.30	138.80
35	-37.652463	145.125626	137.53	1.30	138.83
36	-37.652462	145.125718	137.65	1.30	138.95
37	-37.652366	145.125718	137.37	1.30	138.67
38	-37.652368	145.125911	137.10	1.30	138.40
39	-37.652190	145.125911	136.02	1.30	137.32
40	-37.652190	145.126058	136.10	1.30	137.40
41	-37.652143	145.126056	135.51	1.30	136.81
42	-37.652105	145.126058	135.17	1.30	136.47
43	-37.652069	145.126059	134.98	1.30	136.28
44	-37.652033	145.126059	134.87	1.30	136.17

Route Receptor(s)

Name: Faneco Rd Seymour Dr
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.658915	145.125317	133.69	2.00	135.69
2	-37.659089	145.126659	135.07	2.00	137.07
3	-37.659293	145.127410	134.79	2.00	136.79
4	-37.659777	145.128708	123.26	2.00	125.26
5	-37.659119	145.129614	104.73	2.00	106.73
6	-37.658545	145.130510	92.88	2.00	94.88
7	-37.658112	145.131186	99.80	2.00	101.80
8	-37.657135	145.132645	116.94	2.00	118.94
9	-37.656893	145.133686	110.67	2.00	112.67
10	-37.656704	145.134318	113.82	2.00	115.82
11	-37.655982	145.134918	119.58	2.00	121.58
12	-37.654810	145.135938	128.56	2.00	130.56
13	-37.654182	145.137000	139.55	2.00	141.55

Name: Heard Ave
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.646305	145.131155	180.08	2.00	182.08
2	-37.652115	145.130254	155.08	2.00	157.08
3	-37.653848	145.129970	125.75	2.00	127.75
4	-37.655305	145.129675	102.79	2.00	104.79
5	-37.657777	145.129133	112.28	2.00	114.28
6	-37.658690	145.128945	117.07	2.00	119.07
7	-37.659165	145.128897	116.51	2.00	118.51
8	-37.659675	145.128854	122.08	2.00	124.08

Name: Yan Yean Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.648318	145.127696	170.18	2.00	172.18
2	-37.648571	145.126929	170.21	2.00	172.21
3	-37.648839	145.125379	170.30	2.00	172.30
4	-37.649088	145.124096	172.02	2.00	174.02
5	-37.649338	145.123026	173.94	2.00	175.94
6	-37.649554	145.122648	173.29	2.00	175.29
7	-37.650542	145.121631	173.82	2.00	175.82
8	-37.651241	145.120878	173.05	2.00	175.05
9	-37.652022	145.120599	172.52	2.00	174.52
10	-37.652589	145.120623	171.47	2.00	173.47
11	-37.653143	145.120862	167.24	2.00	169.24
12	-37.653500	145.121141	165.02	2.00	167.02
13	-37.653950	145.121806	160.43	2.00	162.43
14	-37.654366	145.122728	152.70	2.00	154.70
15	-37.654772	145.123445	145.84	2.00	147.84
16	-37.655233	145.123938	140.50	2.00	142.50
17	-37.655883	145.124542	137.18	2.00	139.18
18	-37.656525	145.125090	136.01	2.00	138.01
19	-37.657040	145.125360	134.23	2.00	136.23
20	-37.657560	145.125443	133.14	2.00	135.14
21	-37.658333	145.125454	133.59	2.00	135.59
22	-37.659327	145.125142	132.53	2.00	134.53
23	-37.660652	145.124660	134.83	2.00	136.83
24	-37.663312	145.123646	141.56	2.00	143.56
25	-37.663899	145.123568	142.45	2.00	144.45
26	-37.665540	145.124123	133.50	2.00	135.50

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-37.653980	145.123404	149.17	1.50	150.67
OP 2	-37.653054	145.122685	154.00	1.50	155.50
OP 3	-37.652689	145.121752	159.08	1.50	160.58
OP 4	-37.651669	145.121387	177.13	1.50	178.63
OP 5	-37.651331	145.122004	175.29	1.50	176.79
OP 6	-37.650231	145.123398	185.11	1.50	186.61
OP 7	-37.649993	145.125185	181.35	1.50	182.85
OP 8	-37.649802	145.125501	182.06	1.50	183.56
OP 9	-37.649572	145.126048	182.43	1.50	183.93
OP 10	-37.649589	145.126590	177.15	1.50	178.65
OP 11	-37.648837	145.127947	171.73	1.50	173.23
OP 12	-37.650273	145.128564	169.55	1.50	171.05
OP 13	-37.651869	145.129787	160.97	1.50	162.47
OP 14	-37.653328	145.132545	124.82	1.50	126.32
OP 15	-37.653825	145.130308	126.52	1.50	128.02
OP 16	-37.655082	145.131579	118.48	1.50	119.98
OP 17	-37.655965	145.131161	121.10	1.50	122.60
OP 18	-37.657517	145.131184	109.78	1.50	111.28
OP 19	-37.655912	145.132578	142.49	1.50	143.99
OP 20	-37.655682	145.128707	110.80	1.50	112.30
OP 21	-37.655820	145.125411	135.02	1.50	136.52
OP 22	-37.656758	145.122921	141.51	1.50	143.01
OP 23	-37.657208	145.126237	134.92	1.50	136.42
OP 24	-37.657873	145.126577	138.92	1.50	140.42
OP 25	-37.658198	145.126809	139.38	1.50	140.88
OP 26	-37.658593	145.129291	113.06	1.50	114.56
OP 27	-37.658081	145.128432	121.10	1.50	122.60
OP 28	-37.654905	145.133934	161.23	1.50	162.73
OP 29	-37.658932	145.127541	134.64	1.50	136.14
OP 30	-37.659316	145.131822	100.13	1.50	101.63
OP 31	-37.662276	145.130288	112.29	1.50	113.79
OP 32	-37.654402	145.134671	160.48	1.50	161.98
OP 33	-37.660509	145.131248	90.49	1.50	91.99
OP 34	-37.659961	145.129408	114.10	1.50	115.60
OP 35	-37.658456	145.137280	142.75	1.50	144.25
OP 36	-37.656774	145.137154	158.32	1.50	159.82
OP 37	-37.660226	145.139241	156.60	1.50	158.10
OP 38	-37.661514	145.123710	137.21	1.50	138.71
OP 39	-37.661093	145.123860	136.33	1.50	137.83
OP 40	-37.660592	145.123914	135.75	1.50	137.25

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array Stage 1	15.0	0.0	0	28,708	-	-

Distinct glare per month

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

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-sta (green)	0	0	0	0	0	0	0	0	0	0	0	0
pv-array-sta (yellow)	2229	2000	1786	271	0	0	0	31	1247	2156	2146	2309

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array Stage 1 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	995
OP: OP 3	0	1628
OP: OP 4	0	3950
OP: OP 5	0	4175
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	5442
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0

OP: OP 27	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 30	0	0
OP: OP 31	0	0
OP: OP 32	0	0
OP: OP 33	0	0
OP: OP 34	0	0
OP: OP 35	0	0
OP: OP 36	0	0
OP: OP 37	0	0
OP: OP 38	0	0
OP: OP 39	0	0
OP: OP 40	0	0
Route: Faneco Rd Seymour Dr	0	0
Route: Heard Ave	0	6637
Route: Yan Yean Road	0	5881

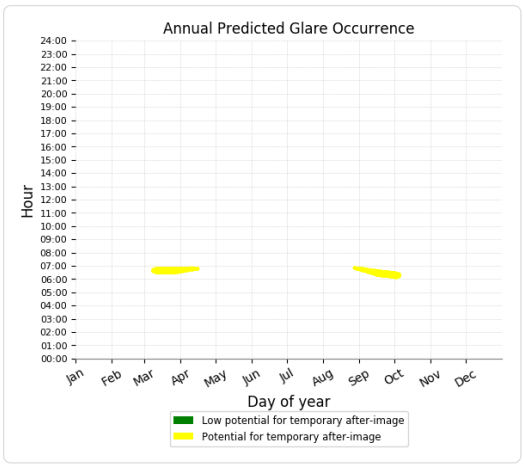
PV array Stage 1 - OP Receptor (OP 1)

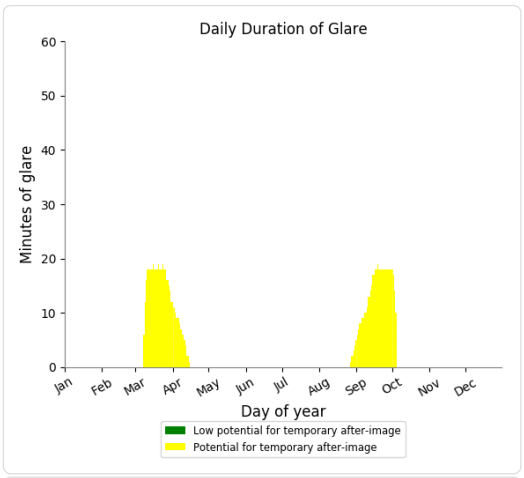
No glare found

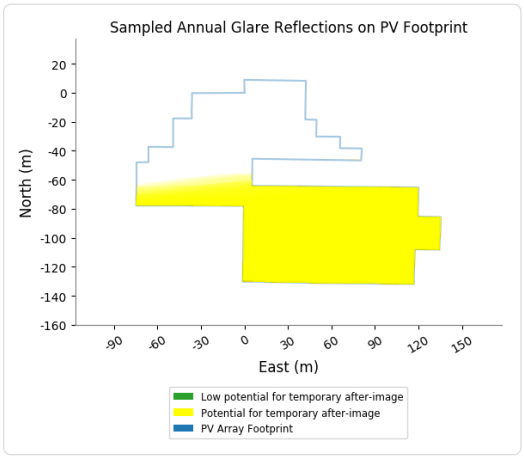
PV array Stage 1 - OP Receptor (OP 2)

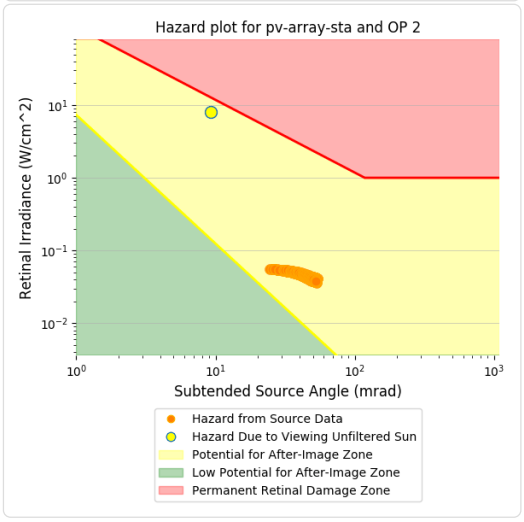
PV array is expected to produce the following glare for receptors at this location:

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





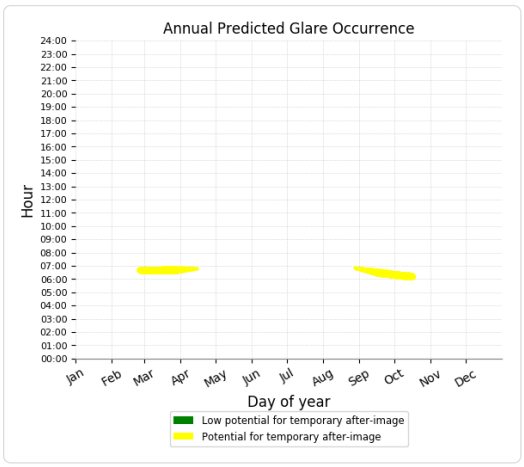


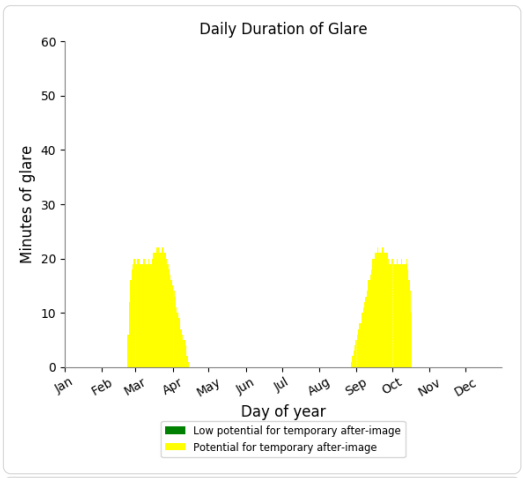


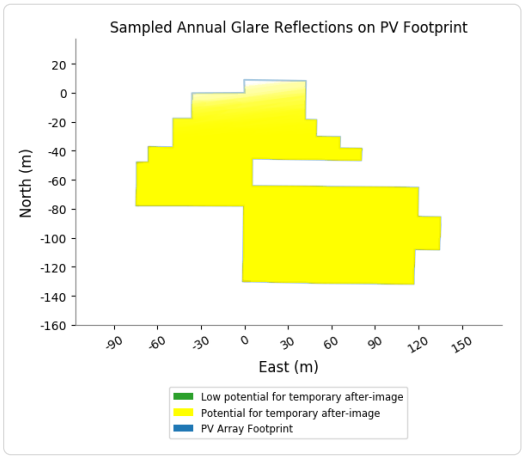
PV array Stage 1 - OP Receptor (OP 3)

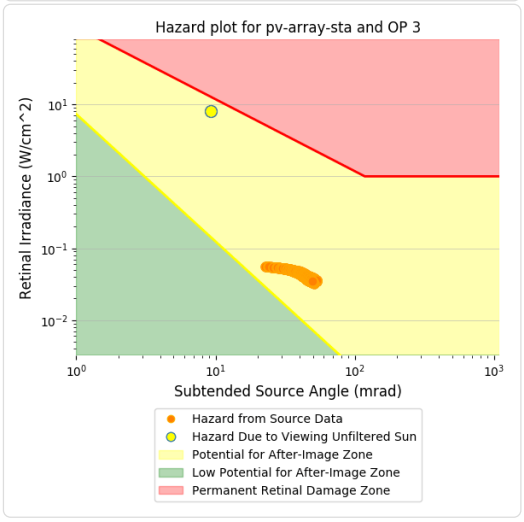
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,628 minutes of "yellow" glare with potential to cause temporary after-image.





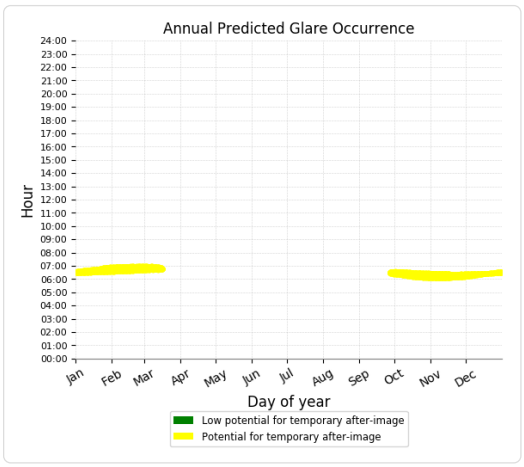


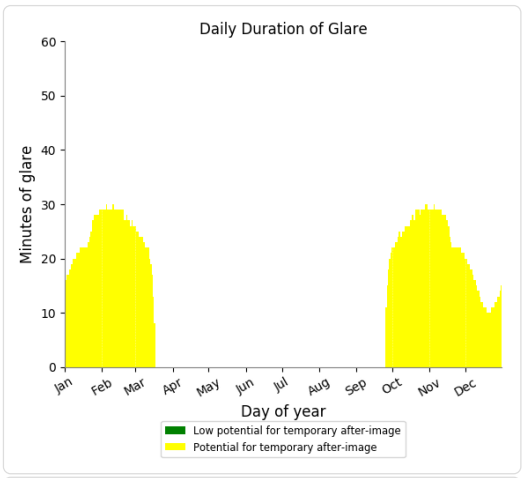


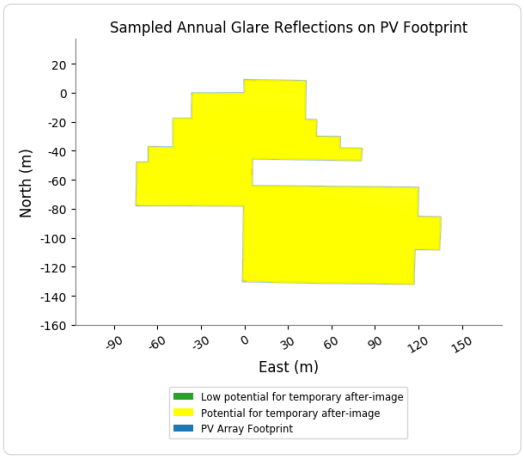
PV array Stage 1 - OP Receptor (OP 4)

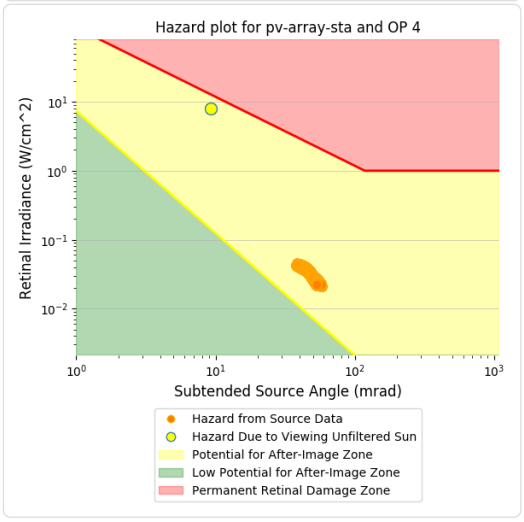
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 3,950 minutes of "yellow" glare with potential to cause temporary after-image.





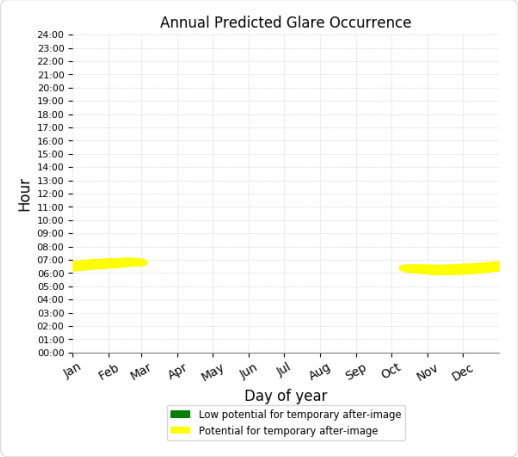


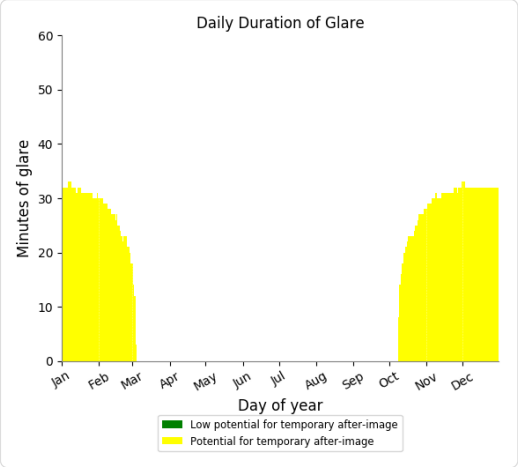


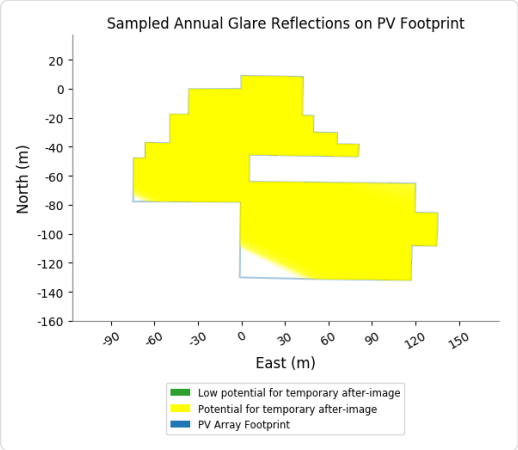
PV array Stage 1 - OP Receptor (OP 5)

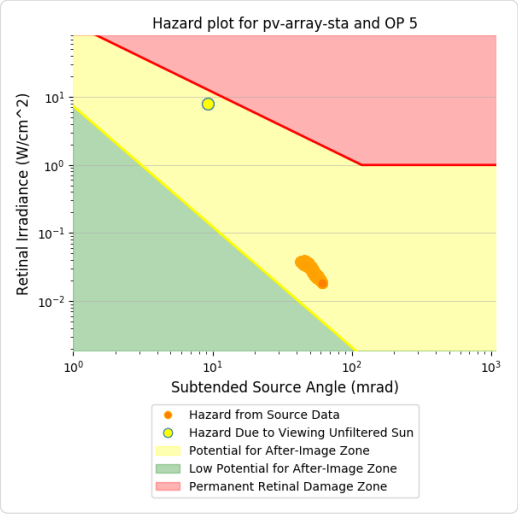
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,175 minutes of "yellow" glare with potential to cause temporary after-image.









PV array Stage 1 - OP Receptor (OP 6)

No glare found

PV array Stage 1 - OP Receptor (OP 7)

No glare found

PV array Stage 1 - OP Receptor (OP 8)

No glare found

PV array Stage 1 - OP Receptor (OP 9)

No glare found

PV array Stage 1 - OP Receptor (OP 10)

No glare found

PV array Stage 1 - OP Receptor (OP 11)

No glare found

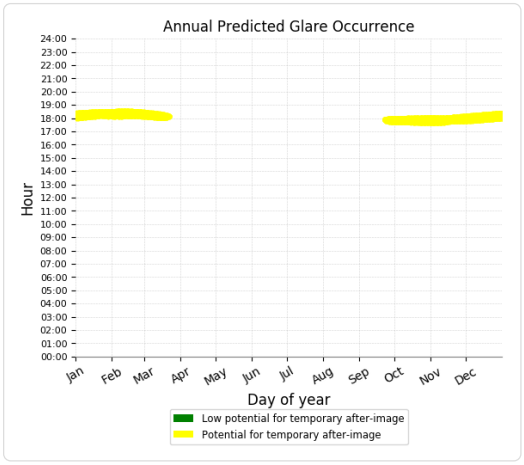
PV array Stage 1 - OP Receptor (OP 12)

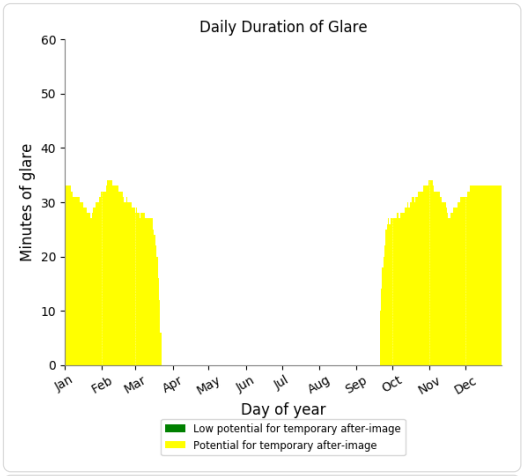
No glare found

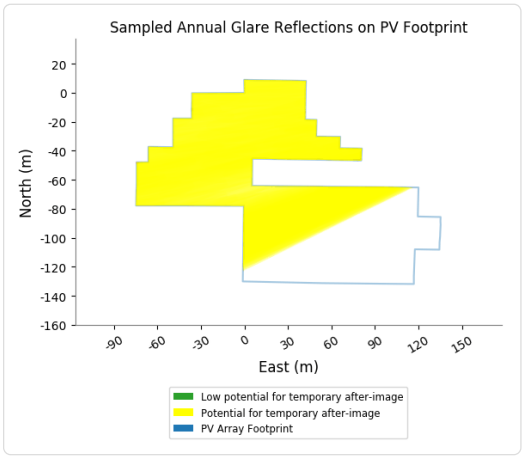
PV array Stage 1 - OP Receptor (OP 13)

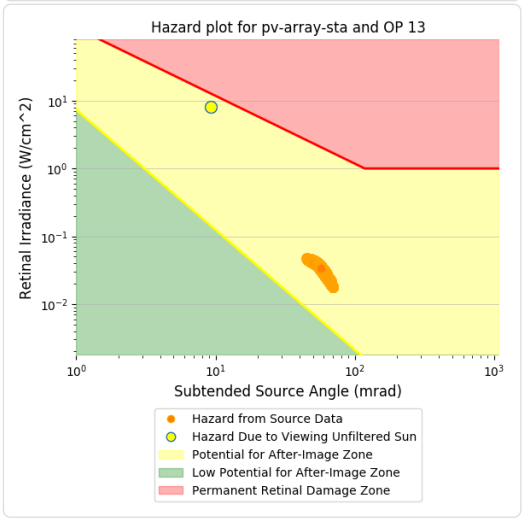
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 5,442 minutes of "yellow" glare with potential to cause temporary after-image.









PV array Stage 1 - OP Receptor (OP 14)

No glare found

PV array Stage 1 - OP Receptor (OP 15)

No glare found

PV array Stage 1 - OP Receptor (OP 16)

No glare found

PV array Stage 1 - OP Receptor (OP 17)

No glare found

PV array Stage 1 - OP Receptor (OP 18)

No glare found

PV array Stage 1 - OP Receptor (OP 19)

No glare found

PV array Stage 1 - OP Receptor (OP 20)

No glare found

PV array Stage 1 - OP Receptor (OP 21)
No glare found

PV array Stage 1 - OP Receptor (OP 22)
No glare found

PV array Stage 1 - OP Receptor (OP 23)
No glare found

PV array Stage 1 - OP Receptor (OP 24)
No glare found

PV array Stage 1 - OP Receptor (OP 25)
No glare found

PV array Stage 1 - OP Receptor (OP 26)
No glare found

PV array Stage 1 - OP Receptor (OP 27)
No glare found

PV array Stage 1 - OP Receptor (OP 28)
No glare found

PV array Stage 1 - OP Receptor (OP 29)
No glare found

PV array Stage 1 - OP Receptor (OP 30)
No glare found

PV array Stage 1 - OP Receptor (OP 31)
No glare found

PV array Stage 1 - OP Receptor (OP 32)
No glare found

PV array Stage 1 - OP Receptor (OP 33)
No glare found

PV array Stage 1 - OP Receptor (OP 34)
No glare found

PV array Stage 1 - OP Receptor (OP 35)
No glare found

PV array Stage 1 - OP Receptor (OP 36)
No glare found

PV array Stage 1 - OP Receptor (OP 37)
No glare found

PV array Stage 1 - OP Receptor (OP 38)
No glare found

PV array Stage 1 - OP Receptor (OP 39)

No glare found

PV array Stage 1 - OP Receptor (OP 40)

No glare found

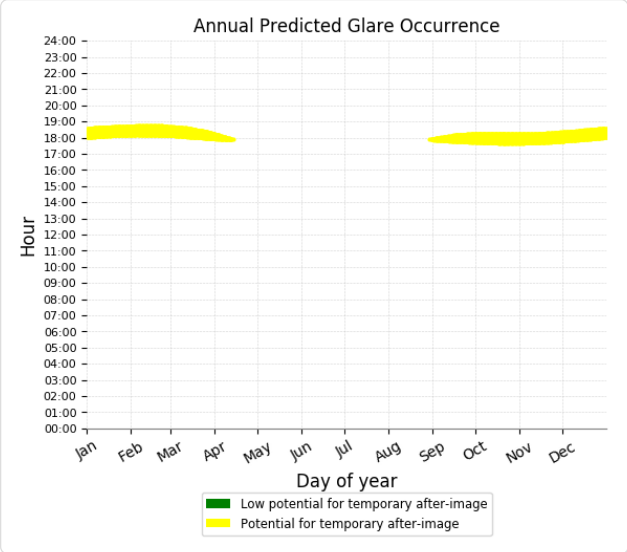
PV array Stage 1 - Route Receptor (Faneco Rd Seymour Dr)

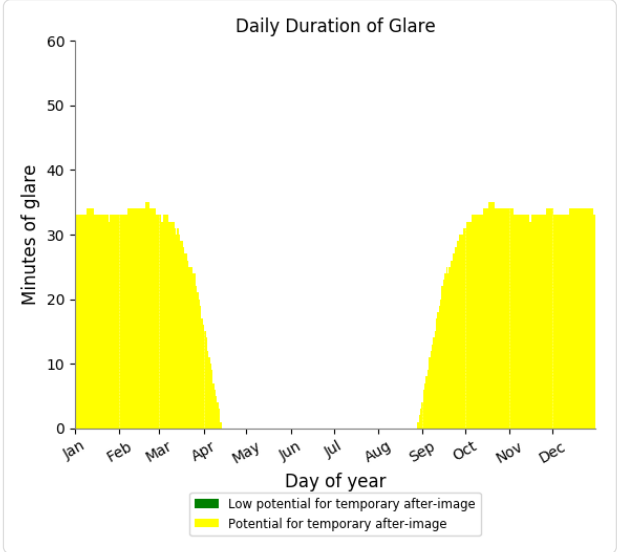
No glare found

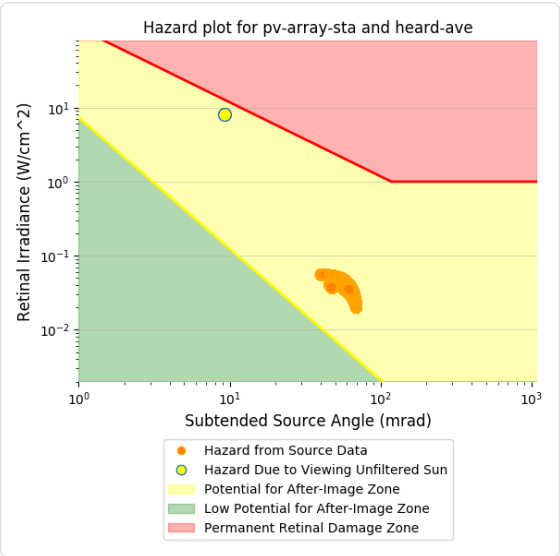
PV array Stage 1 - Route Receptor (Heard Ave)

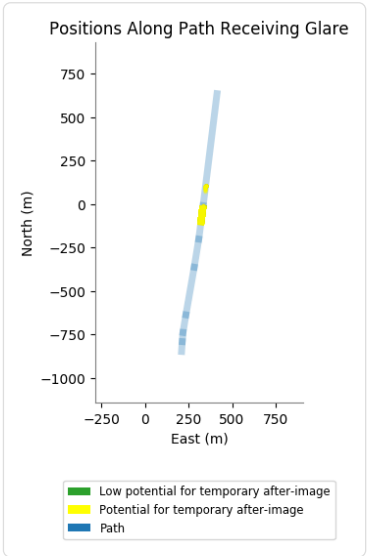
PV array is expected to produce the following glare for receptors at this location:

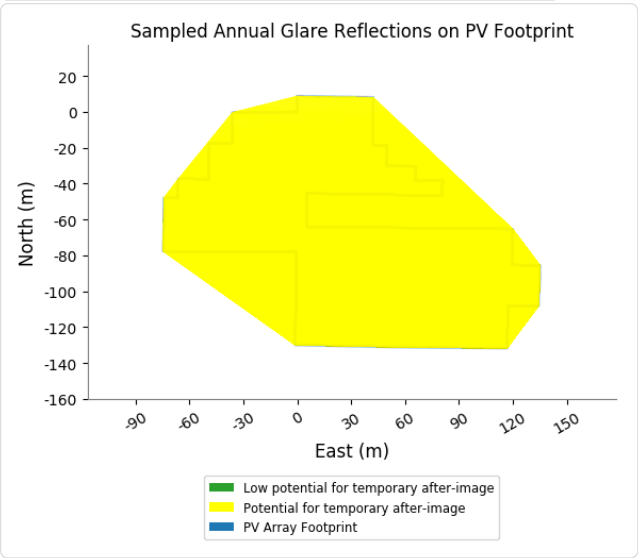
- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 6,637 minutes of "yellow" glare with potential to cause temporary after-image.







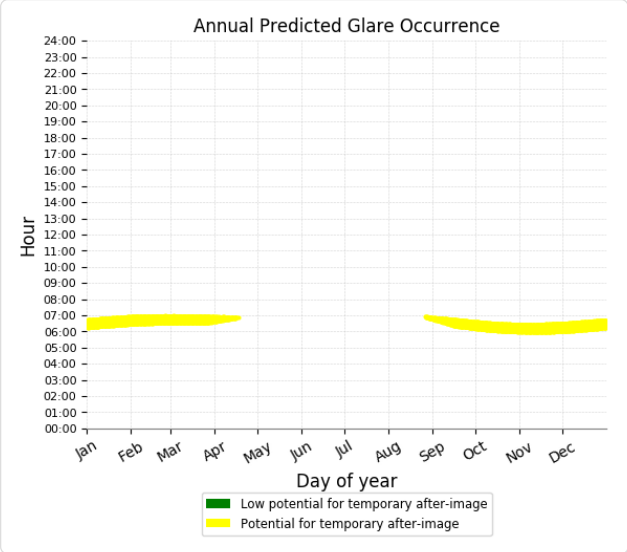


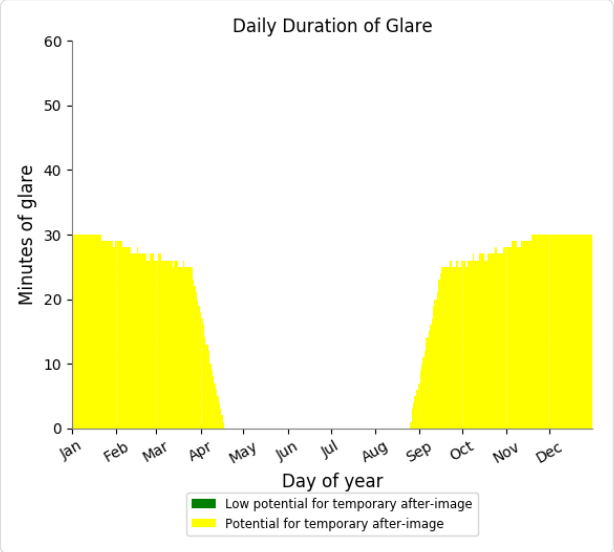


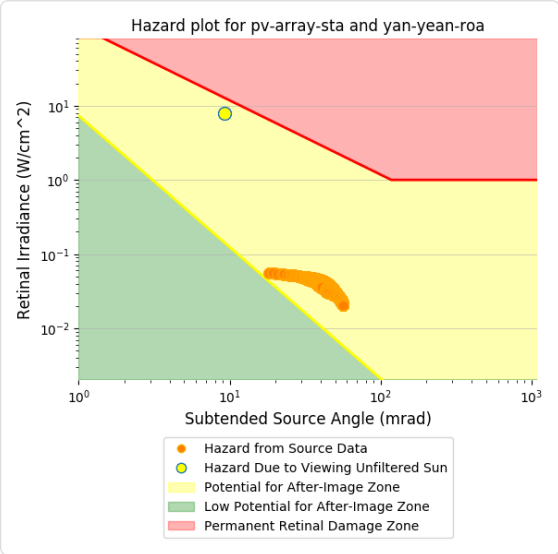
PV array Stage 1 - Route Receptor (Yan Yean Road)

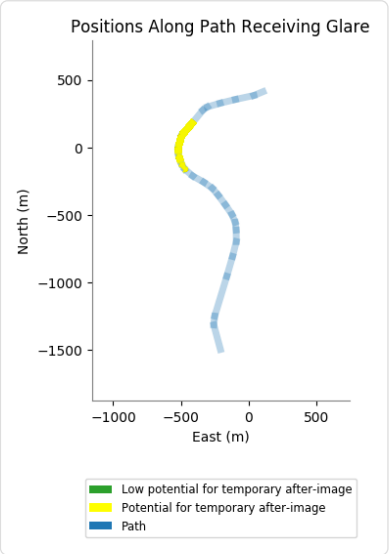
PV array is expected to produce the following glare for receptors at this location:

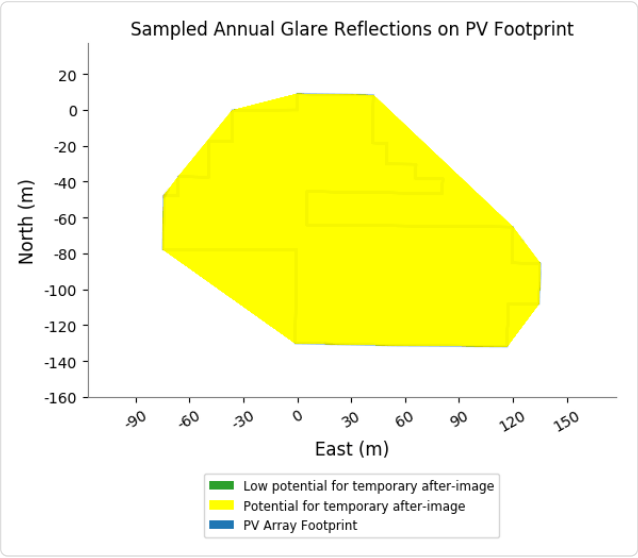
- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 5,881 minutes of "yellow" glare with potential to cause temporary after-image.











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. Actu values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for 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 combine 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 detailed assumptions and limitations not listed here.

ENVIRONMENTAL ETHOS

NILLUMBIK SOLAR FARM

GLINT AND GLARE IMPACT ASSESSMENT REPORT

FINAL ISSUE

Prepared For

LMS ENERGY PTY LTD

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ENVIRONMENTAL
ETHOS

Prepared By Environmental Ethos
for LMS Energy Pty Ltd

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Cover Image: ToGa Wanderings

CONTENTS

EXECUTIVE SUMMARY

The Solar Energy Facilities Design and Development Guidelines, 2019, triggers the assessment of glint and glare resulting from solar farms including potential impacts to dwellings and roads within 1 km of a proposed facility, aviation infrastructure including any air traffic control tower or runway approach path close to a proposed facility, and any other receptor to which a responsible authority considers solar reflection may be a hazard.

This glint and glare impact assessment utilised the Solar Glare Hazard Analysis Tool (SGHAT 3.0) in conjunction with a viewshed analysis, to prepare the glare modelling which is the basis for the impact assessment methodology. The assessment considered dwellings, roads, commercial and public facilities within 1km of the Project.

Melbourne Airport, Essendon Airport, and Lilydale Airport are outside the viewshed of the Project, and at a distance greater than 20km from the site, these facilities are not considered 'close' enough to be affected by the Project

Viewshed and SGHAT modelling is based on topography, the assessment therefore considered other landscape features with the ability to influence the likelihood of glint and glare affecting sensitive receptors, such as minor variation in topography, existing vegetation, and distance from the project. Existing screen planting surrounding the site and recent roadside planting are detailed in the Project Landscape Plan.

The results of the glint and glare modelling together with the consideration of existing and proposed mitigating factors identified the following:

- The viewshed modelling (based on DEM) identified visibility of the Project is generally limited by the surrounding hill to the north, east and west. Visibility extends along the valley in a south and south easterly direction.
- Within 1km of the Project site, 37 dwellings and 3 commercial/non-residential buildings were considered as having potential line of sight to the Project and were included in the SGHAT modelling.
- The SGHAT modelling found potential glare hazard affecting 9 residential dwellings, 1 non-residential building and three roads within the study area.
- Out of the 9 dwellings identified by the modelling, 7 of the dwellings and 2 roads were identified in the assessment as unlikely to be impacted due to intervening screening vegetation.
- 2 dwellings (OP1 and OP2) and 1 non-residential building (OP3) to the west of the Project were identified in the glare modelling as having the potential to be impacted. Substantial screening provided by existing vegetation is considered likely to reduce the potential of glare hazard to occur to 'low likelihood'.
- A 250m section of Yan Yean Road was identified in the modelling as potentially affected by glare. Travellers heading south are more likely to be impacted, glare hazard potential occurs during the early morning between spring and autumn. Recent road works in this location included landscape treatment and tree planting along the road verges and these plantings are considered likely to provide some screening in the future. The Project

Landscape Plan provides details of the road side planting which will assist in reducing the likelihood of glare affecting travellers along Yan Yean Road.

1. INTRODUCTION

This report has been prepared by Environmental Ethos on behalf of LMS Energy Pty Ltd to assess the potential solar glint and glare impacts of the proposed Nillumbik Solar Energy Facility (the Project). The Project comprises of the installation and operation of a solar farm up to 2.8MW, which will utilise photovoltaic (PV) modules to generate electricity.

The Project is located on the former Nillumbik landfill site, adjoining Nillumbik Recycling Centre at 290 Yan Yean Road, Plenty, Victoria.

The PV panels will face north (Azimuth 0 degrees) in rows running east-west and will be mounted on a fixed frame system with a tilt angle of 15 degrees. The PV panels, including the mounting structures, will be a maximum height of 1.25 metres.

1.1. Location

The Project site is located approximately 1.6 km north of Plenty, within the Shire of Nillumbik Local Government Area, *refer Figure 1.*

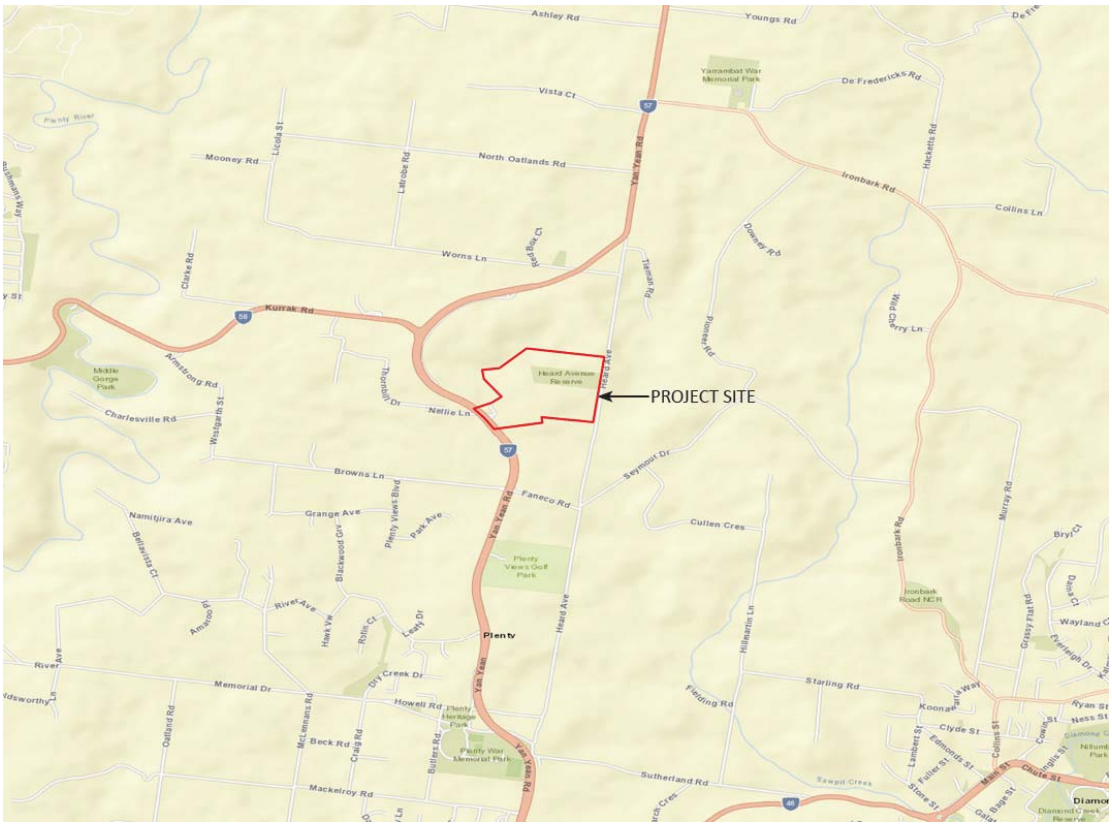


Figure 1. Location Plan

The former landfill site has been filled and capped, providing a cleared and undulating surface.

The site is zoned PUZ6 Public Land Use Zone for Local Government and surrounded by rural residential lots zoned RCZ3 – Rural Conservation Zone. To the west is Yan Yean Road (Route 57) and to the east is Heard Avenue.

2. SCOPE OF THE ASSESSMENT

The scope of this Glint and Glare Impact Assessment includes the following:

- Description of the methodology used to undertake the study;
- Assessment of the baseline conditions;
- Description of the elements of the Project with the potential to influence glare including size, height, and angle of PV modules, and types of framing;
- Identification of the viewshed and potential visibility of the Project;
- Desktop mapping of potential glare at the location of sensitive receptors within the viewshed, based on Solar Glare Hazard Analysis and viewshed analysis;
- Assessment of the potential glare hazard affecting sensitive receptors during operation of the Project; and
- Assessment of potential mitigations measures to avoid, mitigate, or manage potential impacts.

3. METHODOLOGY

3.1. Glint and Glare Definitions

Glint and glare refers to the human experience of reflected light.

This study utilises Solar Glare Hazard Analysis software developed in the USA to address policy adherence required for the 2013 U.S. Federal Aviation Administration (FAA) Interim Policy 78 FR 63276. The FAA definitions of glint and glare are as follows:

"Reflectivity refers to light that is reflected off surfaces. The potential effects of reflectivity are glint (a momentary flash of bright light) and glare (a continuous source of bright light). These two effects are referred to hereinafter as "glare," which can cause a brief loss of vision, also known as flash blindness."[1]

The FAA Technical Guidelines distinguishes between glint and glare according to time duration, without correlation to light intensity.

The Solar Energy Facilities Design and Development Guidelines, 2019[2] (Development Guidelines), identifies the difference between glint and glare as intensity:

"Glint can be caused by direct reflection of the sun from the surface of an object, whereas glare is a continuous source of brightness. Glare is much less intense than glint."(p23)

This differentiation is consistent with the descriptions of glint and glare as:

- Glint being specular reflection, a momentary flash of light produced as a direct reflection of the sun in the surface of an object (such as a PV panel); and

[1] Federal Aviation Administration, Version 1.1 April 2018, Technical Guidance for Evaluating Selected Solar Technologies on Airports

[2] The State of Victoria Department of Environment, Land, Water and Planning 2019, Solar Energy Facilities Design and Development GuidelineS

- Glare being a continuous source of brightness relative to the ambient lighting, glare is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun.

Solar Glare Hazard Analysis software evaluates the potential impact of light produced as a direct reflection of the sun from PV modules, this is consistent with the Development Guidelines reference to 'glint', as the more intense type of solar reflectivity. However, the FAA Guidelines refers to direct solar reflection from stationary objects such as fixed frame solar systems, or relatively slow moving objects such as solar tracking systems, as 'glare' since the source of the solar reflectance occurs over a long (not momentary) duration.

For the purpose of this study the term 'glare' is used in reference to the more intense light impact of direct solar reflectivity from PV modules, (defined as 'glint' in the Development Guidelines), over potentially long duration defined as 'glare' by FAA Guidelines.

3.2. Solar glare Assessment Parameters

Solar glare assessment modelling for solar farms is based on the following factors:

- the tilt, orientation, and optical properties of the PV modules in the solar array;
- sun position over time, taking into account geographic location;
- the location of sensitive receptors (viewers); and
- Screening potential of surrounding topography, vegetation and buildings.

3.3. Glare Intensity Categories

The potential hazard from solar glare is a function of retinal irradiance (power of electromagnetic radiation per unit area produced by the sun) and the subtended angle (size and distance) of the glare source.[3]

Glare can be broadly classified into three categories: low potential for after-image, potential for after-image, and potential for permanent eye damage, *Figure 2* illustrates the glare intensity categories used in this study.

[3] HO, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare hazards from Concentrated Solar Power Plants

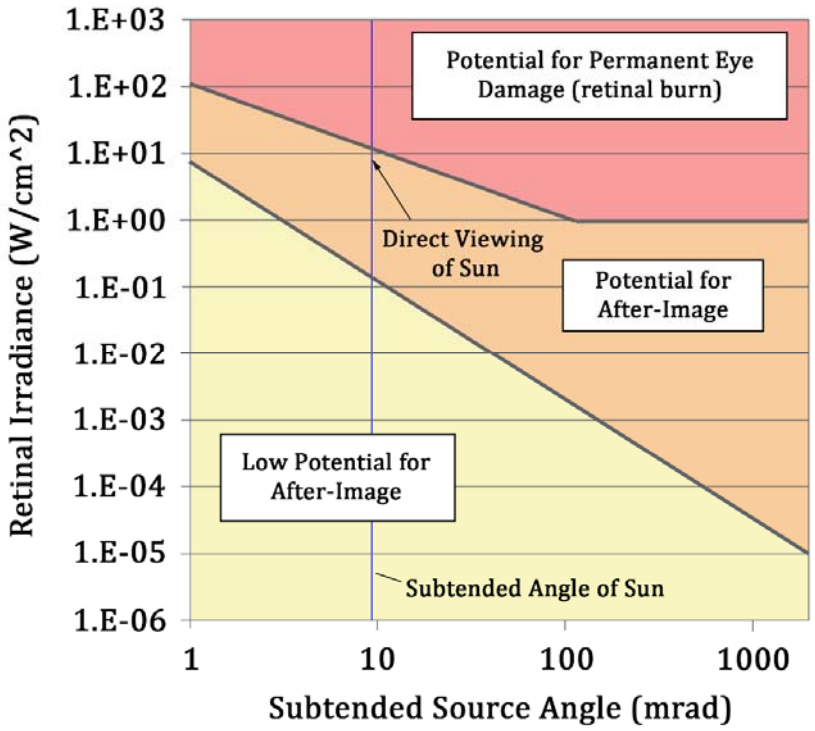


Figure 2. Ocular impacts and Hazard Ranges[4]

The amount of light reflected from a PV module depends on the amount of sunlight hitting the surface, as well as the surface reflectivity. The amount of sunlight interacting with the PV module will vary based on geographic location, time of year, cloud cover, and PV module orientation. 1000W/m^2 is generally used in most counties as an estimate of the solar energy interacting with a PV module when no other information is available. This study modelled scenarios using 2000 W/m^2 in order to cover potentially higher solar energy levels in Australia as compared to other parts of the world. Flash blindness for a period of 4-12 seconds (i.e. time to recovery of vision) occurs when 7-11 W/m^2 (or 650-1,100 lumens/m^2) reaches the eye[5].

3.4. Reflection and Angle of Incidence

PV modules are designed to maximise the absorption of solar energy and therefore minimise the extent of solar energy reflected. PV modules have low levels of reflectivity between 0.03 and 0.20 depending on the specific materials, anti-reflective coatings, and angle of incidence.[6]

The higher reflectivity values of 0.20, that is 20% of incident light being reflected, can occur when the angle of incidence is greater than 50^o. *Figure 3 and 4* show the relationship between increased angles of incidence and increased levels of reflected light. Where the angle of incidence remains below 50° the amount of reflected light remains below 10%. The angle of incidence is particularly

[4] Source: Solar Glare Hazard Analysis Tool (SGHAT) Presentation (2013) https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Ho.pdf
[5] Sandia National Laboratory, SGHAT Technical Manual
[6] *Ho, C. 2013 Relieving a Glare Problem*

relevant to specular reflection (light reflection from a smooth surface). Diffuse reflection (light reflection from a rough surface) may also occur in PV modules, however this is typically a result of dust or similar materials building up on the PV module surface, which would potentially reduce the reflection.

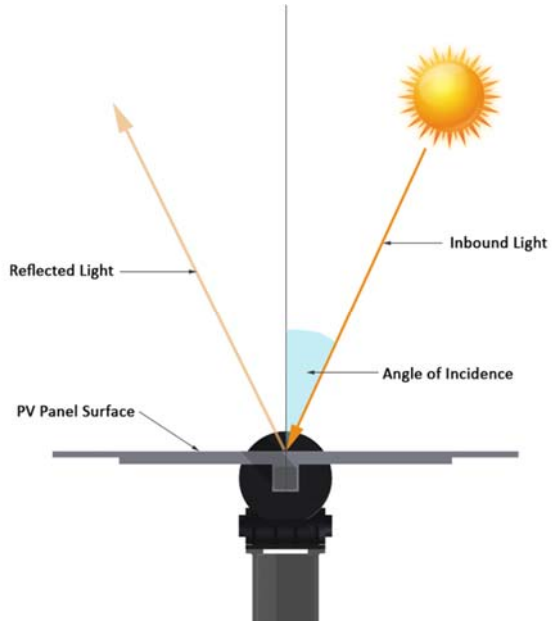


Figure 3. Angle of Incidence Relative to PV Panel Surface

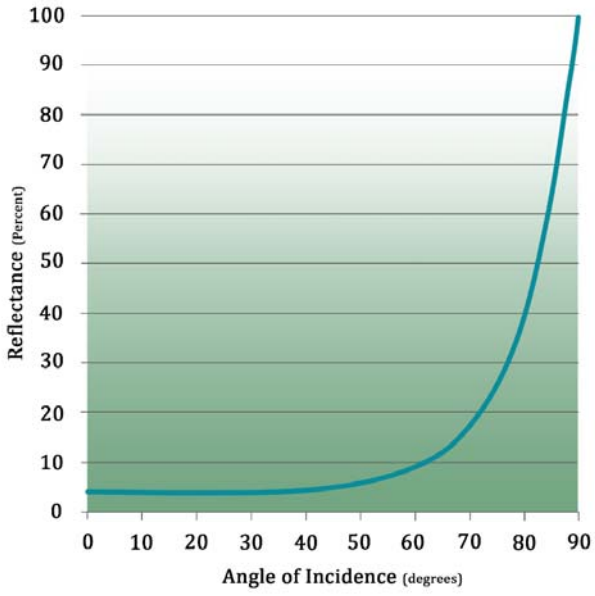


Figure 4. Angles of Incidence and Increased Levels of Reflected Light (Glass (n-1.5))

The sun changes its east-west orientation throughout the day, and the sun's north-south position in the sky changes throughout the year. The sun reaches its highest position at noon on the Summer Solstice (21 December in the Southern Hemisphere) and its lowest position at sunrise and sunset on the Winter Solstice (21 June in the Southern Hemisphere).

In a fixed PV solar array, the angle of incidence varies as the sun moves across the sky, that is the angle of incidence are at their lowest around noon where the sun is directly overhead, and increase in the early mornings and late evenings.

3.5. Viewshed Analysis

A desktop viewshed analysis was undertaken using ArcGIS 3D modelling. The extent of visibility of the proposed solar farm, within a 2km radius, was assessed relative to the location of sensitive receptors (dwellings, roads, etc.) The desktop viewshed analysis is based on topography only and does not take into consideration vegetation.

3.6. Solar Glare Hazard Analysis

This assessment has utilised the Solar Glare Hazard Analysis Tool (SGHAT 3.0) co-developed by Sandi National Laboratory[7] and ForgeSolar (Sim Industries) (referred to as GlareGauge) to assess potential glare utilising latitude and longitudinal coordinates, elevation, sun position, and vector calculations. The PV module orientation, reflectance environment and ocular factors are also considered by the software. If potential glare is identified by the model, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards according to the glare intensity categories (refer *Section 3.3*).

The sun position algorithm used by SGHAT calculates the sun position in two forms: first as a unit vector extending from the Cartesian origin toward the sun, and second as azimuthal and altitudinal angles. The algorithm enables determination of the sun position at one (1) minute intervals throughout the year.

The SGHAT is a high level tool and does not take into consideration the following factors:

- Gaps between PV modules;
- Atmospheric conditions; and
- Vegetation between the solar panels and the viewer (sensitive receptor).

SGHAT has been used extensively in the United States to assess the potential impact of solar arrays located in close proximity to airports. The US Federal Aviation Administration requires the use of SGHAT to demonstrated compliance with the safety requirements for all proposed solar energy systems located at federally obligated airports. Used in conjunction with a viewshed analysis, the two tools represent a conservative assessment.

Route Parameters

The assessment of potential glare impacts to route receptors, people travelling along roads and rail, includes the parameters of direction of travel (single or both directions) and field-of-view (FOV). FOV defines the left and right field-of-view of observers traveling along a route. A view angle of 90° means the observer has a field-of-view of 90° to their left and right, i.e. a total FOV of 180°, refer *Figure 5.*

[7] https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Technical_Reference-v5.pdf

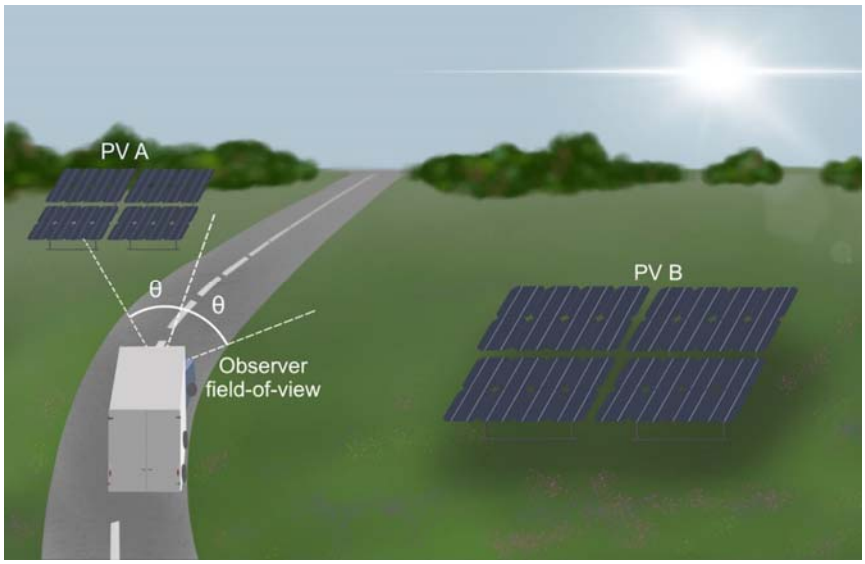


Figure 5. Diagrammatic illustration of Observer Field of View relative to PV array (source: ForgeSolar).

FAA research has identified 'impairment ratings' based on simulations of glare at various angles and duration, and the effect on a pilot's ability to fly a plane[8]. The research identified impairment was highest when the glare source was within a FOV of 25° or less. The impact of glare fell below 'slight impairment' rating when the glare source was at an angle of 50° from the direction of travel. When the glare source was located at an angle of 90° the impairment rating reduced further. In relation to piloting a plane, the report noted there was no significant difference in impairment when the source of glare angle was increased from 50° to 90°. In conclusion the research noted 'these results taken together suggest that any sources of glare at an airport may be potentially mitigated if the angle of the glare is greater than 25° from the direction that the pilot is looking in'.

SGHAT default parameters is FOV 50°, this assessment increased the FOV to 90°, representing a conservative assessment of potential hazard to drivers using roads and rail network within the vicinity of the solar farm.

3.7. Hazard Assessment

Once the potential for solar glare has been identified through the viewshed analysis and SGHAT, which is based on topography only, an assessment of the likelihood of glare hazard occurring is undertaken taking into consideration existing mitigating factors such as existing vegetation, buildings, and minor topographic variations outside the parameters of the modelling. Embedded mitigation measures, such as proposed vegetation screens to be undertaken as part of the Project, are also considered to identify residual glare potential. An assessment is then undertaken to identify the potential significance of the glare hazard based on the magnitude (amount and intensity) of the glare hazard generated, duration and frequency, distance from the Project, and the sensitivity of the receptors (viewers). Additional mitigation measures, beyond those previously considered as part of the Project, maybe required to manage any residual glare hazards.

[8] https://www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/media/201512.pdf

3.8. Limitations to the assessment

This desktop assessment is based on a geometric analysis of potential glare using SGHAT software modelling. The parameters of the modelling are based on the default values within the software. Where these values have been altered (generally increased), this has been noted in the assessment.

The assessment considers potential impacts of solar glare under normal operational procedures, potential impacts during construction and non-operational events have not been assessed.

Field tests has not been undertaken as part of the assessment, therefore the modelling is reliant on the algorithms contained in the software.

SGHAT software is used under license to Sims Industries d/b/a ForgeSolar, refer to assumptions and limitations listed in the data output (Appendices) and for further information refer to www.forgesolar.com/help/.

Environmental Ethos does not verify the accuracy of the SGHAT software modelling. Responsibility and accountability for the accuracy of the SGHAT software (GlareGauge) resides with Sims Industries d/b/a ForgeSolar.

4. EXISTING CONDITIONS

The baseline is a statement of the characteristics which currently exist in the Project area. The baseline glare condition assessment takes into consideration the following:

- Characteristics of the environment that may affect the potential for glare;
- Land use and human modifications to the landscape such as roads, buildings and existing infrastructure which may influence glare and sensitivity to glare.

4.1. Baseline Conditions

The Project site is located on a former landfill site within what was once a narrow valley. The landfill area has been capped and grassed, resulting in a cleared and undulating surface profile. The site is surrounded on three sides by wooded hills, and is located behind the existing Nillumbik recycling centre. The site is generally screened from surrounding areas by topography and vegetation.

Large lot residential properties surround the site, with some pockets of residential development to the west. A small number of dwellings have views into the site from elevated positions in the surrounding hills.

The Project site is located 25km to the east of Melbourne Airport, 20km to the east of Essendon Airport, and 21km from Lilydale Airport.

There are no existing features in the landscape with the potential to contribute to glare hazard.

4.2. Atmospheric Conditions

Atmospheric conditions such as cloud cover, dust and haze will impact light reflection, however these factors have not been accounted for in this glare assessment. The Bureau of Meteorology statistics for Bundoora (Latrobe University) approximately 10km to the south west of the Project site (the closest BOM records for cloud cover statistics) recorded 80 cloudy days per year (mean

number over the period 1979 to 2002)[9]. Cloudy days predominantly occur during the winter months, June to July. Since atmospheric conditions have not been factored into this assessment modelling, statistically the glare potential represents a conservative assessment.

5. PROJECT DESCRIPTION

The general layout of the Project is as shown in *Figure 6.* The main elements of the Project with the potential to influence glare are the tilt, orientation, and optical properties of the PV modules in the solar array. Whilst specific products are yet to be finalised for the Project, the general technical properties of the main elements influencing glare are described below.

5.1. PV modules

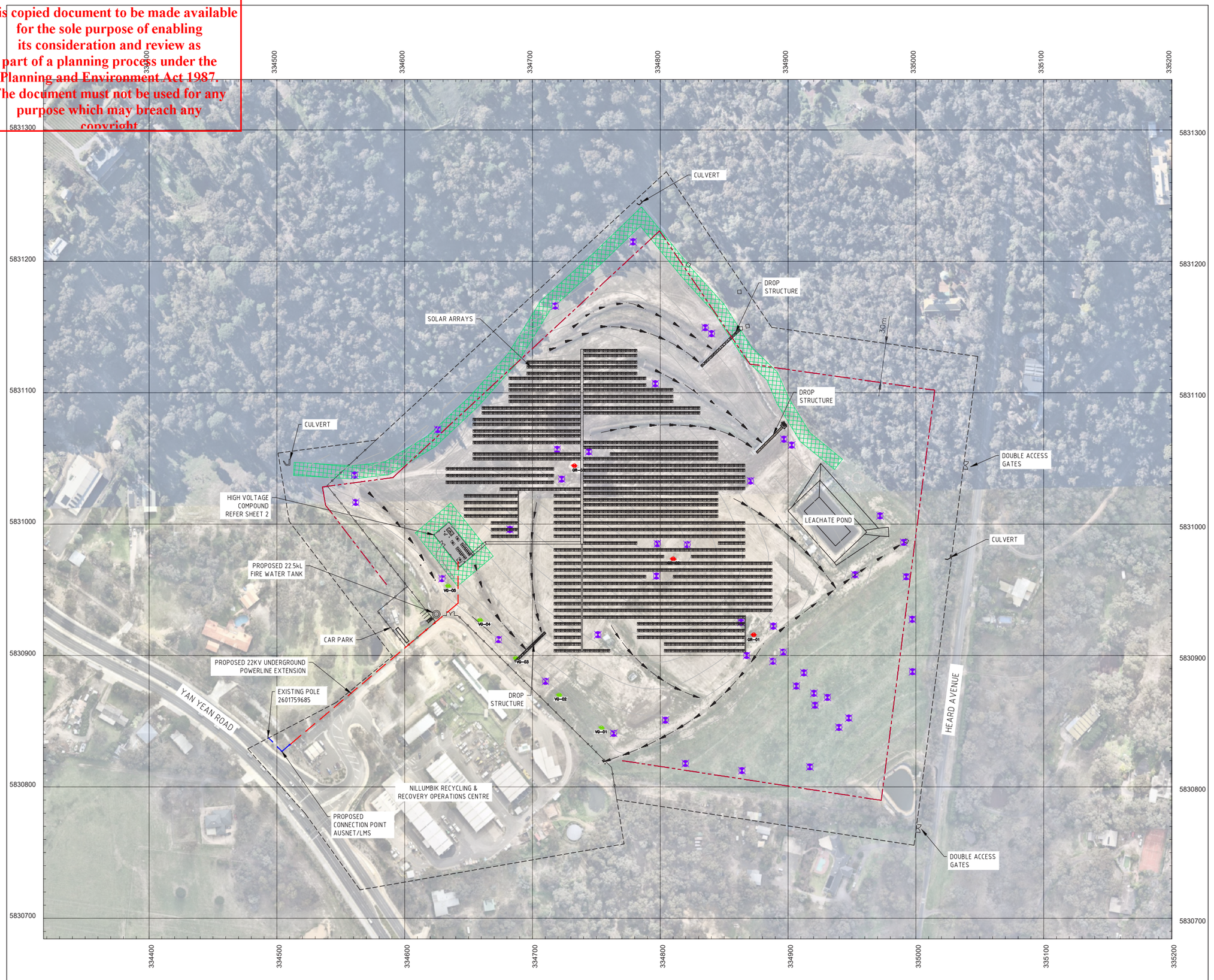
The approximate dimensions for the solar panel selected for the Project is 2.2 metres x 1.25 metre. The proposed solar array arrangement for this Project is one (1) solar panels in portrait, resulting in an array width of approximately 2.2 metres wide.

5.2. Fixed Frame System

This study assessed the potential glare impacts of a fixed tilt system in which the PV panels are supported by a frame at a fixed angle. The zenith tilt angle of the panels was set at 15 degrees, that is, the panels are tilted to the north at 15 degrees where 0 degrees is parallel to the ground. The PV panels are orientated 0 degrees due north. The maximum height of the PV modules above natural ground is anticipated to be 1.25 metres.

Photo 1. Example of a typical fixed tilt system

[9] http://www.bom.gov.au/climate/averages/tables/cw_086351.shtml



ENVIRONMENTAL ETHOS

LEGEND

- FIRE BREAK (10m WIDE)
- PROPOSED 22kV UNDERGROUND LINE
- PROPOSED 22kV OVERHEAD LINE
- PROPERTY BOUNDARY
- FACILITY FENCE
- PV MODULES
- LFG CLEANOUT PIPE
- LFG RELIEF VENT
- VERTICAL GAS WELL

PV SYSTEM DETAILS

SITE ADDRESS: 290 YAN YEAN ROAD, PLENTY, VIC, 3090
NMI: TBA
GENERATION CAPACITY: 4900 kW

NOTES:
1) LAYOUT IS BASED ON AERIAL IMAGERY. DIMENSIONS ARE ONLY APPROXIMATE.
2) DETAILED ONSITE MEASUREMENTS TO BE TAKEN BY THE INSTALLATION CONTRACTOR PRIOR TO CONSTRUCTION.
3) FOR DC DESIGN DETAIL REFER TO 30032-ES-102 SOLAR FACILITY DC SCHEMATICS.
4) REFER TO 30032-GA-104 SOLAR FACILITY SET-OUT & LEVEL SURVEY FOR DATUM AND CO-ORDINATES.
5) REFER TO 30032-GA-103 SOLAR FACILITY SOLAR ARRAY FOOTING SET-OUT ARRANGEMENT FOR POSITION OF SOLAR ARRAY CONCRETE BLOCKS.
6) AUSNET/LMS POINT OF CONNECTION PROPOSED AT NEW POLE MOUNTED RECLOSER ON YAN YEAN ROAD. FINAL CONNECTION ARRANGEMENT TO BE ADVISED BY AUSNET.
7) PROPOSED CARPARK TO BE INSTALLED BY COUNCIL.
8) REFER CONNECTION POINT LOCALITY PLAN 30032-EA-118 FOR HV CONNECTION.

SOURCE: LMS ENERGY
30032-GA-111
REV. A 24/08/2021

PROJECT NO. 21010
CREATED BY: SC
DATE: 12 07 2021 VERSION: B

NILLUMBIK SOLAR FARM

GLINT AND GLARE IMPACT ASSESSMENT

PROJECT LAYOUT PLAN

FIGURE 6.0

5.3. Solar Inverters, Control Room, and Fencing

The Project will also include solar inverters and a control/switch building, these elements are not considered likely to influence solar glare as they generally comprise of non-reflective surfaces typically found in the built environment.

6. DESKTOP GLARE ASSESSMENT

The aim of the desktop glare assessment is to identify if any sensitive receptors have the potential to be impacted by glare. The software modelling systems used in the desktop assessment include viewshed modelling to identify the location of sensitive receptors with line of sight to the Project, and the SGHAT to identify the potential and ocular significance of glare.

6.1. Viewshed Analysis

The results of the viewshed analysis (based on topography) are shown in *Figure 7.*

The Digital Elevation Model (DEM) for the viewshed modelling was set as 'Finest' (> 10 m). Contour information for the site (DELWP dataset) was assessed and shows the Project site is located within a narrow valley surrounded on three sides by wooded hills.

The desktop assessment identified visibility of the Project is generally limited by the surrounding hill to the north, east and west. Visibility extends along the valley in a south and south easterly direction.

40 observation points were assessed within the viewshed including 37 dwellings and 3 observation points at commercial (non-residential) buildings. All observation point locations and numbers shown in *Figure 7* are consist with the glare modelling results provided in the appendices and detailed in *Table 1*.

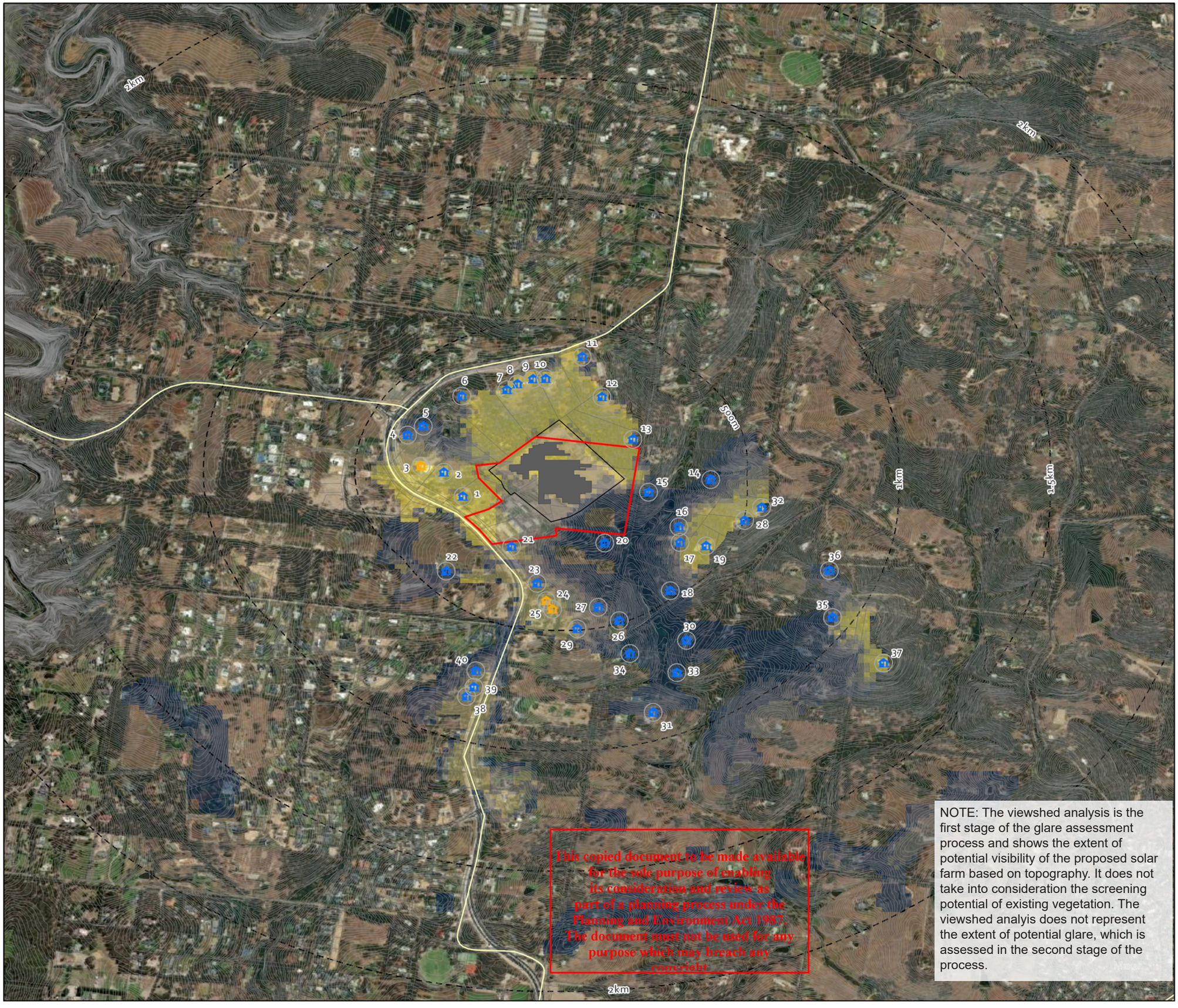
Table 1. Location of Observation Points relative to distance from the Project

Distance from Project	Observation Points (Residential dwellings and commercial facilities)	Identified as potentially visible in the viewshed modelling
<500m	29 (OP1 to OP29) residential properties and 3 commercial (non-residential) properties	Yes
500m – 1km	10 (OP30 TO OP36, and 38 to 40) residential properties	Yes
1km – 2km	1 (OP37) residential property	Yes

The following roads pass through the viewshed and these were included in the glare modelling (both directions of travel) as follows:

- Yan Yean Road (57)
- Heard Ave
- Faneco Road and Seymour Drive

Melbourne Airport, Essendon Airport, and Lilydale Airport are outside the viewshed of the Project, and at a distance greater than 20km from the site, these facilities are not considered close enough to be affected by the Project.



NOTE: The viewshed analysis is the first stage of the glare assessment process and shows the extent of potential visibility of the proposed solar farm based on topography. It does not take into consideration the screening potential of existing vegetation. The viewshed analyis does not represent the extent of potential glare, which is assessed in the second stage of the process.

ENVIRONMENTAL ETHOS

N

DATUM GDA 1994,
PROJECTION MGA ZONE 56

0 0.1 0.2 0.4 0.6 0.8
Kilometers

SCALE 1:15,000 @ A3

Legend ADVERTISED PLAN

- SITE BOUNDARY
- PERIMETER FENCE
- PV MODULE AREA
- DISTANCE FROM SOLAR FARM
- DWELLINGS*
- COMMERCIAL/PUBLIC PROPERTIES

EXTENT OF VISIBILITY*

Less visible

More visible

*(Analysis based on Digital Terrain Model)

*RURAL DWELLING LOCATIONS BASED ON DESKTOP ASSESSMENT GROUND-TRUTHING EXCLUDED

PROJECT No. 21010
CREATED BY: SC
DATE: 11 07 2021
VERSION: B

NILLUMBIK SOLAR FARM

GLINT AND GLARE ASSESSMENT

VIEWSHED ANALYSIS

FIGURE 7.0

6.2. Solar Glare Hazard Analysis

The parameters used in the SGHAT model are detailed in *Tables 2.*

Table 2. Input data for SGHAT Analysis – Fixed Frame System

SGHAT Model Parameters	Values
Time Zone	UTC +10
Axis Tracking	Fixed (no rotation)
Tilt	15 degrees
Orientation	0 degrees
Module Surface material	Smooth glass without anti-reflective coating (ARC)
Reflectivity	Vary with sun
Correlate slope error with surface type?	Yes
Slope error	6.55mrad
Height of panels above ground	1.3 m maximum height

6.3. Solar Glare Hazard Analysis Tool (SGHAT) Results

The assessment outcomes for the SGHAT modelling are outlined in *Table 3,* locations of the observation points are shown in *Figure 7*.

Table 3. SGHAT Assessment Results – Fixed Frame System

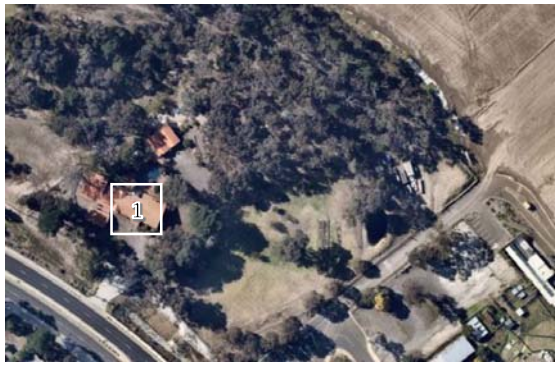
Sensitive Receptor	Glare Potential
10 Observation Points Residential Dwellings at OP1, OP2, OP4, OP5, OP13, OP14, OP15, OP28, OP32 Non-residential building at OP3	Glare Potential – refer Table 4
28 Observation Points Residential Dwellings at OP6 – OP12, OP16-OP23, OP26-27, OP29-31, OP33 - OP40	No Glare
2 Observation Points Commercial Facilities at OP24, OP25	No Glare
Yan Yean Road	Glare Potential– refer Table 4
Heard Ave	Glare Potential– refer Table 4
Faneco Rd & Seymour Dr	Glare Potential – refer Table 4

The SGHAT modelling found potential glare hazard affecting nine (9) residential dwellings, one (1) non-residential building, and three (3) roads within the study area, *refer Appendix A.* Viewshed and SGHAT modelling are based on topography only and these models do not take into consideration the screening potential of existing vegetation and buildings within the landscape, and minor variations in topography (below the scale of measurements used in the modelling). The potential screening effect of these elements in relation to line of sight between the Project and potentially affected dwellings, non-residential buildings, and roads are detailed in section 6.4.

6.4. Existing Mitigation Factors in the Landscape

A summary of the likelihood of potential glare hazard to affect sensitive receptors identified in the SGHAT modelling taking into consideration existing mitigating factors (minor variations in topography, existing vegetation, existing buildings, and distance from the site) is outline in *Table 4*. Information was derived from the aerial photography and 'Streetview'. In addition, photographs from specific locations surrounding the site were obtained and used to verify the extent of existing vegetation. Existing screen planting surrounding the Project site is also detailed in the Project Landscape Plan.

Table 4. Analysis of likelihood of glare hazard potential based on existing mitigation factors

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP1 Dwelling	<500m	Glare Potential (Yellow) – OP1: 1,489 minutes per year Early morning – spring and autumn.	Existing vegetation to the east of the house likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards dwelling at OP1 showing intervening screening vegetation*	Monitor potential impacts via the Project EMP including a formal complaints process.	Possible – Very small to negligible amount of glare through tree canopy	None to Low Impact

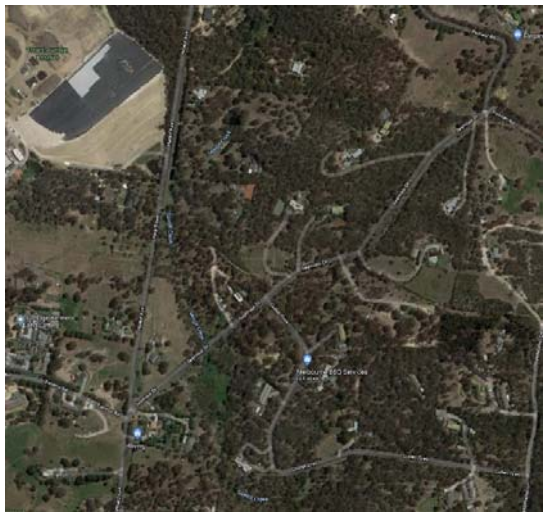
Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP2 Dwelling	<500m	Glare Potential (Yellow) – OP2: 4,906 minutes per year.	Existing vegetation to the east of the dwelling likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards dwellings at OP1, OP2 & OP3 showing intervening screening vegetation.*	Monitor potential impacts via the Project EMP including a formal complaints process.	Possible – Very small to negligible amount of glare through tree canopy	None to Low Impact

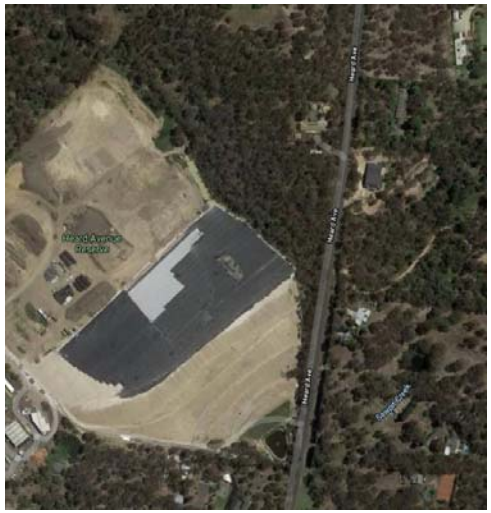
Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP3 Non-residential (shed)	<500m	OP3: 4,902 minutes per year Early morning – spring to autumn.	Existing vegetation to the east of the non-residential building likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards building at OP3 showing intervening screening vegetation*	Non-residential building. Monitor potential impacts via the Project EMP including a formal complaints process.	Possible – Very small to negligible amount of glare through tree canopy	None to Low Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP4 & OP5 Dwellings	<500m	Glare Potential (Yellow) – OP4 5,116 minutes per year. OP5 4,354 minutes per year Early morning – spring to autumn.	Existing vegetation to the east of the houses likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards OP4 and OP5 showing intervening screening vegetation*	N/A	Unlikely	No Impact

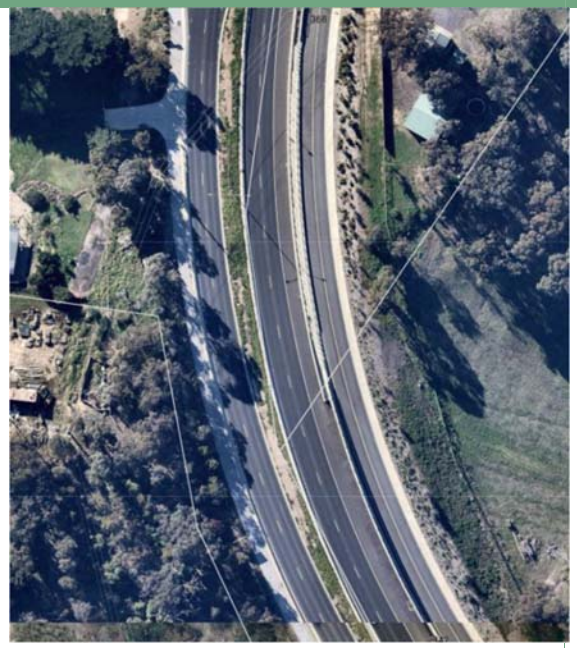
Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP13 OP14 OP15 Dwellings	<500m	Glare Potential (Yellow) – OP13 5,805 minutes per year Late afternoon – spring to autumn. OP14 468 minutes per year. Late afternoon – spring and autumn. OP15 338 minutes per year Late afternoon – spring and autumn.	Existing vegetation to the west of the houses likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards OP13, OP14 and OP15 showing intervening screening vegetation*	N/A	Unlikely	No Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
OP28 OP32 Dwellings	<500m to just over 500m	Glare Potential (Yellow) – OP28 123 minutes per year Late afternoon – April and September OP32 497 minutes per year. Late afternoon – April and September	Existing vegetation to the west of the houses likely to provide screening from glare hazard identified in the model.	 *Aerial Image*  *View from site towards OP28 and OP32 showing intervening screening vegetation*	N/A	Unlikely	No Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
Faneco Rd & Seymour Dr	500m – 1km	Glare Potential (Yellow) 271 minutes per year. Late afternoon – March and September	Existing vegetation and minor variations in topography provides substantial screening.	 *Aerial Image*  *View from Seymour Dr towards site showing intervening screening vegetation*	N/A	Unlikely	No Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
Heard Ave	<500m	Glare Potential (Yellow) 9,222 minutes per year. Late afternoon – Spring to Autumn	Existing vegetation and minor variations in topography provides substantial screening.	 *Aerial Image*  *View along Heard Ave showing roadside vegetation.*	N/A	Unlikely	No Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
Yan Yean Road	<500m	Glare Potential (Yellow) 6,286 minutes per year. Early morning – Spring to Autumn	Existing vegetation and minor variations in topography provides screening along the majority of Yan Yean Road. A short section of road to the west of the Project site has view towards the site and this section was identified as having potential glare hazard. Recent road works included tree planting along this section of road which is likely to provide some screening once established.	 *Aerial Image*	Monitor potential impacts via the Project EMP and provide additional planting if required to maintain a dense vegetation screen.	Possible – Small amount of glare over the tree canopy	Low Impact

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
				 *Aerial Image – section of road exposed to potential glare, showing recent landscape screening to properties on the east side which is also likely to provide some screening to the proposed solar farm, once established.*			

Sensitive Receptor	Distance from glare source	Glare Potential (SGHAT model based on topography)	Existing mitigating factors	Images of screening elements in the landscape	Proposed mitigation measures	Likelihood of glare hazard prior to screen planting	Likelihood of glare hazard after screen planting established
				 *View from Yan Yean Road showing the Project site visible in the background.*			

Yellow = Glare with potential to cause temporary after-image

Of the nine (9) dwellings, one (1) non-residential building, and three (3) roads identified in the SGHAT modelling with the potential to be impacted by glare, seven (7) of the dwellings and two (2) roads were identified in the assessment as unlikely to be affected due to intervening screening vegetation.

Two (2) dwellings (OP1 and OP2) and the non-residential building (OP3) to the west of the Project site are currently screened by existing vegetation, which is likely to effectively screen the majority of glare hazard. The density of existing vegetation and its effective screening potential will be monitored and maintained as detailed in the Project Landscape Plan, further information is detailed in *Section 7*.

A section of Yan Yean Road, located in an elevated location to the west of the site has partial views of the site over the existing tree canopy. This section of road was identified as having potential glare hazard. Recent road works along the exposed section of Yan Yean road included landscape treatment to the east side of the road. It is considered likely this landscape treatment, which included planting of Red Box trees, will provide some screening to the east side of the road, and once established, has the potential to reduce the glare hazard identified in the modelling.

Mitigation measures to address the potential glare hazard at these locations are detailed below.

7. MANAGEMENT AND MITIGATION MEASURES

7.1. Mitigation measures for potential impacts on dwellings and non-residential buildings

All dwellings identified as having the potential to be impacted by glare in the modelling are substantially screened by existing vegetation. Therefore management of surrounding vegetation is important to maintaining effective screening during the life of the Project.

Two (2) dwellings (OP1 and OP2) and the non-residential building (OP3) to the west of the Project require consideration of potential glare hazard. Whilst the likelihood of glare affecting the amenity of occupants at these locations is considered very low, the potential small hazard can be managed by maintaining and enhancing existing vegetation screens to ensure effective density and height.

A formal Complaints Process will be included in the Project Environmental Management Plan (EMP) for managing concerns regarding glare and provides a rectification procedure that may include additional vegetation where appropriate.

7.2. Mitigation measures for potential impacts on roads

The section of Yan Yean Road identified in the modelling as potentially affected by glare is located south of Kurrak Road intersection and north of entrance to the recycling centre, and extends approximately 250m. The intersections are not affected by glare due to screening by topography and vegetation. Travellers heading south are more likely to be impacted, glare hazard potential occurs during the early morning between spring and autumn.

Recent road works in this location included landscape treatment and tree planting along the road verges and these plantings are considered likely to provide some screening in the future.

As detailed previously a formal Complaints Process will be incorporated in to the Project EMP to manage concerns regarding glare hazard and provide rectification measures if required.

8. SUMMARY

In summary, based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The viewshed modelling (based on DEM) identified visibility of the Project is generally limited by the surrounding hill to the north, east and west. Visibility extends along the valley in a south and south easterly direction.
- Within 1km of the Project site, 37 dwellings and 3 commercial/non-residential buildings were considered as having potential line of sight to the Project and were included in the SGHAT modelling.
- The SGHAT modelling found potential glare hazard affecting 9 residential dwellings, 1 non-residential building and three roads within the study area.
- Out of the 9 dwellings identified by the modelling, 7 of the dwellings and 2 roads were identified in the assessment as unlikely to be impacted due to intervening screening vegetation.
- 2 dwellings (OP1 and OP2) and 1 non-residential building (OP3) to the west of the Project were identified in the glare modelling as having the potential to be impacted. Substantial screening provided by existing vegetation is considered likely to reduce the potential of glare hazard to occur to 'low likelihood'.
- A 250m section of Yan Yean Road was identified in the modelling as potentially affected by glare. Travellers heading south are more likely to be impacted, glare hazard potential occurs during the early morning between spring and autumn. Recent road works in this location included landscape treatment and tree planting along the road verges and these plantings are considered likely to provide some screening in the future. The Project Landscape Plan provides details of the road side planting which will assist in reducing the likelihood of glare affecting travellers along Yan Yean Road.
- Melbourne Airport, Essendon Airport and Lilydale Airport are outside the viewshed of the Project, and at a distance greater than 20km from the site, these facilities are not considered 'close' enough to be affected by the Project.

APPENDIX A:

SOLAR GLARE HAZARD ANALYSIS RESULTS

ForgeSolar

NillumbikSF

NillumbikSF_OPs

Created July 7, 2021
Updated Oct. 5, 2021
Time-step 1 minute
Timezone offset UTC10
Site ID 56181.10045

Project type Advanced
Project status: active
Category 500 kW to 1 MW

Misc. Analysis Settings

DNI: **varies (2,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

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
PV array 1	15.0	0.0	0	43,777	-

Component Data

PV Array(s)

Total PV footprint area: 37,369 m^2

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 0.0 deg
Footprint area: 37,369 m^2
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.652020	145.126465	135.08	1.30	136.38
2	-37.651948	145.126472	134.63	1.30	135.93
3	-37.651956	145.127191	134.75	1.30	136.05
4	-37.652028	145.127187	135.23	1.30	136.53
5	-37.652024	145.126941	135.58	1.30	136.88
6	-37.652197	145.126944	136.50	1.30	137.80
7	-37.652205	145.127038	136.59	1.30	137.89
8	-37.652307	145.127034	136.91	1.30	138.21
9	-37.652307	145.127222	136.74	1.30	138.04
10	-37.652378	145.127216	136.90	1.30	138.20
11	-37.652385	145.127387	136.41	1.30	137.71
12	-37.652452	145.127383	136.76	1.30	138.06
13	-37.652439	145.126532	137.18	1.30	138.48
14	-37.652608	145.126531	138.03	1.30	139.33
15	-37.652621	145.127829	135.07	1.30	136.37
16	-37.652797	145.127820	135.84	1.30	137.14
17	-37.652805	145.128232	132.94	1.30	134.24
18	-37.652901	145.128222	134.20	1.30	135.50
19	-37.652903	145.127818	136.22	1.30	137.52
20	-37.652956	145.127817	136.47	1.30	137.77
21	-37.652958	145.128016	135.66	1.30	136.96
22	-37.653002	145.128014	135.75	1.30	137.05
23	-37.652994	145.127619	137.07	1.30	138.37
24	-37.653164	145.127609	137.59	1.30	138.89
25	-37.653173	145.127841	136.71	1.30	138.01
26	-37.653220	145.127833	136.80	1.30	138.10
27	-37.653228	145.128072	136.39	1.30	137.69
28	-37.653394	145.128060	136.49	1.30	137.79
29	-37.653398	145.128270	135.77	1.30	137.07
30	-37.653810	145.128245	135.62	1.30	136.92
31	-37.653808	145.127922	136.68	1.30	137.98
32	-37.654236	145.127906	135.37	1.30	136.67
33	-37.654232	145.127204	137.06	1.30	138.36
34	-37.654080	145.127210	137.72	1.30	139.02
35	-37.654078	145.126876	136.72	1.30	138.02
36	-37.653991	145.126884	137.11	1.30	138.41
37	-37.653976	145.126500	136.11	1.30	137.41
38	-37.654167	145.126497	135.31	1.30	136.61
39	-37.654170	145.126695	135.96	1.30	137.26
40	-37.654297	145.126697	135.45	1.30	136.75
41	-37.654284	145.126232	133.03	1.30	134.33
42	-37.653071	145.126252	138.17	1.30	139.47
43	-37.653077	145.125911	138.29	1.30	139.59
44	-37.653328	145.125917	135.71	1.30	137.01
45	-37.653321	145.125649	136.65	1.30	137.95
46	-37.653117	145.125655	137.36	1.30	138.66
47	-37.653107	145.125379	136.86	1.30	138.16
48	-37.652967	145.125376	136.92	1.30	138.22
49	-37.652965	145.125221	136.47	1.30	137.77
50	-37.652795	145.125226	136.47	1.30	137.77
51	-37.652799	145.125623	137.61	1.30	138.91
52	-37.652460	145.125623	137.52	1.30	138.82
53	-37.652461	145.125716	137.65	1.30	138.95
54	-37.652369	145.125724	137.37	1.30	138.67
55	-37.652368	145.125913	137.10	1.30	138.40

56	-37.652194	145.125913	136.02	1.30	137.32
57	-37.652192	145.126055	136.08	1.30	137.38
58	-37.652092	145.126055	135.12	1.30	136.42
59	-37.652088	145.126318	135.29	1.30	136.59
60	-37.652018	145.126323	134.63	1.30	135.93

Route Receptor(s)

Name: Faneco Rd Seymour Dr
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.658915	145.125317	133.69	2.00	135.69
2	-37.659089	145.126659	135.07	2.00	137.07
3	-37.659293	145.127410	134.79	2.00	136.79
4	-37.659777	145.128708	123.26	2.00	125.26
5	-37.659119	145.129614	104.73	2.00	106.73
6	-37.658545	145.130510	92.88	2.00	94.88
7	-37.658112	145.131186	99.80	2.00	101.80
8	-37.657135	145.132645	116.94	2.00	118.94
9	-37.656893	145.133686	110.67	2.00	112.67
10	-37.656704	145.134318	113.82	2.00	115.82
11	-37.655982	145.134918	119.58	2.00	121.58
12	-37.654810	145.135938	128.56	2.00	130.56
13	-37.654182	145.137000	139.55	2.00	141.55

Name: Heard Ave
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.646305	145.131155	180.08	2.00	182.08
2	-37.652115	145.130254	155.08	2.00	157.08
3	-37.653848	145.129970	125.75	2.00	127.75
4	-37.655305	145.129675	102.79	2.00	104.79
5	-37.657777	145.129133	112.28	2.00	114.28
6	-37.658690	145.128945	117.07	2.00	119.07
7	-37.659165	145.128897	116.51	2.00	118.51
8	-37.659675	145.128854	122.08	2.00	124.08

Name: Yan Yean Road
Route type Two-way
View angle: 90.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-37.648318	145.127696	170.18	2.00	172.18
2	-37.648571	145.126929	170.21	2.00	172.21
3	-37.648839	145.125379	170.30	2.00	172.30
4	-37.649088	145.124096	172.02	2.00	174.02
5	-37.649338	145.123026	173.94	2.00	175.94
6	-37.649554	145.122648	173.29	2.00	175.29
7	-37.650542	145.121631	173.82	2.00	175.82
8	-37.651241	145.120878	173.05	2.00	175.05
9	-37.652022	145.120599	172.52	2.00	174.52
10	-37.652589	145.120623	171.47	2.00	173.47
11	-37.653143	145.120862	167.24	2.00	169.24
12	-37.653500	145.121141	165.02	2.00	167.02
13	-37.653950	145.121806	160.43	2.00	162.43
14	-37.654366	145.122728	152.70	2.00	154.70
15	-37.654772	145.123445	145.84	2.00	147.84
16	-37.655233	145.123938	140.50	2.00	142.50
17	-37.655883	145.124542	137.18	2.00	139.18
18	-37.656525	145.125090	136.01	2.00	138.01
19	-37.657040	145.125360	134.23	2.00	136.23
20	-37.657560	145.125443	133.14	2.00	135.14
21	-37.658333	145.125454	133.59	2.00	135.59
22	-37.659327	145.125142	132.53	2.00	134.53
23	-37.660652	145.124660	134.83	2.00	136.83
24	-37.663312	145.123646	141.56	2.00	143.56
25	-37.663899	145.123568	142.45	2.00	144.45
26	-37.665540	145.124123	133.50	2.00	135.50

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-37.653980	145.123404	149.17	1.50	150.67
OP 2	-37.653054	145.122685	154.00	1.50	155.50
OP 3	-37.652689	145.121752	159.08	1.50	160.58
OP 4	-37.651669	145.121387	177.13	1.50	178.63
OP 5	-37.651331	145.122004	175.29	1.50	176.79
OP 6	-37.650231	145.123398	185.11	1.50	186.61
OP 7	-37.649993	145.125185	181.35	1.50	182.85
OP 8	-37.649802	145.125501	182.06	1.50	183.56
OP 9	-37.649572	145.126048	182.43	1.50	183.93
OP 10	-37.649589	145.126590	177.15	1.50	178.65
OP 11	-37.648837	145.127947	171.73	1.50	173.23
OP 12	-37.650273	145.128564	169.55	1.50	171.05
OP 13	-37.651869	145.129787	160.97	1.50	162.47
OP 14	-37.653328	145.132545	124.82	1.50	126.32
OP 15	-37.653825	145.130308	126.52	1.50	128.02
OP 16	-37.655082	145.131579	118.48	1.50	119.98
OP 17	-37.655965	145.131161	121.10	1.50	122.60
OP 18	-37.657517	145.131184	109.78	1.50	111.28
OP 19	-37.655912	145.132578	142.49	1.50	143.99
OP 20	-37.655682	145.128707	110.80	1.50	112.30
OP 21	-37.655820	145.125411	135.02	1.50	136.52
OP 22	-37.656758	145.122921	141.51	1.50	143.01
OP 23	-37.657208	145.126237	134.92	1.50	136.42
OP 24	-37.657873	145.126577	138.92	1.50	140.42
OP 25	-37.658198	145.126809	139.38	1.50	140.88
OP 26	-37.658593	145.129291	113.06	1.50	114.56
OP 27	-37.658081	145.128432	121.10	1.50	122.60
OP 28	-37.654905	145.133934	161.23	1.50	162.73
OP 29	-37.658932	145.127541	134.64	1.50	136.14
OP 30	-37.659316	145.131822	100.13	1.50	101.63
OP 31	-37.662276	145.130288	112.29	1.50	113.79
OP 32	-37.654402	145.134671	160.48	1.50	161.98
OP 33	-37.660509	145.131248	90.49	1.50	91.99
OP 34	-37.659961	145.129408	114.10	1.50	115.60
OP 35	-37.658456	145.137280	142.75	1.50	144.25
OP 36	-37.656774	145.137154	158.32	1.50	159.82
OP 37	-37.660226	145.139241	156.60	1.50	158.10
OP 38	-37.661514	145.123710	137.21	1.50	138.71
OP 39	-37.661093	145.123860	136.33	1.50	137.83
OP 40	-37.660592	145.123914	135.75	1.50	137.25

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	15.0	0.0	0	43,777	-	-

Distinct glare per month

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

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1 (green)	0	0	0	0	0	0	0	0	0	0	0	0
pv-array-1 (yellow)	2902	2360	1896	314	0	0	0	50	1338	2407	2785	2932

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 potential temporary after-image

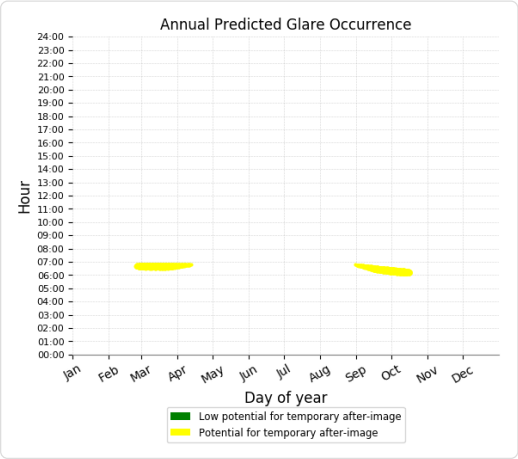
Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	1489
OP: OP 2	0	4906
OP: OP 3	0	4902
OP: OP 4	0	5116
OP: OP 5	0	4354
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	5805
OP: OP 14	0	468
OP: OP 15	0	338
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0

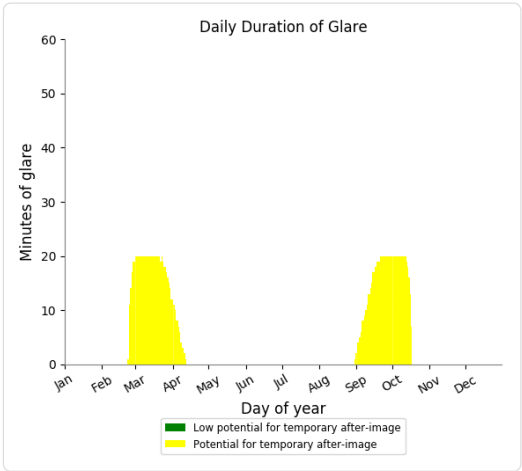
OP: OP 27	0	0
OP: OP 28	0	123
OP: OP 29	0	0
OP: OP 30	0	0
OP: OP 31	0	0
OP: OP 32	0	497
OP: OP 33	0	0
OP: OP 34	0	0
OP: OP 35	0	0
OP: OP 36	0	0
OP: OP 37	0	0
OP: OP 38	0	0
OP: OP 39	0	0
OP: OP 40	0	0
Route: Faneco Rd Seymour Dr	0	271
Route: Heard Ave	0	9222
Route: Yan Yean Road	0	6286

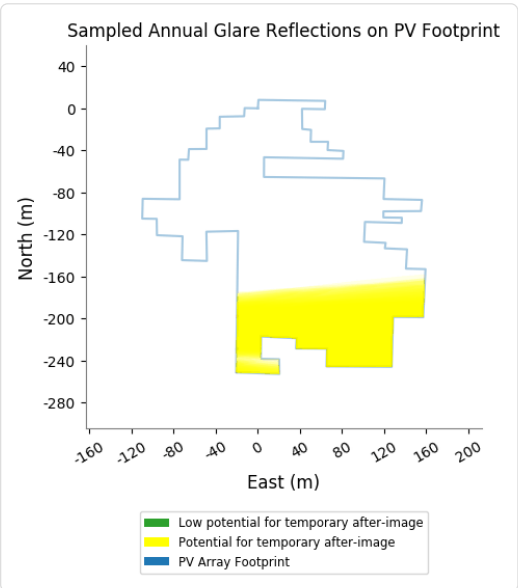
PV array 1 - OP Receptor (OP 1)

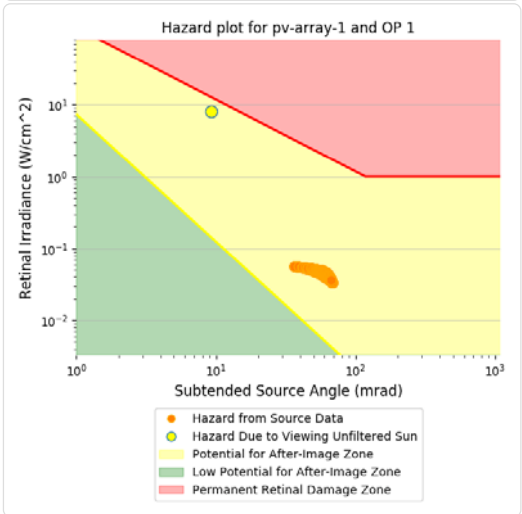
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 1,489 minutes of "yellow" glare with potential to cause temporary after-image.





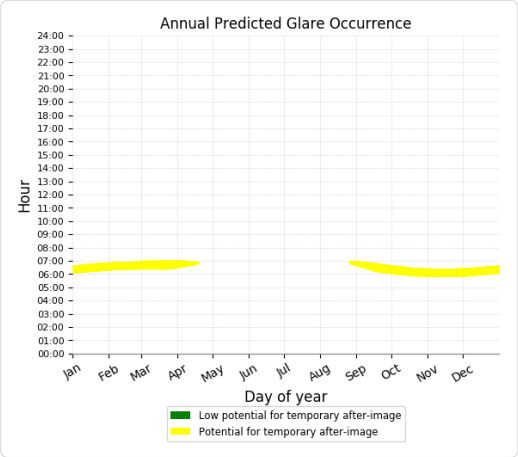


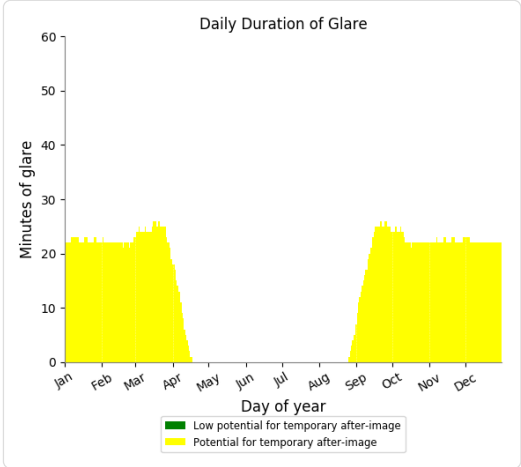


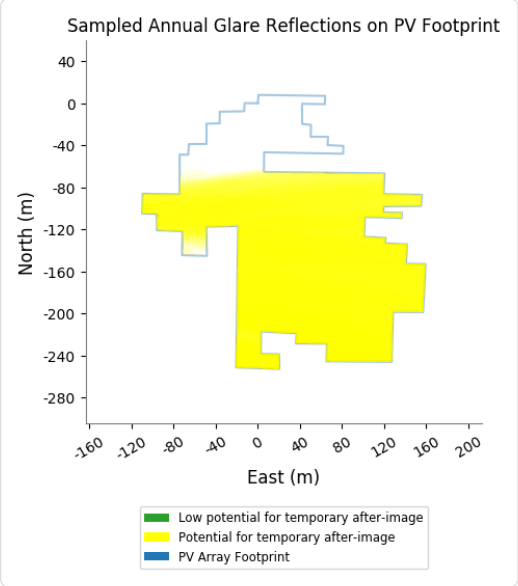
PV array 1 - OP Receptor (OP 2)

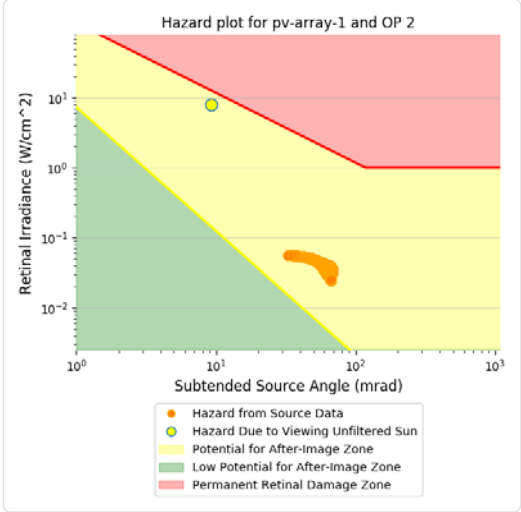
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,906 minutes of "yellow" glare with potential to cause temporary after-image.





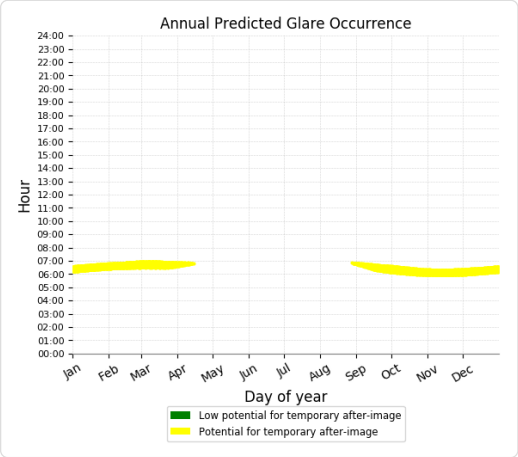


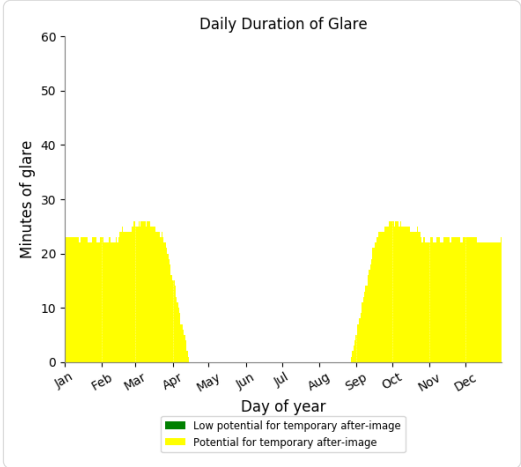


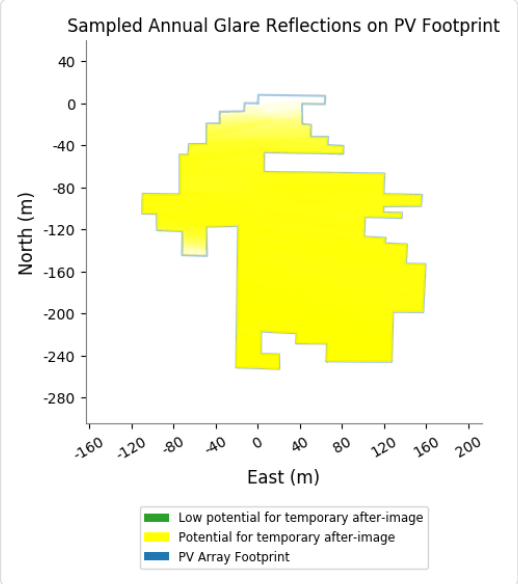
PV array 1 - OP Receptor (OP 3)

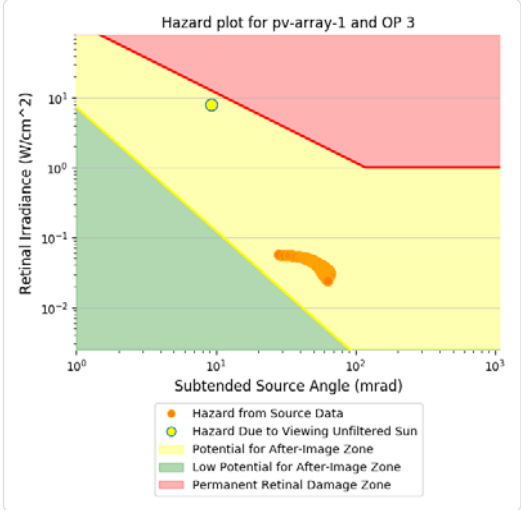
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,902 minutes of "yellow" glare with potential to cause temporary after-image.





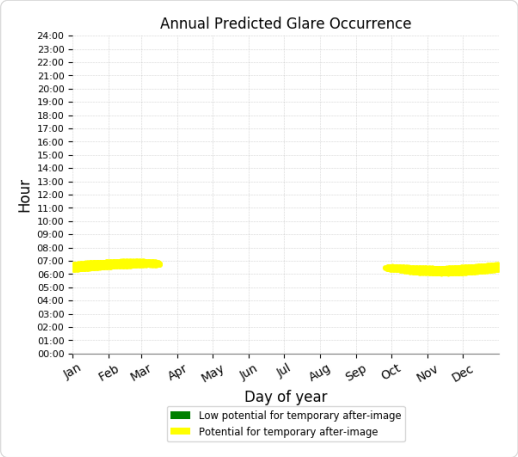


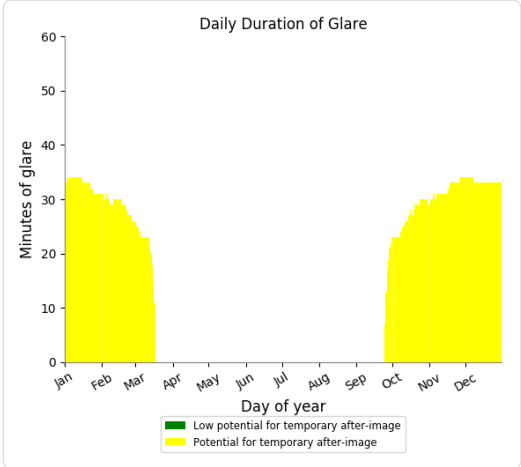


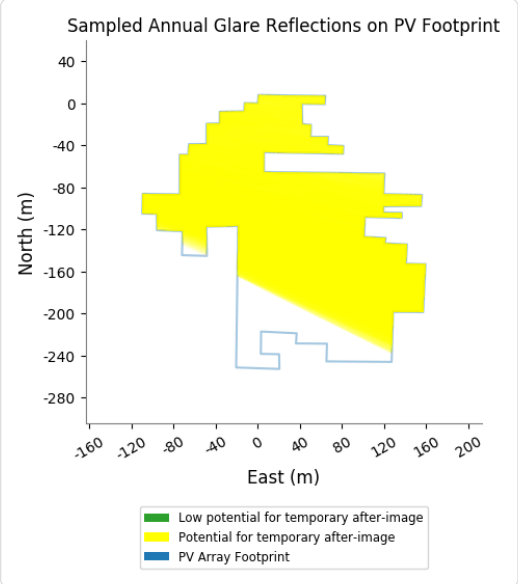
PV array 1 - OP Receptor (OP 4)

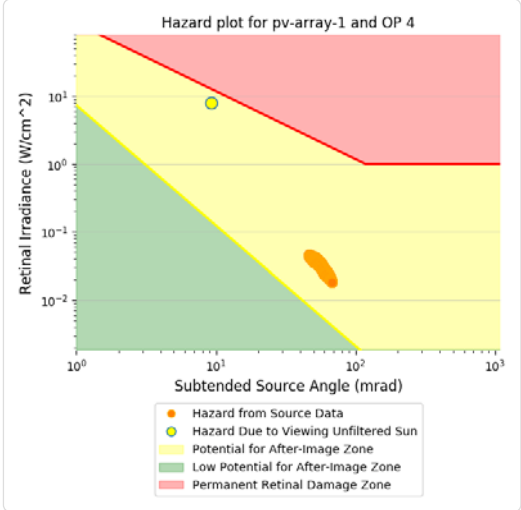
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 5,116 minutes of "yellow" glare with potential to cause temporary after-image.





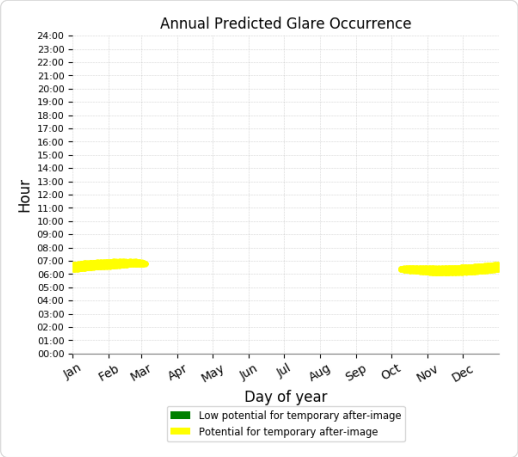


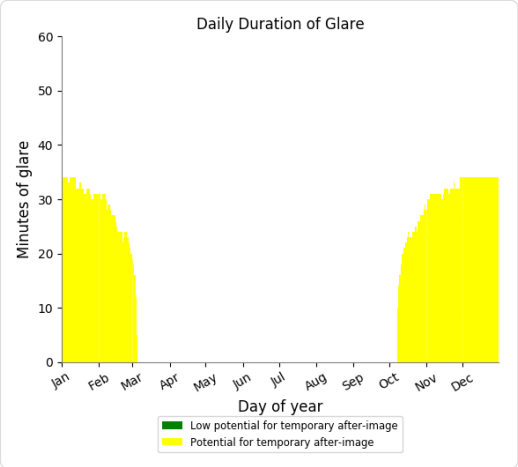


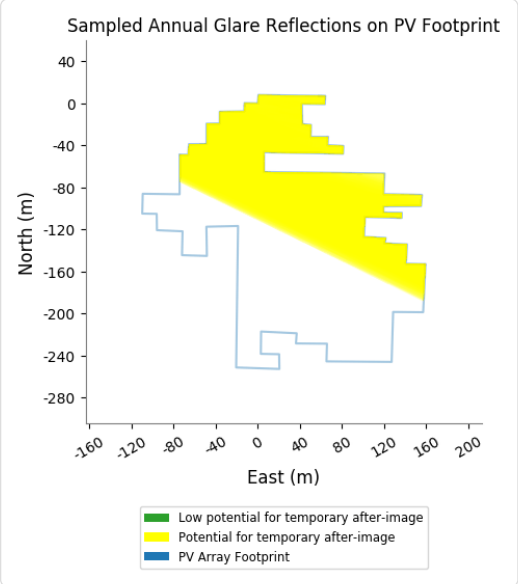
PV array 1 - OP Receptor (OP 5)

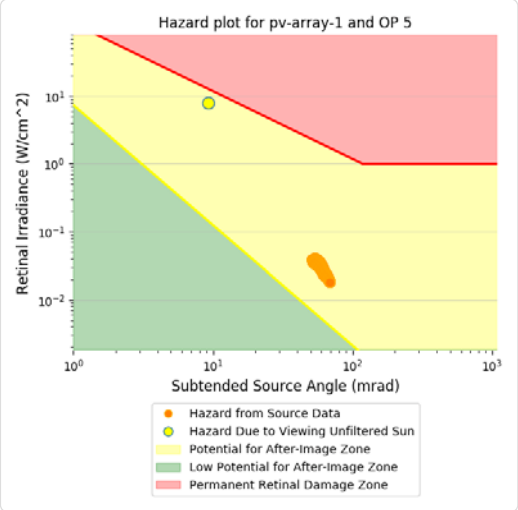
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 4,354 minutes of "yellow" glare with potential to cause temporary after-image.









PV array 1 - OP Receptor (OP 6)

No glare found

PV array 1 - OP Receptor (OP 7)

No glare found

PV array 1 - OP Receptor (OP 8)

No glare found

PV array 1 - OP Receptor (OP 9)

No glare found

PV array 1 - OP Receptor (OP 10)

No glare found

PV array 1 - OP Receptor (OP 11)

No glare found

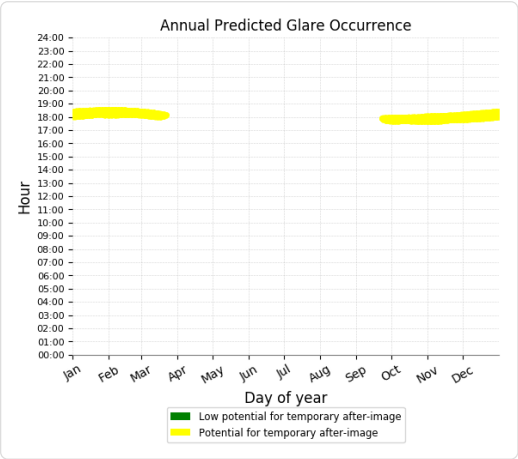
PV array 1 - OP Receptor (OP 12)

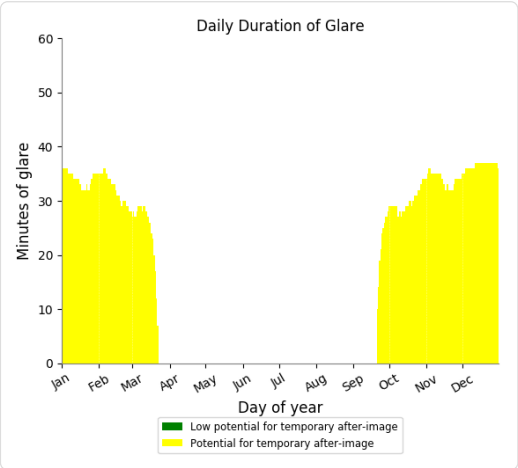
No glare found

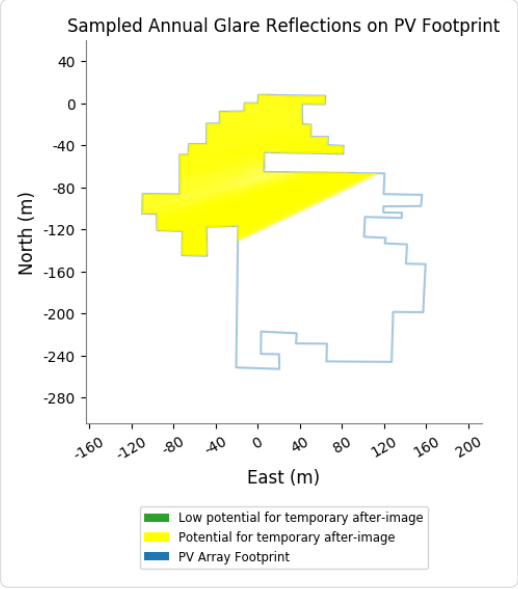
PV array 1 - OP Receptor (OP 13)

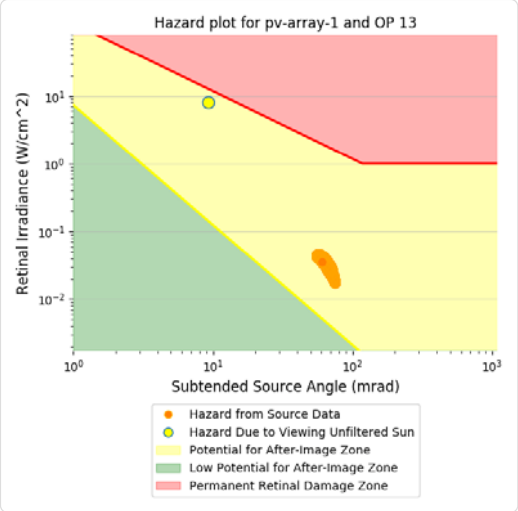
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 5,805 minutes of "yellow" glare with potential to cause temporary after-image.





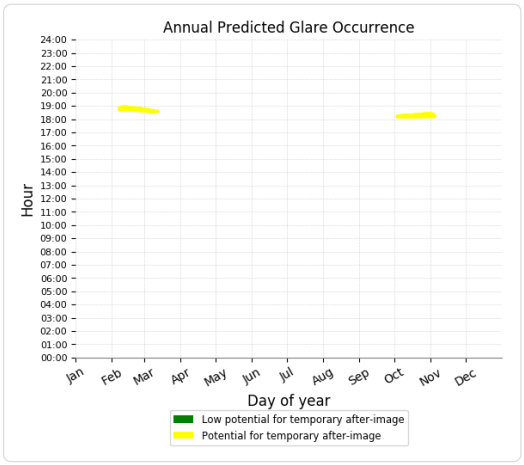


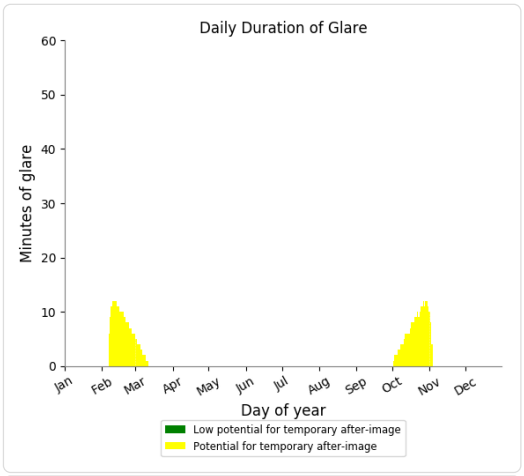


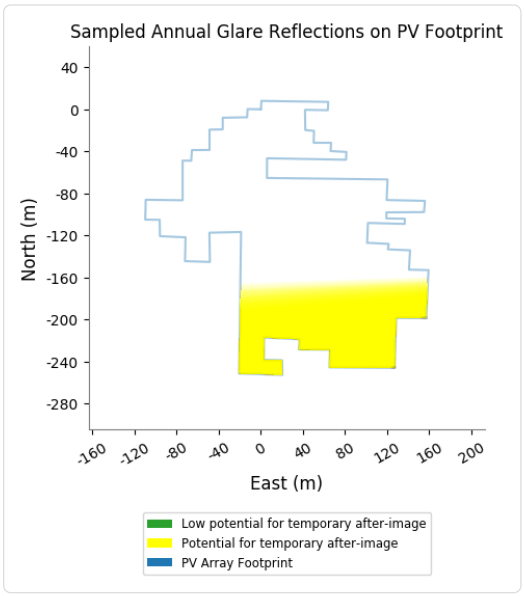
PV array 1 - OP Receptor (OP 14)

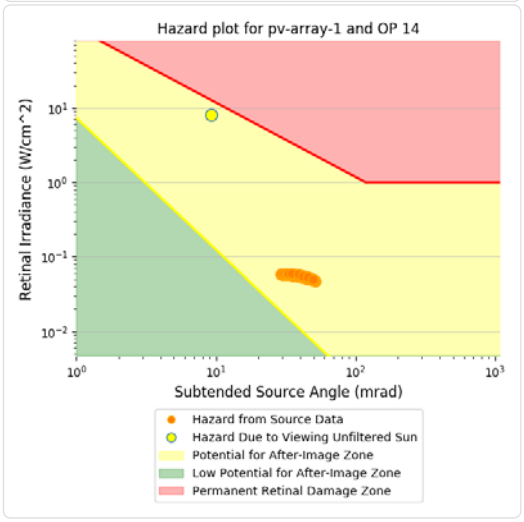
PV array is expected to produce the following glare for receptors at this location:

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





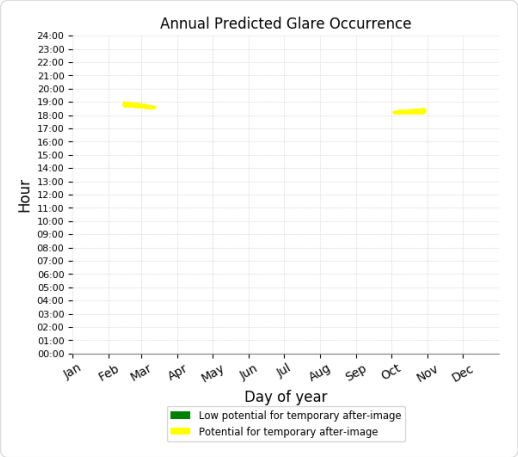


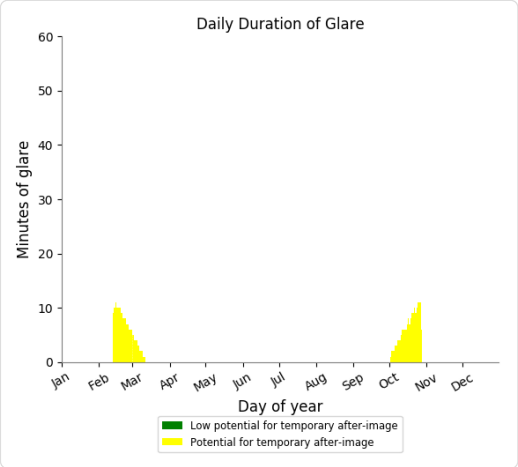


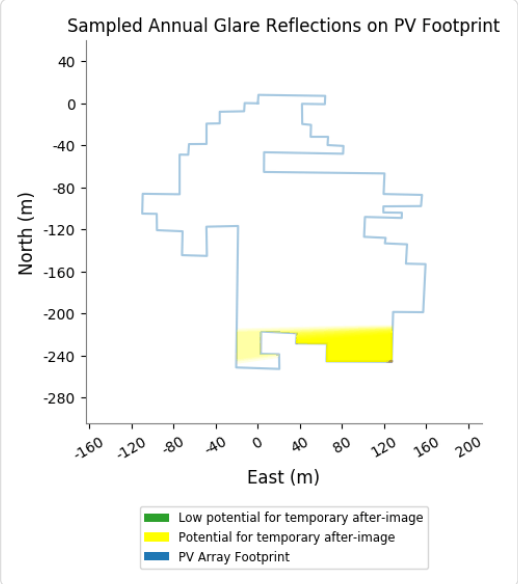
PV array 1 - OP Receptor (OP 15)

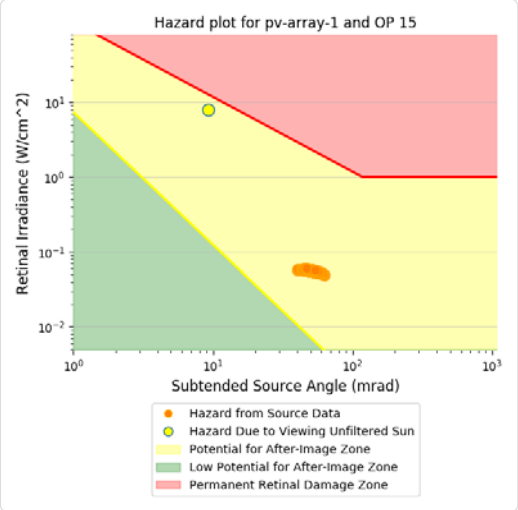
PV array is expected to produce the following glare for receptors at this location:

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









PV array 1 - OP Receptor (OP 16)

No glare found

PV array 1 - OP Receptor (OP 17)

No glare found

PV array 1 - OP Receptor (OP 18)

No glare found

PV array 1 - OP Receptor (OP 19)

No glare found

PV array 1 - OP Receptor (OP 20)

No glare found

PV array 1 - OP Receptor (OP 21)

No glare found

PV array 1 - OP Receptor (OP 22)

No glare found

PV array 1 - OP Receptor (OP 23)

No glare found

PV array 1 - OP Receptor (OP 24)

No glare found

PV array 1 - OP Receptor (OP 25)

No glare found

PV array 1 - OP Receptor (OP 26)

No glare found

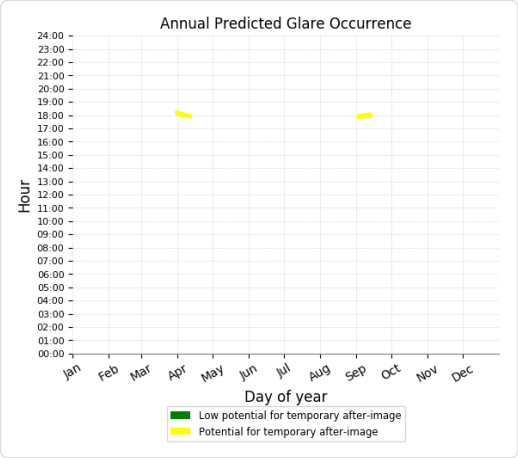
PV array 1 - OP Receptor (OP 27)

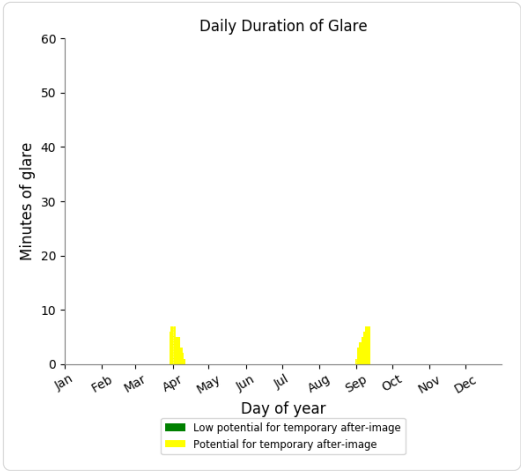
No glare found

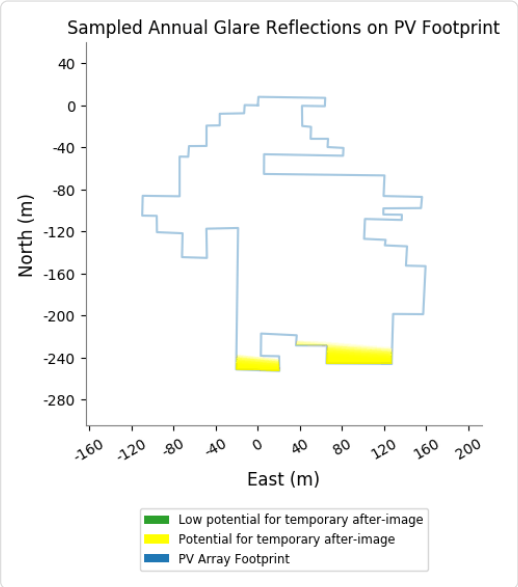
PV array 1 - OP Receptor (OP 28)

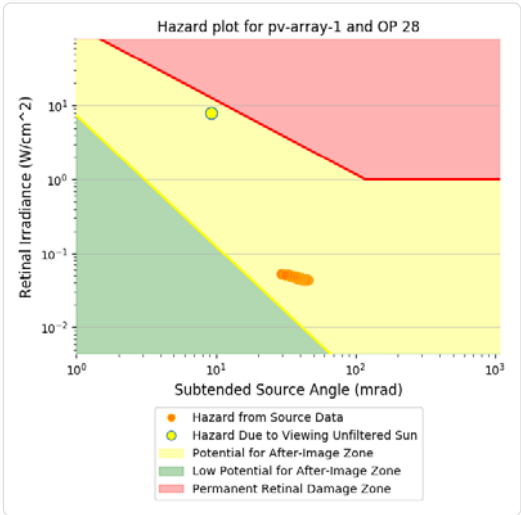
PV array is expected to produce the following glare for receptors at this location:

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









PV array 1 - OP Receptor (OP 29)

No glare found

PV array 1 - OP Receptor (OP 30)

No glare found

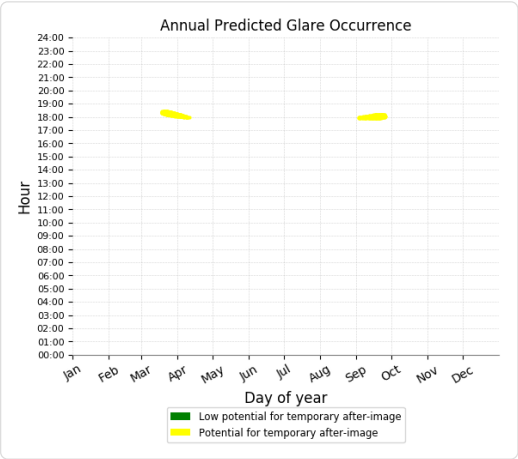
PV array 1 - OP Receptor (OP 31)

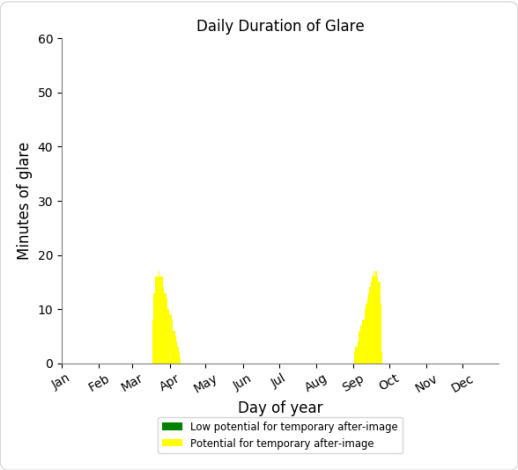
No glare found

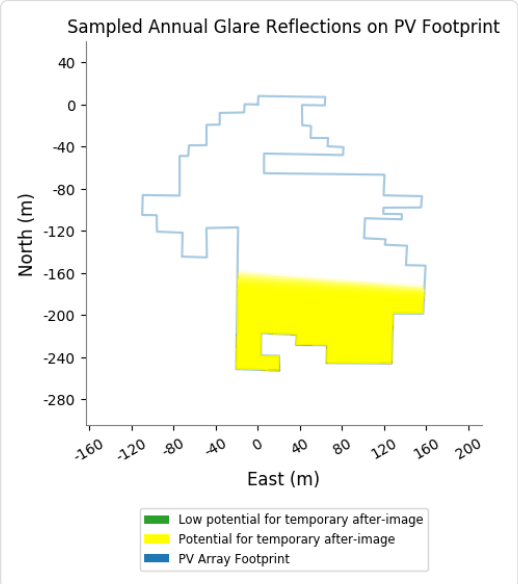
PV array 1 - OP Receptor (OP 32)

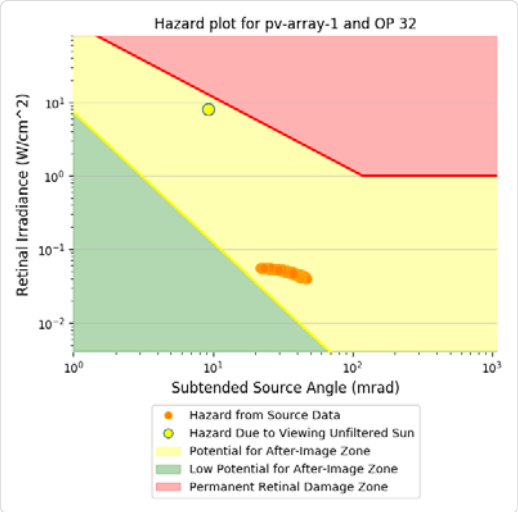
PV array is expected to produce the following glare for receptors at this location:

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









PV array 1 - OP Receptor (OP 33)

No glare found

PV array 1 - OP Receptor (OP 34)

No glare found

PV array 1 - OP Receptor (OP 35)

No glare found

PV array 1 - OP Receptor (OP 36)

No glare found

PV array 1 - OP Receptor (OP 37)

No glare found

PV array 1 - OP Receptor (OP 38)

No glare found

PV array 1 - OP Receptor (OP 39)

No glare found

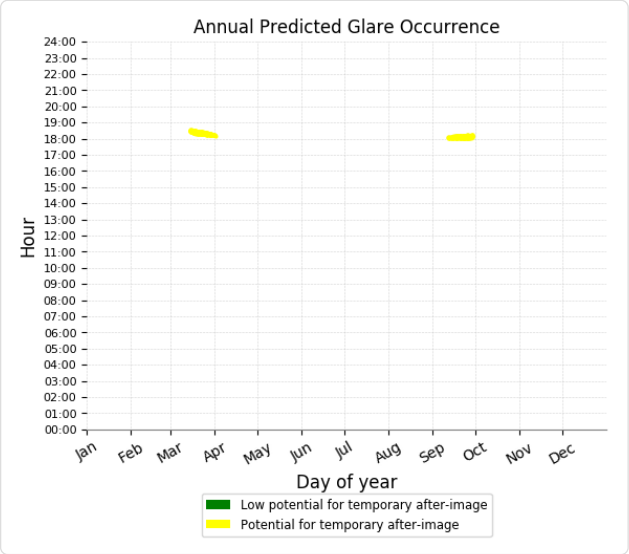
PV array 1 - OP Receptor (OP 40)

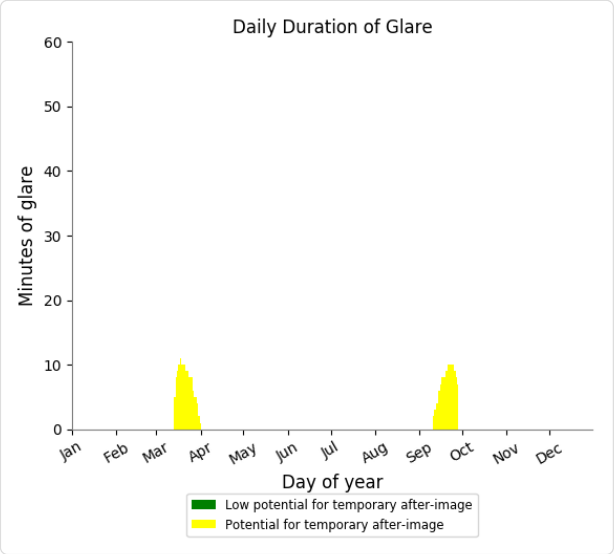
No glare found

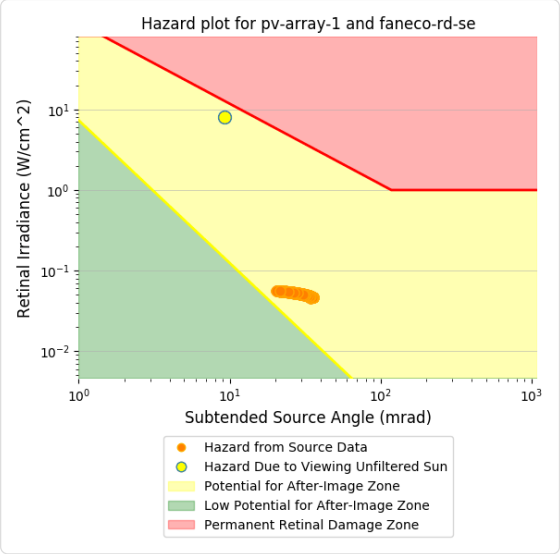
PV array 1 - Route Receptor (Faneco Rd Seymour Dr)

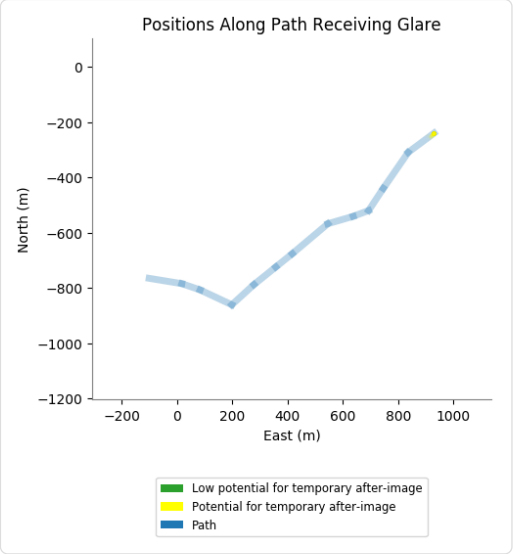
PV array is expected to produce the following glare for receptors at this location:

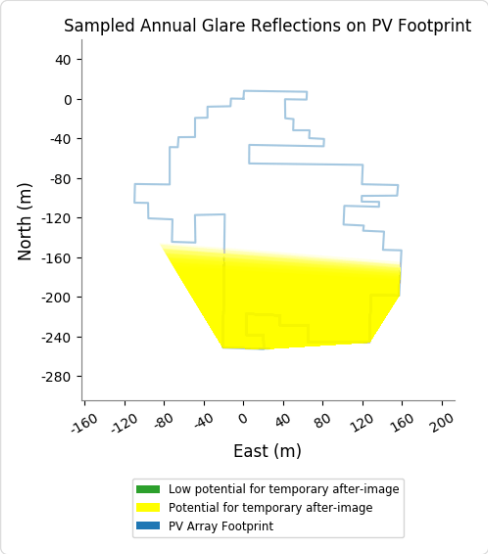
- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 271 minutes of "yellow" glare with potential to cause temporary after-image.







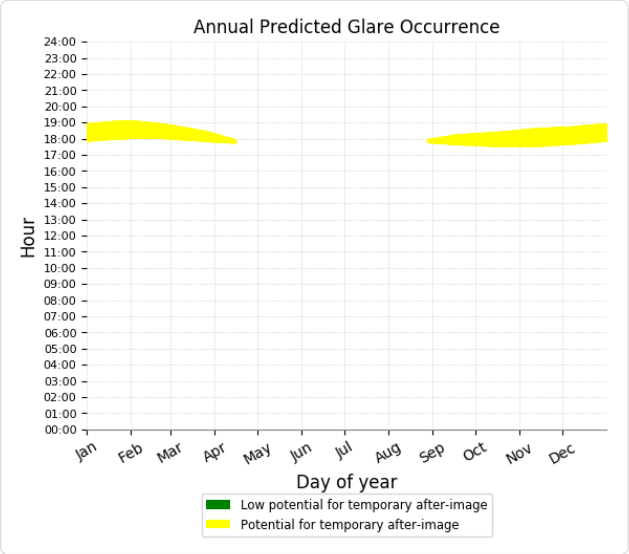


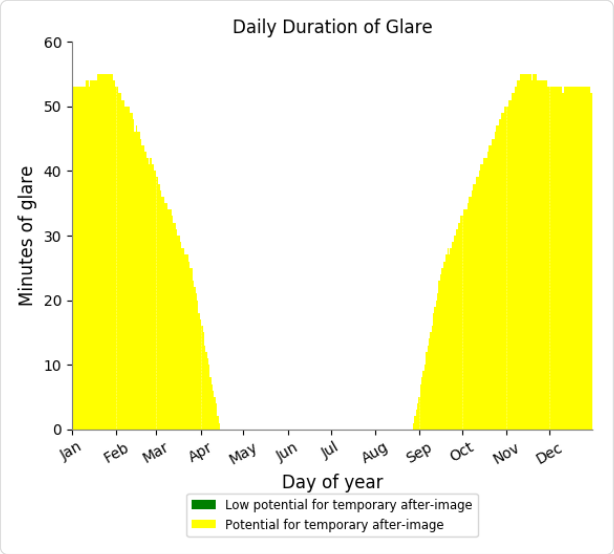


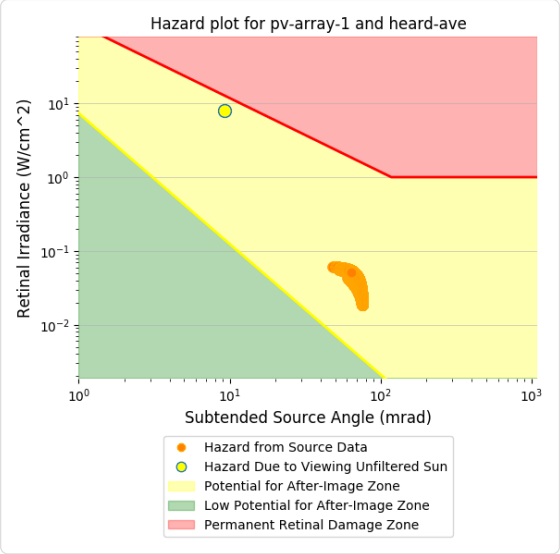
PV array 1 - Route Receptor (Heard Ave)

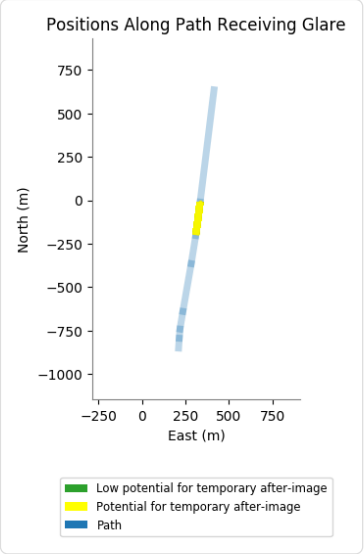
PV array is expected to produce the following glare for receptors at this location:

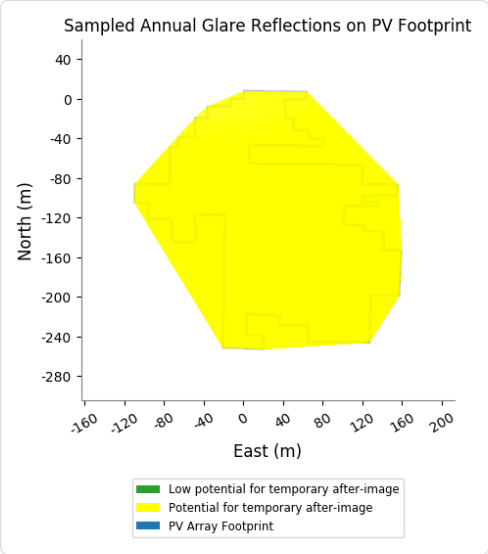
- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 9,222 minutes of "yellow" glare with potential to cause temporary after-image.







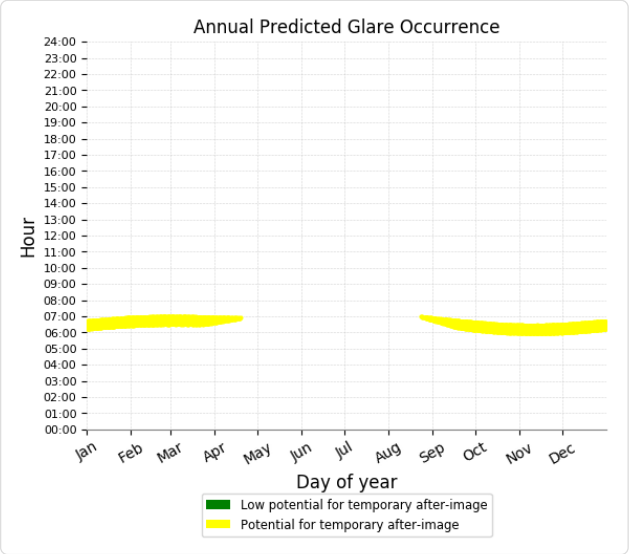


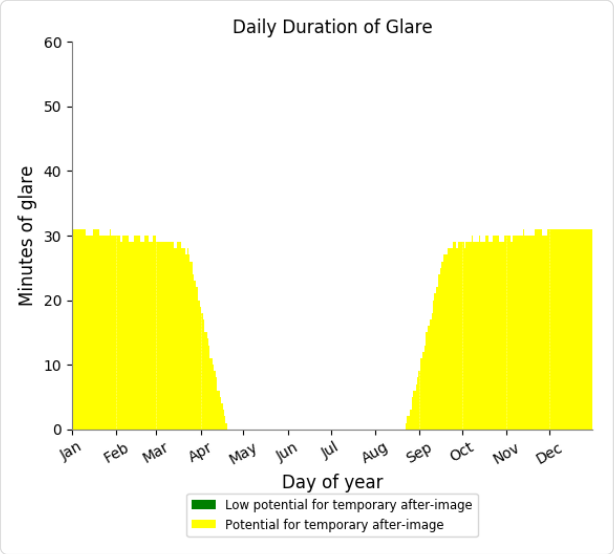


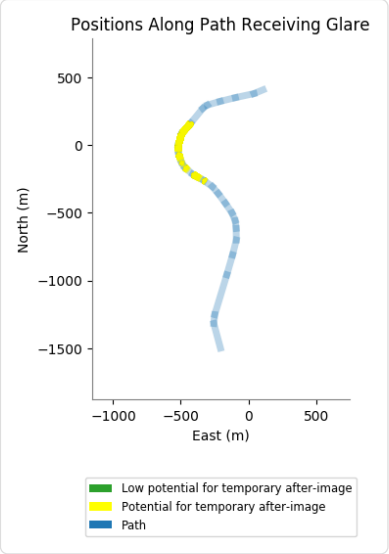
PV array 1 - Route Receptor (Yan Yean Road)

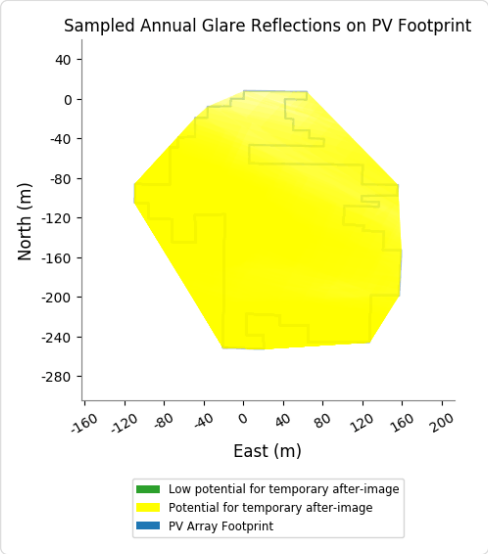
PV array is expected to produce the following glare for receptors at this location:

- 0 minutes of "green" glare with low potential to cause temporary after-image.
- 6,286 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. Actu values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for 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 combine 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 detailed assumptions and limitations not listed here.