Hannah Elliott

EXHIBIT
tabbies
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From: Brent Bybee
Sent: Tuesday, September 6, 2022 1:15 PM
To: Hannah Elliott
Subject: FW: Avangrid/Empire Solar - Supplemental Information
Attachments: image001.jpg; image002.png; EmpireSolar_Update to CCC 18.161.010.2.B.x_Recreation-Visual.pdf; EmpireSolar_GlareAnalysisMemo_08-30-2022.pdf; image001.jpg; image002.png; message.eml

Hey Hannah, please upload these as well. Thank you!

CROOK COUNTY
SEP 02 2022
PLANNING DEPT

Brent Bybee

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From: Hutchinson, Matthew <matthew.hutchinson@avangrid.com>
Sent: Friday, September 2, 2022 11:29 AM
To: Brent Bybee <Brent.Bybee@co.crook.or.us>
Cc: Walker, Rachel <rachel.walker@avangrid.com>; Hicks, Paul <paul.hicks@tetratech.com>; Elaine Albrich <ElaineAlbrich@dwt.com>; Walsh, Brian <Brian.Walsh@avangrid.com>
Subject: Avangrid/Empire Solar - Supplemental Information

Brent,

Aurora Solar, LLC provides the following information to supplement its CUP amendment application for the Empire Solar Project (17-22-000152-PLNG & 217-22-000153-PLNG).

1) Updated findings on socioeconomic impact assessment under CCC 18.161.010(2)(B)(X).
2) Glare Analysis Memo to demonstrates de minis impacts on neighboring properties and consistency with county standards.
3) Correspondence with correspondence with the Crooked River Watershed Council regarding the use trees removed from the project sited for fish habitat enhancements. This supports the County's proposed condition of approval on this matter.

We appreciate the opportunity to work with the County on developing this solar energy project and hope the attached information supports the permitting record for the project.

Thanks,
Matt

Matt Hutchinson
Senior Energy Developer
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Empire Solar Project: Additional Analysis under CCC 18.161.010(2)(B)(X) – Visual and Recreation

> *(x) A socioeconomic impact assessment of the photovoltaic energy system, evaluating such factors as, but not limited to, the project's effects upon the social, economic, public service, cultural, visual, and recreational aspects of affected communities and/or individuals. These effects can be viewed as either positive or negative. The purpose of this information is to provide decision makers with information in order to maximize potential benefits and to mitigate outcomes that are viewed as problematic. The applicant may submit information provided by the Economic Development of Central Oregon or similar entity to meet this requirement.*

Finding:

The Applicant provides the following additional analysis to supplement the response to CCC 18.161.010(2)(B)(X) with regard to visual and recreational resources:

... As described in the Applicant's response to CCC 18.16.020(3) in the CUP Amendment narrative, the proposed Project will be designed to blend with the surrounding landscape to the greatest extent feasible. For example, the O&M building will be painted a neutral color consistent with the background viewshed. The proposed Project will be well screened by existing vegetation (primarily mature and intermediate juniper trees, 15 to 35 feet tall) as well as the currently operational Gala Solar Facility. Although the proposed Project components will modify the existing landscape, they will be similar in nature to existing modifications (e.g., Gala Solar Facility, transmission lines) and will be set back from SW Millican Road between 0.2 and 0.5 mile to reduce contrast with the remote character of the area.

The Applicant reviewed Chapter III (Land Use – Recreation) and Chapter VI (Natural/Scenic/Buffer Areas) in the Crook County Comprehensive Plan (CCCP) to identify potential scenic and recreational resources near the Project site. The approximate distance between the Project Site Boundary and resources identified in the CCCP are as follows:

- Highway 126 (Ochoco Highway) – 4.25 miles
- Highway 27 (Crooked River) – 2.5 miles
- Highway 380 (Paulina Highway) – 8.7 miles
- U.S. Highway 26 - 8.8 miles
- Prineville Reservoir State Park – 9 miles
- Ochoco Reservoir State Park – 13 miles
- Ochoco Wayside Viewpoint – 8 miles
- Barnes Butte – 10 miles
- Ochoco National Forest – 20 miles

- Big Summit Prairie – 30 miles
- Powell Buttes – less than 2 miles
- Twelve Mile Creek Grassland – 40 miles
- Green Mountain – 20 miles
- Lookout Mountain – 30 miles
- Grizzly Mountain 17 miles
- Forest Creeks – 40 miles

At its closest points, the Project is 2.5 miles from scenic Highway 27 (Crooked River) and 4.25 miles from Highway 126 (Ochoco Highway), which the CCCP also designates as scenic highways, scenic views and recreational bikeways. The Project is also 8.7 miles from U.S. Highway 26 and 8.8 miles from Highway 380 (Paulina Highway), which the CCCP designates as scenic highways. The Project will not be visible from these resources due to distance, intervening topography, elevation, and vegetation screening. For example, Powell Buttes blocks the view from Highway 126 toward the Project, while the Crooked River Canyon blocks the view from Highway 27 toward the Project. The Project will also not be visible from U.S. Highway 26 and Highway 380 (Paulina Highway) due to even greater distances, elevation changes, and vegetation.

In addition to the scenic resources discussed above, the CCCP designates the rimrocks and the Palisades of Crooked River as scenic features. The CCCP generally defines the rimrocks as the large plateaus surrounding the valley floors of the Prineville area. CCC 18.124.100 identifies rimrock set back requirements as follows, "a proposed structure locating on the rimrock shall be set back 200 feet from the edge of said rimrock." The Project is not located on a rimrock and is located 8.2 miles from Prineville and 2.3 miles from Crooked River Canyon, well beyond the setback requirements of the nearest rimrock. Bowman Dam is located 7.6 miles from the Project site and the Palisades of Crooked River lie below Bowman Dam. The Project will not be visible from the Palisades of Crooked River due to distance, elevation changes and vegetation.

The Project site is not identified for recreational resources, nor is it near any local City/County, State, or Federal parks. Oregon State managed parks are between approximately 8 and 13 miles from the Project, including Prineville Reservoir State Park, Ochoco Reservoir State Park, and Ochoco Wayside Viewpoint. The Ochoco Wayside Viewpoint is also designated as a scenic view in the CCCP. Due to distance, elevation changes and vegetation, the Project will not be visible from Ochoco Wayside Viewpoint. The reservoirs have recreational value for camping and boating. The Prineville Reservoir State Park is approximately 9 miles southeast of the Project, while the Ochoco Reservoir State Park is over 13 miles northeast of the Project, and the Ochoco Wayside Viewpoint is over 8 miles north of the Project. The nearest incorporated city (Prineville, which has its own local parks and trails) is approximately 8 miles north of the Project site. At this distance, Prineville's recreational resources will not be affected by the proposed Project.

In terms of natural areas, the Project site is not near most of the resources outlined in the Natural/Scenic/Buffer Areas chapter of the CCCP. The Project is over 20 miles southwest of the Ochoco National Forest and over 30 miles southwest of Big Summit Prairie. Therefore, the recreational trails in these natural areas will not be impacted by the proposed Project. The closest natural area is Powell Buttes, which is owned and managed by BLM as a Research Natural Area (RNA). However, this area is designated due to its examples of several plant communities rather than for its scenic qualities, and the proposed Project does not restrict access to the RNA. Therefore, the proposed Project's proximity to Powell Buttes will not conflict with education, research, and collection of baseline data that may occur within the RNA.

A portion of Crooked River, located 2.7 miles from the Project, is designated as a Recreational River Area under the National Wild and Scenic Rivers System (National Wild and Scenic Rivers System 2022). Recreational River Areas are those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past. Due to distance, elevation changes and vegetation, the Project will not be visible from, restrict access or reduce enjoyment of the Crooked River. Therefore, the Project will not impact the scenic or recreational value of the river.

In summary, this additional analysis in response to CCC 18.161.010(2)(B)(X) demonstrates that the proposed amendment will not result in negative impacts to either scenic or recreation resources. Therefore, this criterion is met.

Reference:

National Wild and Scenic Rivers System. 2022. Crooked River, Oregon. Website: https://www.rivers.gov/rivers/crooked.php. Accessed 7/27/2022.

TETRA TECH

MEMO

To:	Avangrid Renewables, LLC
From:	Tetra Tech, Inc.
Date:	August 30, 2022
Subject:	Empire Solar Glint and Glare Analysis

Aurora Solar, LLC (Applicant), a wholly owned subsidiary of Avangrid Renewables, LLC, proposes to construct and operate the Empire Solar Project (Project), which is on vacant land off SW Millican Road in Crook County, Oregon. The Project area is near property with a Destination Resort Overlay. The Applicant is providing this supplementary information to demonstrate that the proposed Project is not likely to cause "misdirection of solar radiation onto nearby property, public roads or other areas accessible to the public" (Crook County Code 18.161.2(c)(vi)), including the property in the County's Destination Resort Overlay zone.

Literature Overview

Solar panels are designed to convert solar radiation into electricity by absorbing light onto poly or mono-crystallin cells, and the high-efficiency solar panels installed at utility-scale projects use a special type of glass coating (an anti-reflective coating) intended to increase absorption of solar radiation and decrease reflection. As a result, the solar glare from photovoltaic modules can have less glare than standard glass windows or water. In certain situations, the glass surfaces of solar photovoltaic systems can produce glint (a momentary flash of bright light) and glare (a reflection of bright light for a longer duration); but these situations are rare and limited to occasions when the sun is low in the sky (i.e., early morning and evening). In cases where solar projects have been installed near airports, the Federal Aviation Administration (FAA) has concluded that glint and glare from solar panels is not a risk to air traffic (Riley and Olson 2011).

Glare Analysis Methods

The Sandia Laboratories Solar Glare Hazard Analysis Tool (SGHAT; ForgeSolar 2022) is an analysis tool that is used by the FAA to model the potential glare from solar projects. In this case, Tetra Tech used SGHAT to estimate potential glare at the five observation points to the west of the Project and from motorists along SW Millican Road (Attachment A):

1. Three observation points are within the County's Destination Resort Overlay zone located west of and adjacent to the proposed Project site boundary. These points are intended to represent possible public viewpoints if the resort property is developed in the future.
2. Two observation points located 100 feet west of and outside the proposed Project site boundary on private property within the County's Exclusive Farm Use – 3 (Powell Butte

Area) zoning district. These locations are consistent with the 100-foot setback for residential development in the Exclusive Farm Use zoning district per Crook County Code 18.16.075(2), and intended to represent possible areas accessible to the public if this property was developed for residential housing.

3. An approximately 4.2-mile segment of Millican Road located east of the proposed Project site boundary to represent an area traveled by motorists.

The panels to be used on the proposed Project are a smooth glass surface material with an anti-reflection coating. Analysis was performed to simulate panels with a single-axis tracking (SAT) system that assumed a 60-degree maximum tracking range and 5-degree resting angle. The analysis was conducted for a panel height of 9 feet above ground surface (centroid height), with applicable panel specifications. The analysis calculated the predicted potential glare minutes at the following specified receptors:

- Viewing height of observer in standard first floor building at 6 feet above ground surface (see OP 1 through 5 in Analysis 1in Attachment B);
- Viewing height of observer in standard vehicle at 5 feet above ground surface (see SW Millican Road in Analysis 1in Attachment B)

Glare Analysis Results

Results of the glare analysis found that there was only two minutes of yellow glare for OP 1 throughout a year with a SAT system (Table 1).

Table 1: Single Axis Tracker Annual Minutes of Glare Summary

Receptor	Green Glare	Yellow Glare	Red Glare
SW Millican Road	0	0	0
OP 1	0	2	0
OP 2	0	0	0
OP 3	0	0	0
OP 4	0	0	0
OP 5	0	0	0

Summary

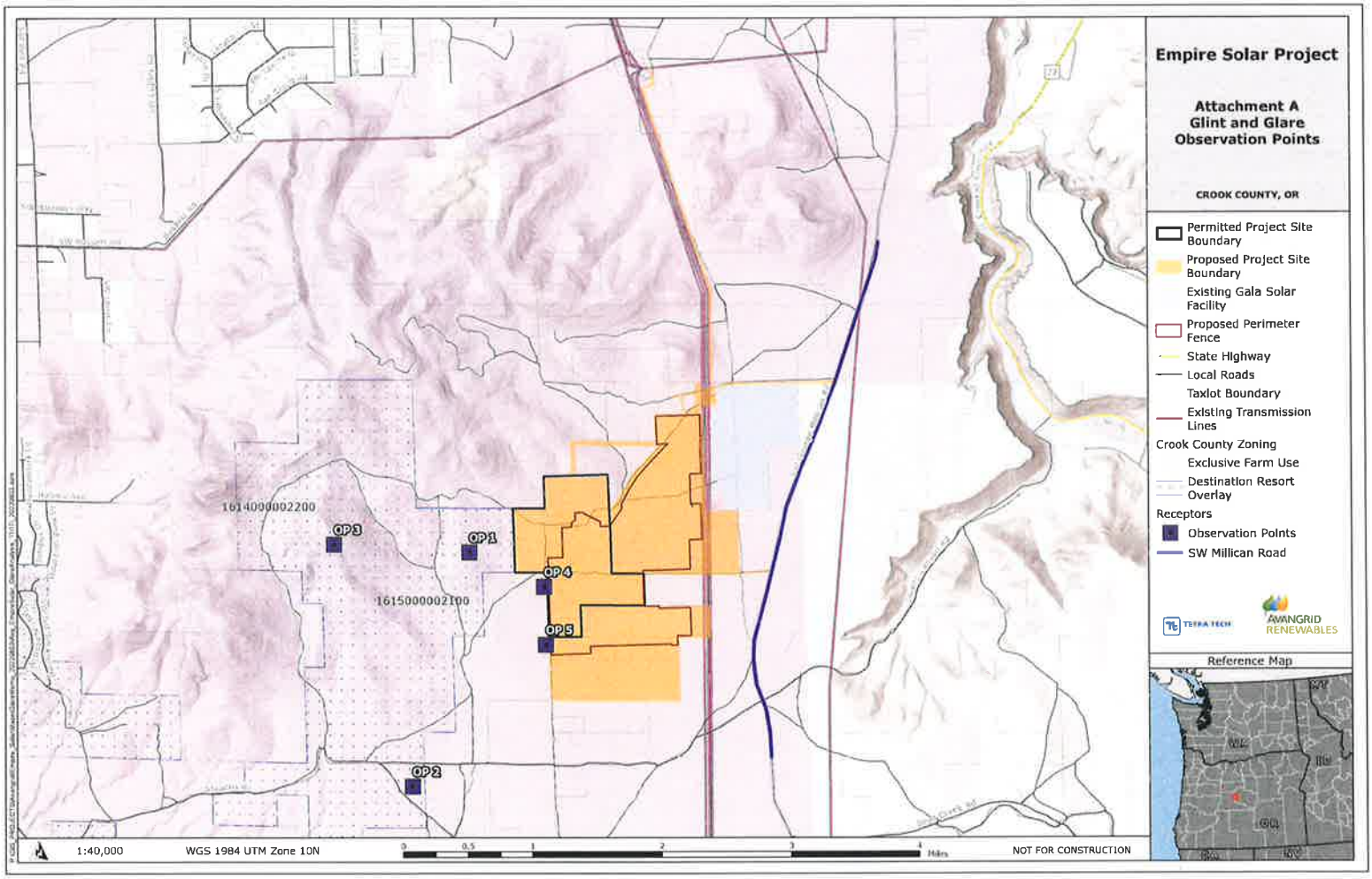
The modeling results support the Applicant's conclusion that the proposed Project likely will not cause significant glint or glare onto adjacent properties that are accessible to the public, either now or in the foreseeable future. The analysis used panel specifications of smooth glass with anti-reflective coating. Based on the results, a SAT system will cause negligible amounts of predicted yellow glare (two minutes annually at OP 1). In addition, the model results do not account for varying ambient conditions (i.e., cloudy days, precipitation), atmospheric attenuation, shading, screening due to existing topography, or existing vegetation or structures (including trees, fences, or walls) between the defined photovoltaic arrays and the observer during analysis. As such, the predicted results are conservative and overestimate the duration of glare.

References

ForgeSolar. 2022. Sandia Solar Glare Hazard Analysis Tool, GlareGauge hosted by ForgeSolar. https://www.forgesolar.com/.

Riley, Evan and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems", International Scholarly Research Notices, vol. 2011, Article ID 651857, 6 pages, 2011. https://doi.org/10.5402/2011/651857.

ATTACHMENT A


Empire Solar Project
Attachment A
Glint and Glare
Observation Points
CROOK COUNTY, OR
Permitted Project Site Boundary
Proposed Project Site Boundary
Existing Gala Solar Facility
Proposed Perimeter Fence
State Highway
Local Roads
Taxlot Boundary
Existing Transmission Lines
Crook County Zoning
Exclusive Farm Use
Destination Resort Overlay
Receptors
Observation Points
SW Millican Road
TETRA TECH
AVANGRID RENEWABLES
Reference Map
OP 1
OP 2
OP 3
OP 4
OP 5
1614000002200
1615000002100
1:40,000
WGS 1984 UTM Zone 10N
0
0.5
1
2
3
4
Miles
NOT FOR CONSTRUCTION

ATTACHMENT B

FORGESOLAR GLARE ANALYSIS

Project: **Empire Solar**
Site configuration: **Empire Solar Analysis 1-SAT**

Created 28 Jul, 2022
Updated 28 Jul, 2022
Time-step 1 minute
Timezone offset UTC-8
Site ID 73265.12900
Category 100 MW to 1 GW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 2	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 3	SA tracking	SA tracking	0	0.0	2	0.0	-
PV array 4	SA tracking	SA tracking	0	0.0	0	0.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	2	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 1
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.3
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.186785	-120.931425	3700.10	9.00	3709.10
2	44.186699	-120.924180	3621.60	9.00	3630.60
3	44.175861	-120.924073	3622.60	9.00	3631.60
4	44.176300	-120.939311	3709.37	9.00	3718.37
5	44.183289	-120.931456	3685.41	9.00	3694.41

Name: PV array 2
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.3
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.176578	-120.949332	3893.39	9.00	3902.39
2	44.180032	-120.949050	3930.50	9.00	3939.50
3	44.179778	-120.939184	3810.28	9.00	3819.28
4	44.176296	-120.939274	3709.28	9.00	3718.28

Name: PV array 3
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.3
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.175721	-120.919575	3518.51	9.00	3527.51
2	44.168623	-120.919554	3492.83	9.00	3501.83
3	44.169276	-120.954013	3813.86	9.00	3822.86
4	44.176672	-120.954063	3947.05	9.00	3956.05

Name: PV array 4
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Ground Coverage Ratio: 0.3
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.169225	-120.949097	3739.34	9.00	3748.34
2	44.154532	-120.949061	3624.76	9.00	3633.76
3	44.154393	-120.928719	3495.77	9.00	3504.77
4	44.161752	-120.928719	3516.63	9.00	3525.63
5	44.161567	-120.923912	3490.99	9.00	3499.99
6	44.164861	-120.923869	3501.74	9.00	3510.74
7	44.165292	-120.933804	3565.29	9.00	3574.29
8	44.168924	-120.933826	3598.21	9.00	3607.21

Route Receptors

Name: Millican Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.208531	-120.895942	3398.54	5.00	3403.54
2	44.206039	-120.896157	3393.25	5.00	3398.25
3	44.203270	-120.897144	3394.58	5.00	3399.58
4	44.200194	-120.898088	3402.87	5.00	3407.87
5	44.198840	-120.898732	3405.62	5.00	3410.62
6	44.194331	-120.901471	3424.71	5.00	3429.71
7	44.189284	-120.903659	3449.52	5.00	3454.53
8	44.182853	-120.907522	3467.34	5.00	3472.34
9	44.177559	-120.910741	3477.33	5.00	3482.33
10	44.175321	-120.912044	3468.44	5.00	3473.44
11	44.169965	-120.913889	3468.43	5.00	3473.43
12	44.163654	-120.916378	3463.32	5.00	3468.32
13	44.161191	-120.917108	3462.09	5.00	3467.09
14	44.158204	-120.917708	3461.82	5.00	3466.82
15	44.156202	-120.917168	3454.00	5.00	3459.00
16	44.152569	-120.915495	3444.86	5.00	3449.86
17	44.151559	-120.915260	3441.91	5.00	3446.91
18	44.142906	-120.914874	3502.96	5.00	3507.96

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	44.171494	-120.961052	4041.06	6.00
OP 2	2	44.145768	-120.970605	3609.32	6.00
OP 3	3	44.173045	-120.982826	4605.19	6.00
OP 4	4	44.167744	-120.949744	3727.87	6.00
OP 5	5	44.161083	-120.949647	3667.74	6.00

Glare Analysis Results

Summary of Results

Glare with potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 2	SA tracking	SA tracking	0	0.0	0	0.0	-
PV array 3	SA tracking	SA tracking	0	0.0	2	0.0	-
PV array 4	SA tracking	SA tracking	0	0.0	0	0.0	-

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

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	2	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

PV: PV array 1

no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

PV array 1 and Millican Road

Receptor type: Route
No glare found

PV array 1 and OP 1

Receptor type: Observation Point
No glare found

PV array 1 and OP 2

Receptor type: Observation Point
No glare found

PV array 1 and OP 3

Receptor type: Observation Point
No glare found

PV array 1 and OP 4

Receptor type: Observation Point
No glare found

PV array 1 and OP 5

Receptor type: Observation Point
No glare found

PV: PV array 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

PV array 2 and Millican Road

Receptor type: Route
No glare found

PV array 2 and OP 1

Receptor type: Observation Point
No glare found

PV array 2 and OP 2

Receptor type: Observation Point
No glare found

PV array 2 and OP 3

Receptor type: Observation Point
No glare found

PV array 2 and OP 4

Receptor type: Observation Point
No glare found

PV array 2 and OP 5

Receptor type: Observation Point
No glare found

PV: PV array 3 potential temporary after-image

Receptor results ordered by category of glare

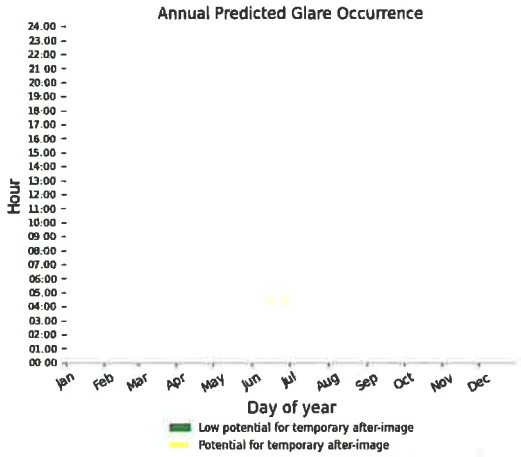
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	2	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

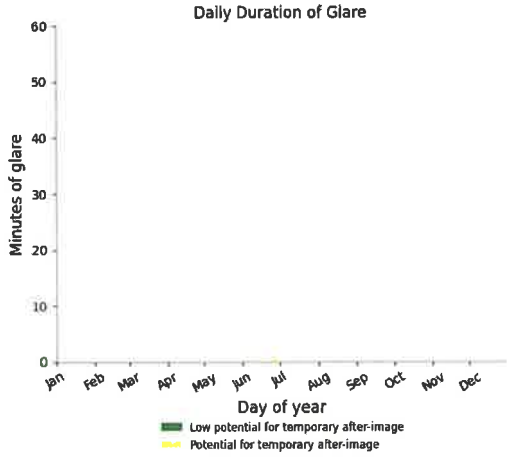
PV array 3 and Millican Road

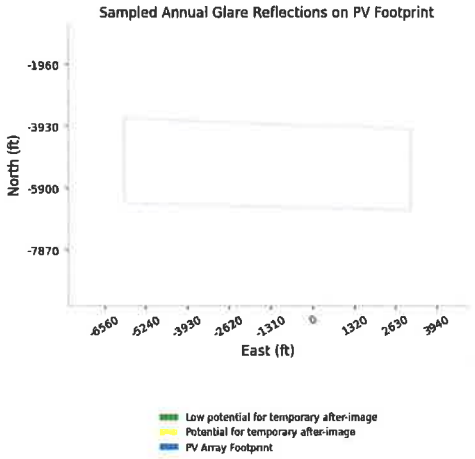
Receptor type: Route
No glare found

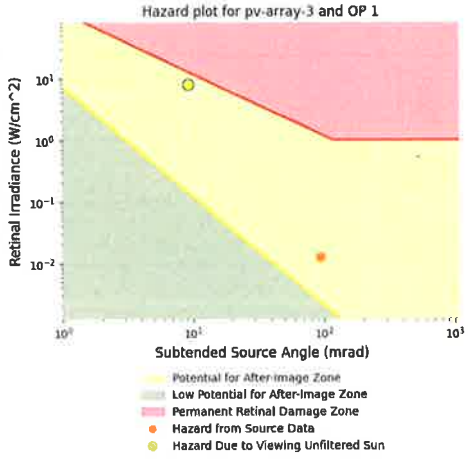
PV array 3 and OP 1

Receptor type: Observation Point
2 minutes of yellow glare
0 minutes of green glare









PV array 3 and OP 2

Receptor type: Observation Point
No glare found

PV array 3 and OP 3

Receptor type: Observation Point
No glare found

PV array 3 and OP 4

Receptor type: Observation Point
No glare found

PV array 3 and OP 5

Receptor type: Observation Point
No glare found

PV: PV array 4 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Millican Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0

PV array 4 and Millican Road

Receptor type: Route
No glare found

PV array 4 and OP 1

Receptor type: Observation Point
No glare found

PV array 4 and OP 2

Receptor type: Observation Point
No glare found

PV array 4 and OP 3

Receptor type: Observation Point
No glare found

PV array 4 and OP 4

Receptor type: Observation Point
No glare found

PV array 4 and OP 5

Receptor type: Observation Point
No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

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

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Hutchinson, Matthew

From: Chris Gannon <Chris@crwc.info>
Sent: Thursday, August 11, 2022 3:22 PM
To: Hutchinson, Matthew
Subject: Re: Empire Solar & Juniper Trees

EXTERNAL SENDER: Be cautious, especially with links and attachments. Report phishing if suspicious.

Thanks Matt,

It would be easier for us if you can use our email exchanges as proof of coordination to meet County interests. We are not opposed to writing a letter to the County on our letterhead if you have a strong preference for that approach.

All else sounds great. We expect to pay for transport off your site as you suggest so I think we are in good shape. That is a lot of ground, so I am curious now about the project's duration. Will it all be cleared with downed trees needing to be addressed in one year? Maybe two?

BTW- the County may also have an erosion/soil containment provision for these types of developments that also lists our council as a point of contact for these types of issues. We have seen this applied in the past, but not so much for recent developments. Do you have any updates on this requirement?

Thanks for the note, I will respond to the meeting invite when it arrives -
Chris

From: Hutchinson, Matthew <matthew.hutchinson@avangrid.com>
Sent: Thursday, August 11, 2022 3:06 PM
To: Chris Gannon <Chris@crwc.info>
Cc: Mark Peterson <Mark@crwc.info>; Bodie Brown <Bodie@crwc.info>
Subject: RE: Empire Solar & Juniper Trees

Thanks for the information. We are looking at about 800 acres of tree clearing, so I'd say we would remove hundreds to thousands of juniper trees – of all sizes. We happy to work with the watershed council for providing trees for your restoration just as long as we don't have to provide the transportation of material off our project site. But is sounds like you're willing to take care of that part. I'll send out a meeting invite for later this year to check on our progress.

Also – I'd like to use this email correspondence to support our permit application with the county. Or you okay with sharing with this email with the County? Or would you be willing submitted a comment letter on watershed council letterhead that outlines our discussion?

We are exciting to participate this restoration opportunity.

Thanks,
Matt

Internal Use

From: Chris Gannon <Chris@crwc.info>
Sent: Thursday, August 11, 2022 11:46 AM
To: Hutchinson, Matthew <matthew.hutchinson@avangrid.com>

Cc: Mark Peterson <Mark@crwc.info>; Bodie Brown <Bodie@crwc.info>
Subject: Re: Empire Solar & Juniper Trees

EXTERNAL SENDER: Be cautious, especially with links and attachments. Report phishing if suspicious.

Hello Matt,

Thank you for reaching out to us.

Yes, we are eager to work with you on utilization of juniper materials from the site clearing process. Generally, we prefer whole trees with root wads attached, the larger the better, although this material is harder to transport. For our river restoration work, whole trees are highly preferable. We are more interested in juniper compared to other species given its degradation rate is much slower and the material lasts longer in a wet/moist environment. We will begin a soft outreach to some of our conservation partners to see if they could also use some of this material. How many acres of juniper are you looking at for this particular project or phase of a larger project?

Generally, we will work with your crews to sort felled trees into unusable and usable decks (piles) and then we will hire a contractor to move them off your solar site. We can talk more details in a phone call this fall or winter and set up a schedule. Our goal is to hold your costs down regarding juniper tree recovery from the site. This means we will work with you to pick up costs that you would not have had compared to other disposal methods. Clearly, there will be some trees we will not want to use, but we should be able to reduce your total material volumes and save you some money compared to other options and material volumes.

Can we connect by phone some time in the coming few months?

Chris

From: Hutchinson, Matthew <matthew.hutchinson@avangrid.com>
Sent: Wednesday, August 10, 2022 7:00 PM
To: Chris Gannon <Chris@crwc.info>
Subject: Empire Solar & Juniper Trees

Hi Chris,

I'm working with the Crook County Planning Department on permitting a solar project along Milliken Road that next to the existing solar project down there, and the County is suggesting that we work with the Crook County Watershed Council to use the juniper trees removed from our project site at stream restoration projects elsewhere in the county. Can you tell me a what kind of material you're looking for? Such as cut trees, trees with rootball, tree species, minimum size, etc. Also can you describe the logistics on how this would work?

We're happy to work with Council and think it is a great idea to put this material to good use. I'm just looking for information to incorporate into our planning efforts and construction sequencing. We're looking at starting work in 2024 but tree clearing could occurring in late 2023.

Thanks much,
Matt

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RENEWABLES

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