APPENDIX B
GLARE STUDY

DREW SOLAR PROJECT
GLARE STUDY

May 22, 2018 | Prepared by POWER Engineers for Drew Solar, LLC

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POWER ENGINEERS

Drew Solar Project Glare Study

PREPARED FOR: *DREW SOLAR, LLC*

PREPARED BY: *POWER ENGINEERS, INC.*

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ACRONYMS AND ABBREVIATIONS

AR	anti-reflective
KOP	Key Observation Point
MW	megawatts
POWER	POWER Engineers, Inc.
Project	Drew Solar Project
PV	photovoltaic
SGHAT	Solar Glare Hazard Analysis Tool

1.1 INTRODUCTION

POWER Engineers, Inc. (POWER) has performed this Glare Study for the proposed Drew Solar Project (Project) to identify potential glare impacts to motorists and surrounding residences. This study was commissioned by DUDEK on behalf of Drew Solar, LLC. The Project is located approximately 6.5 miles southwest of the city of El Centro in Imperial County, California (see Figure 1). Drew Solar, LLC has indicated that the proposed Project will utilize either single-axis tracking or fixed photovoltaic (PV) technologies. Based on direction provided by DUDEK, this study assumed the use of single-axis tracking PV solar technology with anti-reflective coating and analysis was performed for all PV panel glass surfaces. Additional analysis will be required to determine glare behaviors of dual-axis tracking technologies. Specifically, this study does the following:

- Identifies sensitive viewers within one mile of the Project (see Section 3.1).
- Characterizes typical glare behavior experienced from the solar project throughout the day and year (see Section 3.2).
- Evaluates when and where glare may be visible to sensitive viewers (see Section 4.0).

2.0 DEFINITIONS AND DESCRIPTIONS

The following definitions and descriptions are important for understanding the methodology and results of the study:

Anti-reflective Coating – Anti-reflective Coating, also known as AR coating, is a surface treatment to solar panel glass designed to reduce reflected light and increase panel efficiencies. AR Coating methods may vary by manufacturer. This study assumes both form and function are in original working conditions through the life of the project.

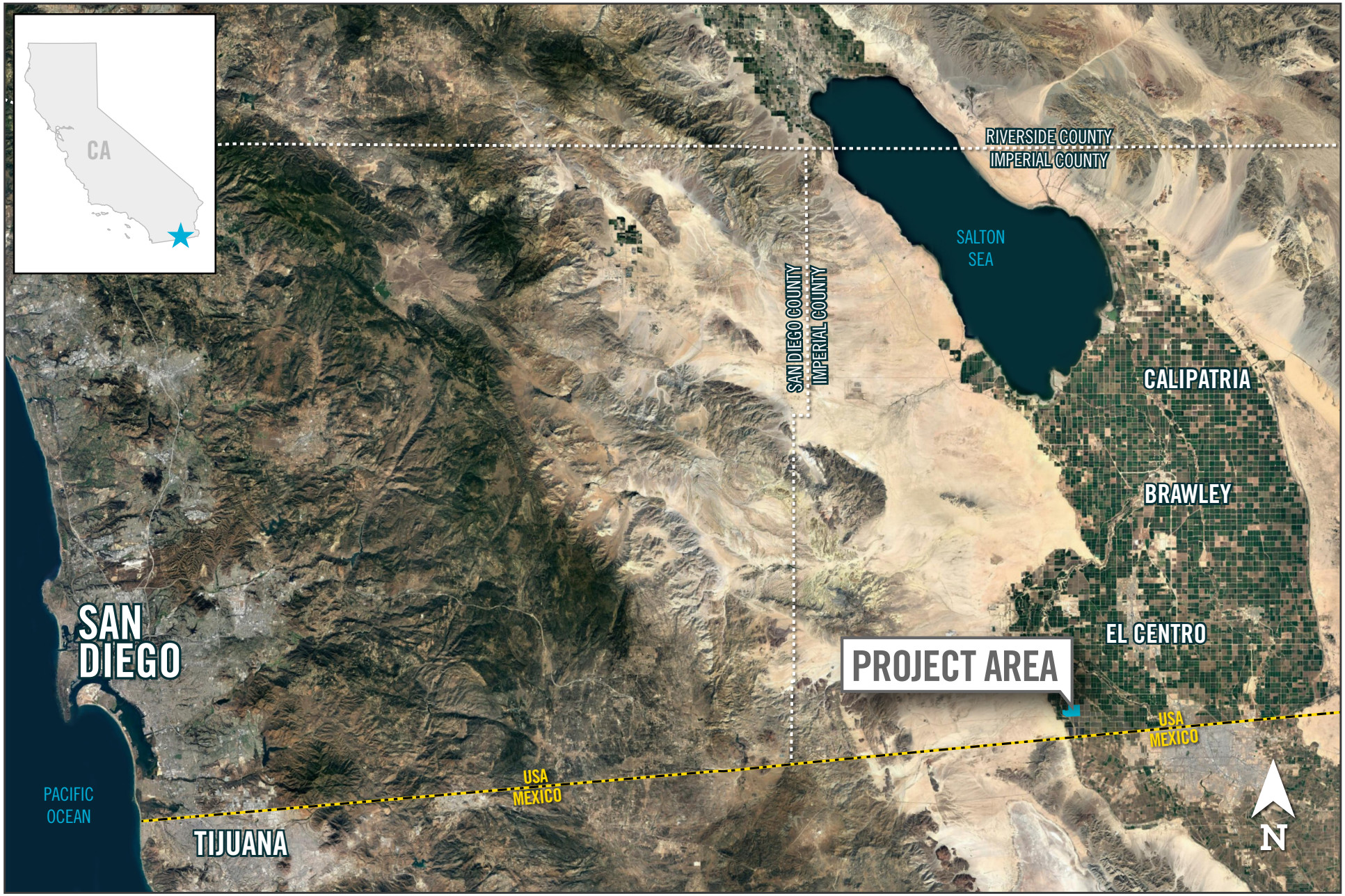
Photovoltaic Panel – Photovoltaic panels, also known as PV panels, are designed to absorb solar energy and retain as much of the solar spectrum as possible in order to produce electricity.

Single Axis Solar Tracker – Single axis solar trackers are designed to maximize the efficiency of a PV panel operation. PV panels mounted to a single axis tracker rotate around a fixed axis allowing PV panels to track the sun's east/west position throughout the day (see Figure 2).

Glare – A continuous source of brightness, relative to diffuse or surface scattered lighting. For purposes of this study, glare is caused by the sun reflecting off solar panels (see Figure 3).

Key Observation Points (KOP) – KOPs refer to locations with sensitivity to potential glare. For this study, KOPs included roadways and residential structures within one mile of the Project (see Section 3.1).

GlareGauge – The GlareGauge tool uses Solar Glare Hazard Analysis Tool (SGHAT) technology. Developed by Sandia National Laboratories, this tool is a web-based application that predicts the potential for solar glare and ocular impacts from solar technologies (see https://share.sandia.gov/phlux/). The GlareGauge tool and SGHAT technologies have become the Federal Aviation Administration standard for analyzing solar glare for both terrestrial and aerial viewers.



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Drew Solar Glare Analysis

Figure 1 - Project Location Map

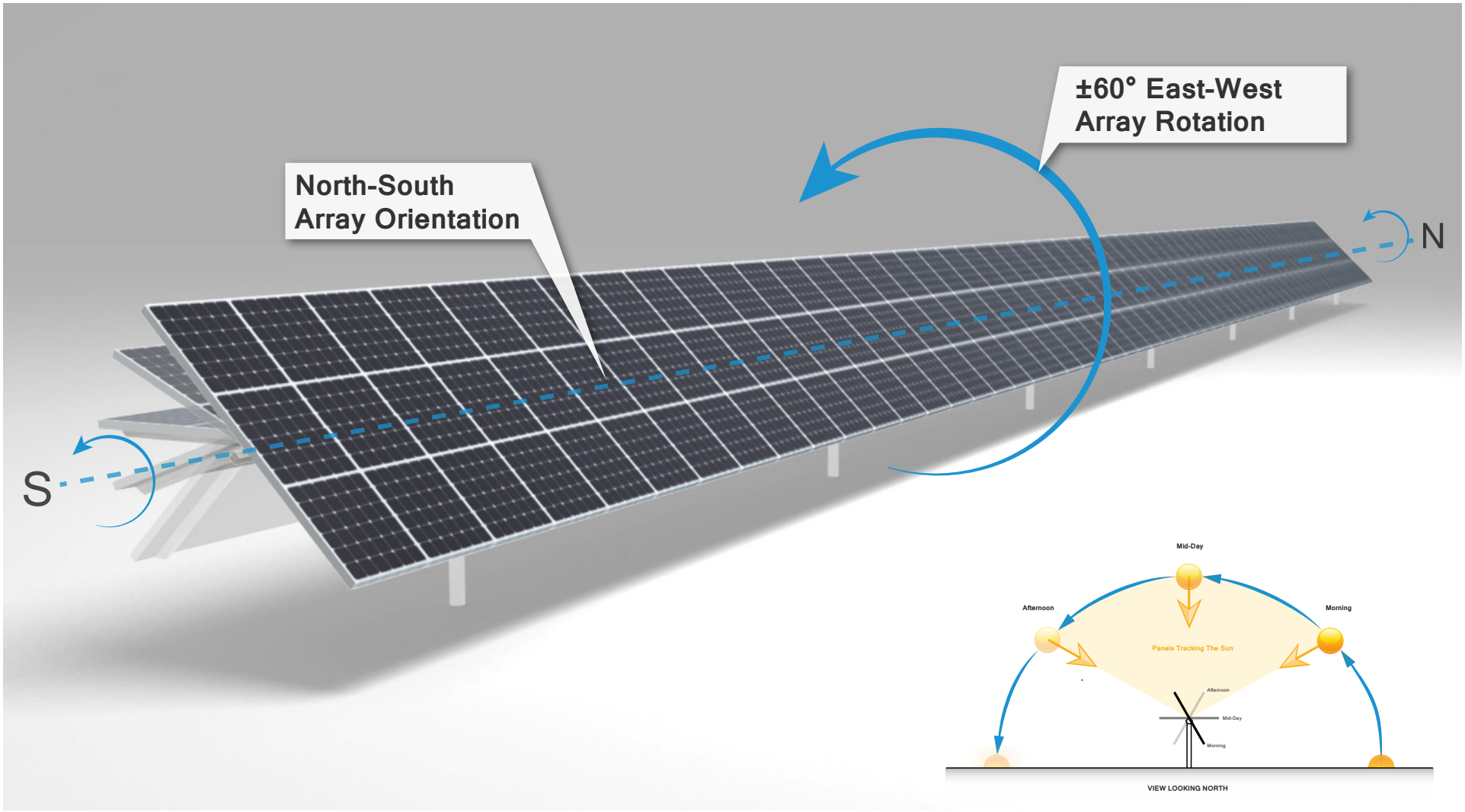


Figure 2 - Single Axis Solar Tracker

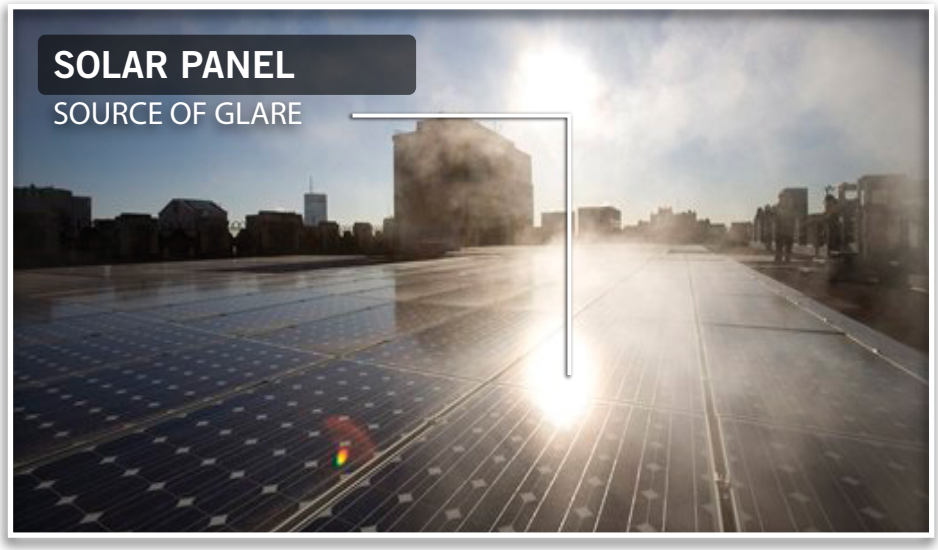


Figure 3 - Examples of Glare

3.0 METHODOLOGY

POWER used the following methodology to determine the location and duration of potential glare:

Identify Potential Glare Issues – This study focused on potential issues where glare may be visible from nearby roadways or residences. POWER prepared the study based on these locations (see Section 3.1).

Characterize Glare Behavior – POWER utilized the GlareGauge tool to determine when and where solar glare may occur throughout the year (see https://share.sandia.gov/phlux/). Technical specifications of proposed solar equipment were provided by DUDEK and include panel dimensions, type, angle, orientation, and placement (see Section 3.2).

Evaluate – Once glare was characterized, visual analysts documented the occurrence and hazard level of potential glare (see Section 3.3).

3.1 Identify Potential Glare Issues

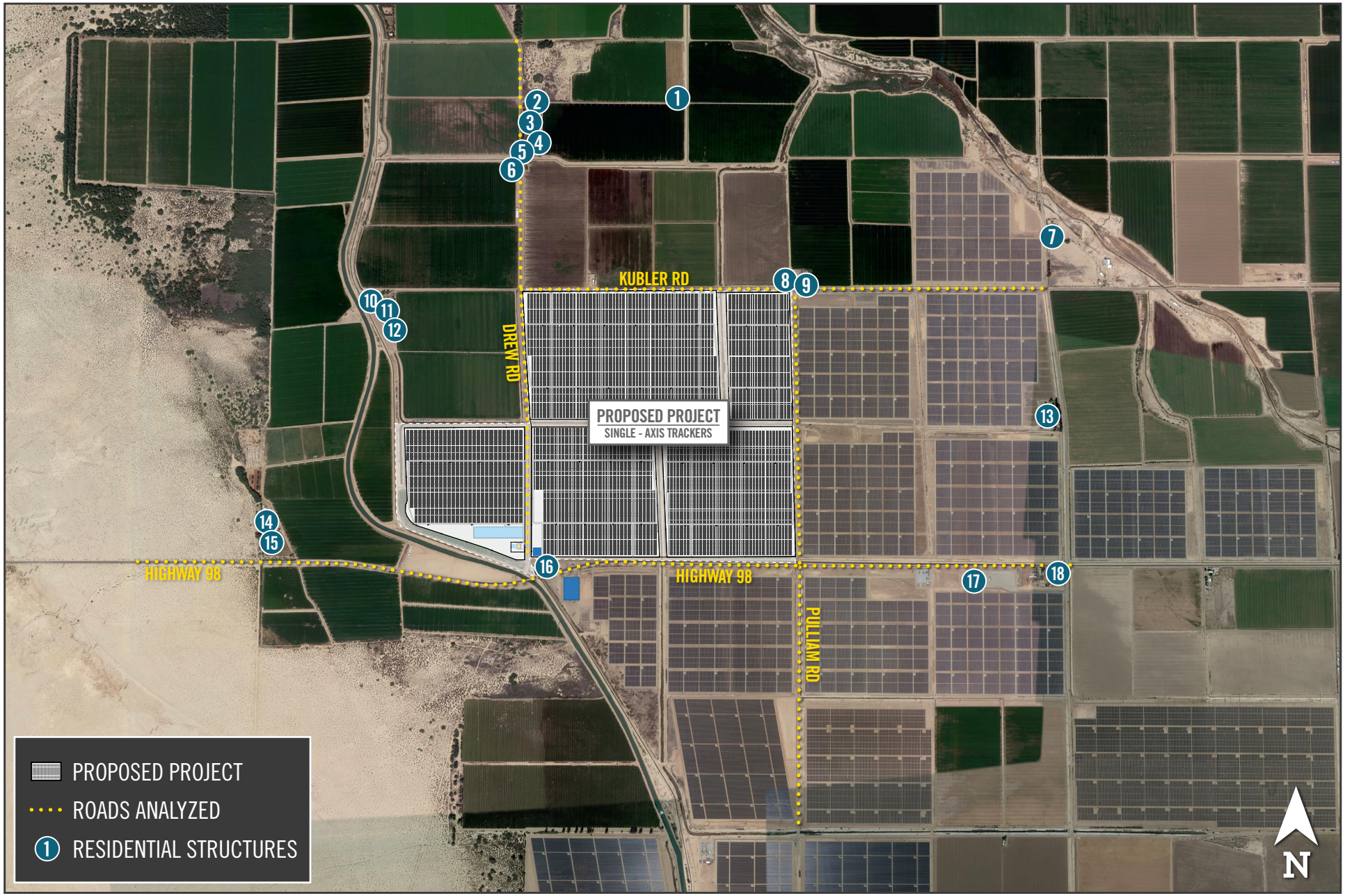
The proposed Project was analyzed to evaluate and document any occurrences of glare that would potentially cause distractions to nearby residences and motorists. Due to the angle of the sun and the tracking process of a single-axis PV system, during normal operating conditions the typical trajectory of potential glare rises the farther away it gets from the surface of the PV panel. As such, the farther away an observer is from the site, the lower their potential of seeing glare from that location. This study utilized a one-mile threshold for analysis. If potential glare is reported at the one-mile threshold, further analysis may be performed.

Google Earth aerial imagery was used to identify any major structures within one mile of the Project. Proposed solar operations were then studied from Key Observation Points (KOPs) identified at 17 surrounding residential structures and four roadways adjacent the site (see Figure 4). Single point locations were analyzed for each identified structure. The centerline of each identified roadway was analyzed up to one mile from the Project. Due to the typical trajectory of potential glare, an elevated viewer at a given KOP has a higher potential of seeing glare than a non-elevated viewer. Viewer heights studied were chosen to represent worst case scenarios for both residential and motorist views. Each KOP is described below:

- **Surrounding Residential Structures:**
  - Distance from Project: 0-1.0 mile
  - Viewer Height: 8 feet above ground

- **State Route 98:**
  - Location relative Project: South
  - Viewer Height: 6-10 feet above ground
  - Direction of Travel: East/West

- **Drew Road:**
  - Location relative Project: West
  - Viewer Height: 6-10 feet above ground
  - Direction of Travel: North/South



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Drew Solar Glare Analysis

Figure 4 - Key Observation Points

- **Pulliam Road:**
    - Location relative Project: East
    - Viewer Height: 6-10 feet above ground
    - Direction of Travel: North/South

- **Kubler Road:**
    - Location relative Project: North
    - Viewer Height: 6-10 feet above ground
    - Direction of Travel: East/West

3.2 Characterize Glare Behavior

POWER utilized the GlareGauge tool to determine when and where solar glare may occur throughout the year (see https://www.forgesolar.com/). Technical specifications of proposed solar equipment were provided by DUDEK and are described below:

Photovoltaic Solar Panels:

- Single Axis Trackers
- Panel Orientation: North/South
- Panel Rotation Limits: ± 60 degrees
- Coating/Texture: Smooth Glass with AR Coating
- Rack Height: 4 feet above grade

3.3 Glare Evaluation – GlareGauge Analysis

To identify the occurrence of glare, POWER utilized the GlareGauge tool licensed by ForgeSolar. The GlareGauge tool is a web based glare assessment tool, allowing input of viewer position, solar facility location, solar technology, and elevation data. The GlareGauge tool provides a quantified assessment of when and where glare may occur throughout the year from a solar installation, as well as identifying the potential effects on the human eye if glare does occur. Glare was analyzed at one minute intervals throughout the entire year to determine when and where glare may be visible to nearby residences and motorists. Glare was analyzed with PV rotational limits of 60 degrees facing east and west. Refer to Section 4.0 and Appendix A for glare results.

4.0 RESULTS

After review of the Glare Gauge tool analysis, POWER determined no glare will be visible at the KOPs evaluated from the proposed solar operations due to the orientation of the PV panels and their rotational limits. The 60 degree rotational limits cause any resulting glare to be redirected above and away from all sensitive viewers throughout the day and year. For a detailed description of the GlareGauge analysis results, see Appendix A.

5.0 SOURCES

ForgeSolar GlareGauge Web Application. Accessed 2017.
https://www.forgesolar.com/tools/glaregauge.

Files provided by DUDEK:
Draft Drew Solar PD_Dudek.pdf
DrewSolar_SitePlan(FS-18ft)_110817(EX).dwg
11030AltaSht1-3.dwg
11030AltaSht4.dwg
11030AltaSht5.dwg
11030AltaSht6-16.dwg

APPENDIX A GLARE RESULTS

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FORGESOLAR GLARE ANALYSIS

Project: Drew Solar
Single axis Trackers

Site configuration: Drew Solar - 60 Deg Limit
Analysis conducted by Andy Stephens (andy.stephens@powereng.com) at 17:56 on 11 Dec, 2017.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

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

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2 Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m Eye focal length: 0.017 m Sun subtended angle: 9.3 mrad
Site Config ID: 12020.2069

PV Array(s)

Name: PV array 1
Axis tracking: Single-axis rotation Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Limit tracking rotation? Yes
Max tracking angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: 8.43 mrad

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.686857	-115.673836	-20.82	4.00	-16.82
2	32.687363	-115.673836	-19.41	4.00	-15.41
3	32.690907	-115.674121	-23.68	4.00	-19.68
4	32.694487	-115.674362	-16.76	4.00	-12.76
5	32.694473	-115.656799	-17.19	4.00	-13.19
6	32.679622	-115.656445	-16.63	4.00	-12.63
7	32.679660	-115.673448	-17.13	4.00	-13.13
8	32.683444	-115.673407	-18.74	4.00	-14.74
9	32.683453	-115.673836	-18.40	4.00	-14.40

Name: PV array 2
Axis tracking: Single-axis rotation Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Limit tracking rotation? Yes
Max tracking angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: 8.43 mrad

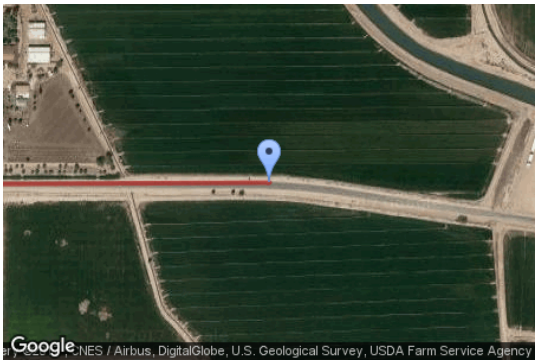
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	32.686891	-115.682108	-20.47	4.00	-16.47
2	32.681668	-115.682044	-17.53	4.00	-13.53
3	32.681668	-115.674577	-16.18	4.00	-12.18
4	32.686888	-115.674620	-22.87	4.00	-18.87

Motorist Receptor(s)

Name: 98 East Bound
Description: Threshold height: 5 ft Direction: 90.43°
Glide slope: 0.0°
Pilot view restricted? No

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.679443	-115.668998	-16.65	5.00	-11.65
Two-mile	32.679226	-115.634608	-15.81	4.16	-11.65

Name: 98 East Bound Left
Description:
Threshold height: 5 ft Direction: 269.71° Glide slope: 0.0°
Pilot view restricted? No

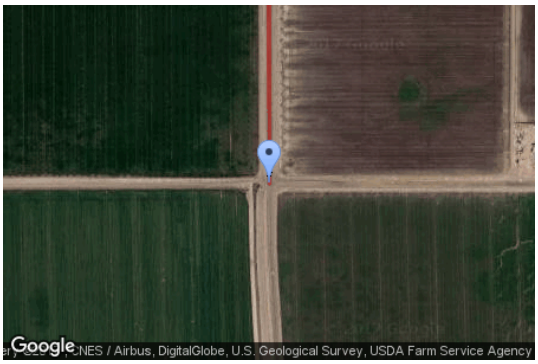


Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.679443	-115.686679	-11.19	5.00	-6.19
Two-mile	32.679297	-115.721069	75.22	-81.41	-6.19

Name: 98 West Bound
Description: Threshold height: 5 ft Direction: 270.29° Glide slope: 0.0°
Pilot view restricted? No

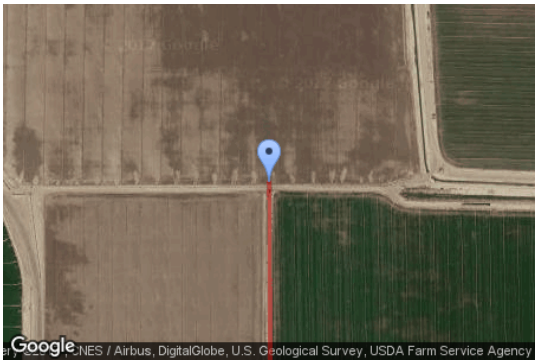
Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.679263	-115.634665	-16.24	5.00	-11.24
Two-mile	32.679409	-115.669055	-17.00	5.76	-11.24

Name: Drew North Bound
Description: Threshold height: 5 ft Direction: 359.77° Glide slope: 0.0°
Pilot view restricted? No



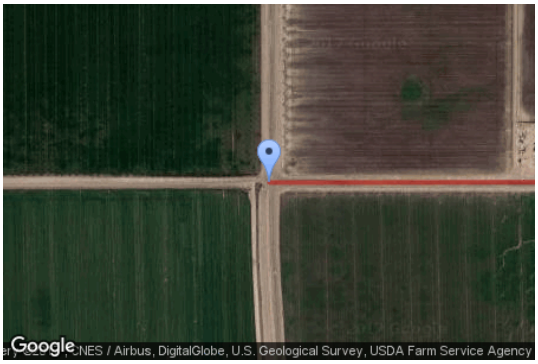
Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.694642	-115.674663	-20.67	5.00	-15.67
Two-mile	32.723554	-115.674801	-26.43	10.76	-15.67

Name: Drew South Bound
Description: Threshold height: 5 ft Direction: 179.74° Glide slope: 0.0°
Pilot view restricted? No



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.723556	-115.674818	-26.35	5.00	-21.35
Two-mile	32.694644	-115.674662	-20.67	-0.68	-21.35

Name: Kubler East Bound
Description: Threshold height: 5 ft Direction: 89.91°
Glide slope: 0.0°
Pilot view restricted? No

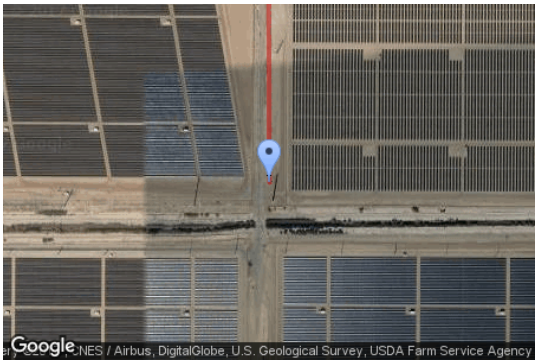


Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.694649	-115.674706	-20.69	5.00	-15.69
Two-mile	32.694695	-115.640309	-17.22	1.53	-15.69

Name: Kubler West Bound
Description:
Threshold height: 5 ft Direction: 269.73° Glide slope: 0.0°
Pilot view restricted? No

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.694740	-115.640266	-15.71	5.00	-10.71
Two-mile	32.694603	-115.674662	-20.65	9.95	-10.71

Name: Pulliam North Bound
Description:
Threshold height: 5 ft Direction:
359.71°
Glide slope: 0.0°
Pilot view restricted? No



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.665246	-115.656166	-16.35	5.00	-11.35
Two-mile	32.694158	-115.656340	-18.96	7.61	-11.35

Name: Pulliam South Bound
Description:
Threshold height: 5 ft Direction:
179.36°
Glide slope: 0.0°
Pilot view restricted? No

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	32.694649	-115.656381	-17.25	5.00	-12.25
Two-mile	32.665738	-115.655996	-16.23	3.98	-12.25

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	32.705497	-115.664003	-18.31	8.00
OP 2	2	32.705084	-115.673836	-14.69	8.00
OP 3	3	32.000000	-115.673895	788.95	8.00
OP 4	4	32.703353	-115.673678	-20.67	8.00
OP 5	5	32.702574	-115.674282	-14.13	8.00
OP 6	6	32.701565	-115.675172	-21.01	8.00
OP 7	7	32.697602	-115.639295	-15.56	8.00
OP 8	8	32.695078	-115.656906	-17.68	8.00
OP 9	9	32.695015	-115.655614	-19.11	8.00
OP 10	10	32.693981	-115.684587	-16.08	8.00
OP 11	11	32.693313	-115.683428	-16.31	8.00
OP 12	12	32.692591	-115.683117	-17.33	8.00
OP 13	13	32.687570	-115.639772	-11.78	8.00
OP 14	14	32.681371	-115.691421	-1.80	8.00
OP 15	15	32.680807	-115.691147	-4.80	8.00
OP 16	16	32.679190	-115.672742	-10.39	8.00
OP 17	17	32.678323	-115.644536	-14.51	8.00
OP 18	18	32.678901	-115.638968	-14.84	8.00
OP 19	19	32.679154	-115.670757	-16.57	6.00
OP 20	20	32.678739	-115.672774	-9.23	6.00
OP 21	21	32.678360	-115.674727	-9.67	6.00
OP 22	22	32.678215	-115.676658	-11.28	6.00
OP 23	23	32.678432	-115.678697	-14.33	6.00
OP 24	24	32.678685	-115.680585	-12.73	6.00
OP 25	25	32.678937	-115.682387	-12.95	6.00
OP 26	26	32.679136	-115.684254	-13.64	6.00
OP 27	27	32.679389	-115.685756	-13.81	6.00
OP 28	28	32.679544	-115.674126	-14.71	6.00
OP 29	29	32.680465	-115.674287	-15.67	6.00
OP 30	30	32.681888	-115.674255	-16.03	6.00
OP 31	31	32.683053	-115.674250	-18.33	6.00
OP 32	32	32.685081	-115.674191	-19.16	6.00
OP 33	33	32.686963	-115.674201	-20.64	6.00
OP 34	34	32.688910	-115.674276	-21.67	6.00
OP 35	35	32.690572	-115.674427	-23.37	6.00
OP 36	36	32.692052	-115.674534	-22.67	6.00
OP 37	37	32.693497	-115.674641	-21.12	6.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV array 1	0.0	180.0	0	0	-
PV array 2	0.0	180.0	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
98 East Bound	0	0
98 East Bound Left	0	0
98 West Bound	0	0
Drew North Bound	0	0
Drew South Bound	0	0
Kubler East Bound	0	0
Kubler West Bound	0	0
Pulliam North Bound	0	0
Pulliam South Bound	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
98 East Bound	0	0
98 East Bound Left	0	0
98 West Bound	0	0
Drew North Bound	0	0
Drew South Bound	0	0
Kubler East Bound	0	0
Kubler West Bound	0	0
Pulliam North Bound	0	0
Pulliam South Bound	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
OP 26	0	0
OP 27	0	0
OP 28	0	0
OP 29	0	0
OP 30	0	0
OP 31	0	0
OP 32	0	0
OP 33	0	0
OP 34	0	0
OP 35	0	0
OP 36	0	0
OP 37	0	0

98 East Bound

0 minutes of yellow glare 0 minutes of green glare

98 East Bound Left

0 minutes of yellow glare 0 minutes of green glare

98 West Bound

0 minutes of yellow glare 0 minutes of green glare

Drew North Bound

0 minutes of yellow glare 0 minutes of green glare

Drew South Bound

0 minutes of yellow glare 0 minutes of green glare

Kubler East Bound

0 minutes of yellow glare 0 minutes of green glare

Kubler West Bound

0 minutes of yellow glare 0 minutes of green glare

Pulliam North Bound

0 minutes of yellow glare 0 minutes of green glare

Pulliam South Bound

0 minutes of yellow glare 0 minutes of green glare

Residential Receptor: OP 1

0 minutes of yellow glare 0 minutes of green glare

Residential Receptor: OP 2

0 minutes of yellow glare 0 minutes of green glare

Residential Receptor: OP 3

0 minutes of yellow glare 0 minutes of green glare

Residential Receptor: OP 4

0 minutes of yellow glare

0 minutes of green glare

Residential Receptor: OP 5

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 6

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 7

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 8

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 9

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 10

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 11

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 12

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 13

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 14

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 15

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 16

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 17

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 18

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 19

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 20

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 21

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 22

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 23

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 24

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 25

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 26

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 27

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 28

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 29

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 30

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 31

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 32

0 minutes of yellow glare 0 minutes of green glare

Motorist Receptor: OP 33

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 34

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 35

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 36

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 37

0 minutes of yellow glare 0
minutes of green glare

Results for: PV array 2

Receptor	Green Glare (min)	Yellow Glare (min)
98 East Bound	0	0
98 East Bound Left	0	0
98 West Bound	0	0
Drew North Bound	0	0
Drew South Bound	0	0
Kubler East Bound	0	0
Kubler West Bound	0	0
Pulliam North Bound	0	0
Pulliam South Bound	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
OP 26	0	0
OP 27	0	0
OP 28	0	0
OP 29	0	0
OP 30	0	0
OP 31	0	0
OP 32	0	0
OP 33	0	0
OP 34	0	0
OP 35	0	0
OP 36	0	0
OP 37	0	0

98 East Bound

0 minutes of yellow glare 0
minutes of green glare

98 East Bound Left

0 minutes of yellow glare 0
minutes of green glare

98 West Bound

0 minutes of yellow glare 0
minutes of green glare

Drew North Bound

0 minutes of yellow glare 0
minutes of green glare

Drew South Bound

0 minutes of yellow glare 0
minutes of green glare

Kubler East Bound

0 minutes of yellow glare 0
minutes of green glare

Kubler West Bound

0 minutes of yellow glare 0
minutes of green glare

Pulliam North Bound

0 minutes of yellow glare 0
minutes of green glare

Pulliam South Bound

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 1

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 2

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Residential Receptor: OP 4

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 5

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 6

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 7

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 8

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 9

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 10

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 11

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 12

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 13

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 14

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 15

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 16

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 17

0 minutes of yellow glare 0
minutes of green glare

Residential Receptor: OP 18

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 19

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 20

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 21

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 22

0 minutes of yellow glare

0 minutes of green glare

Motorist Receptor: OP 23

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 24

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 25

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 26

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 27

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 28

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 29

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 30

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 31

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 32

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 33

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 34

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 35

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 36

0 minutes of yellow glare 0
minutes of green glare

Motorist Receptor: OP 37

0 minutes of yellow glare 0
minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. "Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.