Ross County Solar

Exhibit P

Glare Analysis

Case No. 20-1380-EL-BGN

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MEMORANDUM

To: Ross County, LLC - c/o William Risse

From: Philip DeVita, HMMH

Date: October 2 2020

Subject: Ross County Solar, LLC Glare Analysis

Reference: HMMH Job No.309700.020

Introduction

Harris Miller Miller & Hanson Inc. (HMMH) completed a glare analysis on behalf of Ross County Solar, LLC (Ross County) for the proposed up to 120 MW Solar Project (Project) located in Ross County, Ohio. The analysis evaluated potential glare from sensitive observer locations related to Ross Field and Unger Field, Highway 41 and Rapid Forge Road adjacent to the Project. The proposed project would be located southwest of Ross Field (approximately 1.79 miles) and southeast of Unger Field (approximately 2.81 miles). **Figure 1** shows the project location relative to the airports and its runways.

HMMH used the latest version of the ForgeSolar GlareGauge solar glare tool, formerly known as the Solar Glare Hazard Analysis Tool (SGHAT) developed by Sandia National Laboratories to analyze potential glare at sensitive airport receptor locations. Model results were reviewed relative to the Federal Aviation Administration's (FAA) Interim Policy of Solar Projects at Airports. Nearby roadway locations were also analyzed using the GlareGauge tool and the FAA Solar Policy standards for pilots on final approach.

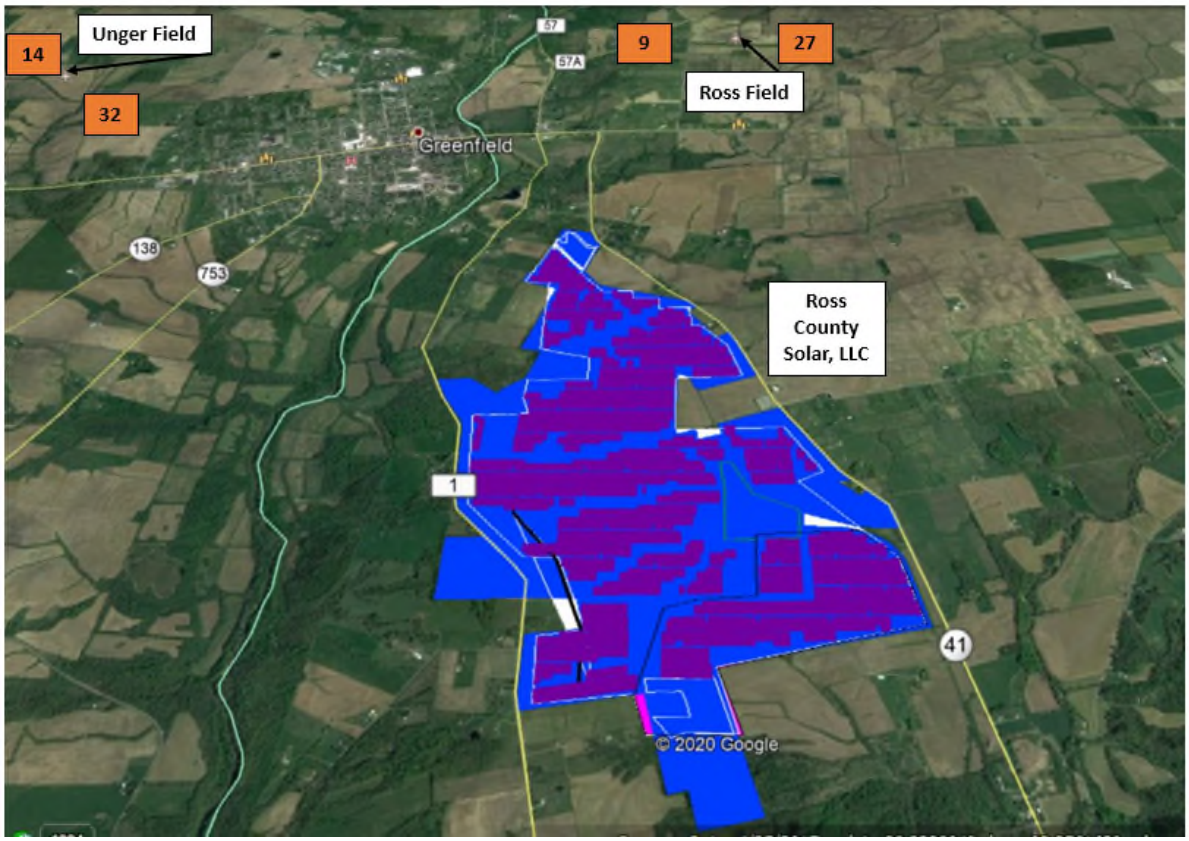


Figure 1. Map of Ross County Solar, LLC Solar Project Relative to Ross Field and Unger Field

Design Parameters

In deploying the model, we selected the footprint of the solar project area of the Ross County array on the GlareGauge map interface and input the project design parameter provided by Ross County Solar, LLC as shown in **Table 1.**

Table 1. Ross County Solar, LLC Proposed Project Design Parameters

Solar System	System	Orientation	Tilt Angle	Panel Height (AGL)
Ross County Solar, LLC Array	***Single Axis***	***180°***	***60°[1]***	***20 feet***

1. Denotes maximum tracking angle.

The Project is proposing up to 120 MW single axis tracking system with a tracking orientation north to south and a maximum tracking angle of 60°. The project will be located on the ground, and a height of up to 20 feet above ground level was assessed for the modules.

Airport Sensitive Receptors and Pilot Analysis

To assess airport sensitive receptors, the FAA requires an evaluation of potential glare for pilots on final approach and at the air traffic control tower (ATCT). For the pilot analysis, we selected the runway threshold and a second point away from the runway to represent the direction of the flight path. GlareGauge automatically evaluates glare along the entire distance of the flight path at a 3-degree glide slope out to two miles. There is no ATCT at either airport; therefore, the analysis only included evaluating impacts to aircraft on approach to each runway end.

FAA Jurisdiction and Standards for Measuring Ocular Impact

The FAA published an Interim Policy for Solar Projects at Airports on October 23, 2013. The policy clarifies the FAA's jurisdiction in reviewing solar projects and the standards it uses to determine if a project will result in a negative glare impact to airspace safety.

Relative to its jurisdiction, the FAA affirmed that it has jurisdiction to regulate potential glare impacts as part of its responsibilities under Federal Aviation Regulations (FAR) Part 77 to any solar project proposed on the property of a Federally-obligated airport, which includes most airports in the U.S. The FAA also clarified that it does not have jurisdiction to regulate potential glare from projects located on non-airport land. However, as stated in the Policy, "the FAA urges proponents of off-airport solar-installations to voluntarily implement the provisions in this policy." *As the project is not located at a Federally-obligated airport, Ross County is not required to conduct a glare analysis for FAA approval. Furthermore, to assess airport sensitive receptors, the FAA requires an evaluation of potential glare for pilots on final approach and at the air traffic control tower (ATCT). Final approach path is defined in the policy as "two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glide path"[1]. The project is located within two miles of Ross Field but just beyond the final approach path of two miles from Unger Filed; however as discussed above, Ross County has sought to voluntarily comply with FAA ocular hazard standards published in the FAA's Interim Policy*.

The Policy also describes the standards for measuring ocular impact:

To obtain FAA approval and a "no objection" to a Notice of Proposed Construction Form 7460-1, the airport sponsor will be required to demonstrate that the proposed solar energy system meets the following standards: (1) no potential for glint or glare in the existing or planned Air Traffic Control Tower cab, and (2) no potential for glare or "low potential for after-image" (shown in green) along the final approach path.

Table 2 presents the airport sensitive receptors that must be evaluated, the potential results presented by the model and whether the result complies with the FAA ocular hazard standard presented in the Policy.

[1] https://www.federalregister.gov/documents/2013/10/23/2013-24729/interim-policy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports

Table 2. Levels of Glare and Compliance with FAA Policy

Airport Sensitive Receptor	Level of Glare	Color Result	Compliance with FAA Policy
ATCT Cab	No glare	None	Yes
	Low Potential for After-Image	Green	No
	Potential for After-Image	Yellow	No
	Potential for Permanent Eye Damage	Red	No
Aircraft along final approach path	No glare	None	Yes
	Low Potential for After-Image	Green	Yes
	Potential for After-Image	Yellow	No
	Potential for Permanent Eye Damage	Red	No

Any glare recorded on the ATCT is not compliant with FAA policy and will not receive a "no objection" determination from the FAA. Measurement of *low potential for after-image* or "Green" is acceptable for aircraft on final approach but greater levels (indicated in yellow and red) are not allowed.

Summary of Results

HMMH analyzed the potential for the Ross County Project site to produce glare on pilots on final approach to the Ross Field and Unger Field. Based on the design and layout, GlareGauge modeling showed:

- Runway End 9 and 27 at Ross Field: No glare detected at any observation points along the flight path; proposed design meets the FAA Standard for aircraft on final approach
- Runway End 14 and 32 at Unger Field: No glare detected at any observation points along the flight path; proposed design meets the FAA Standard for aircraft on final approach
- ATCT: no analysis conducted, no ATCT at either airport.

Results in Detail

To accurately model the proposed project, HMMH outlined the project array on the model's interactive map, and the GlareGauge tool analyzed the potential glare impact from the project site. **Figure 2a** and **Figure 2b** shows the layout of the project area as input into the model for the northern and southern portions, respectively.

Source: GlareGauge

Figure 2a. Ross County Solar, LLC Array (northern half) as Input into the GlareGauge Model

Source: GlareGauge

Figure 2b. Ross County, LLC Array (southern half) as Input into the GlareGauge Model

HMMH input the specifications of the array including a single axis tracking system with a north-south orientation, maximum tracking angle of 60° and a panel height of 20 feet above ground level. A smooth panel surface without any anti-reflective coating was assumed to provide maximum flexibility in module selection. Modeling was then undertaken for the applicable sensitive receptors required by FAA: the pilots in

aircraft along final descent to each runway end. The modeling result output sheets are provided as **Attachment A**.

ATCT

For the Air Traffic Control Tower (ATCT) analysis, no analysis was conducted as neither airport has an ATCT.

Arriving Aircraft

To analyze arriving aircraft, HMMH selected locational information associated with each runway individually and generated associated results to evaluate the potential impacts of the proposed project on that runway. Given that there is one runway and two runway ends at each airport; modeling was conducted separately for each runway end.

To model a runway approach, a point was selected at the centerline on the runway threshold which is located near the runway end. A second point was selected away from the runway to represent the orientation of the aircraft descent (or glide) path. The model automatically plots the glide path out two miles from the runway end and evaluates potential for glare along the entire glide path. Given that Ross Field and Unger Field has two runway ends each; the model assessed the potential for glare along each of the two aircraft flight paths landing at each airport. The model automatically plots the location and height above ground of each observation point along the glide path assuming a 3-degree glide slope for the approach. In the model's flight path window, HMMH checked the "consider pilot visibility from cockpit" box and kept the default azimuth-viewing angle of 50° so that the model would not register glare that the pilot would not see from behind the aircraft. The default downward viewing angle of 30° was used to eliminate false glare results from below the aircraft. **Figure 3** shows the flight path analyzed by the model for each runway at both airports.

Source: GlareGauge

Figure 3. Flight Path Analyzed by GlareGauge

The latest version of the model now shows component results in time for the aircraft along a continuous route. **Table 3** and **Table 4** presents the GlareGauge modeling results for each runway in terms of predicted minutes of green, yellow, or red glare at Ross Field and Unger Field, respectively.

As shown in **Table 3** and **Table 4**, no glare was detected by the model for any of the runway approaches for the single axis tracking system. The no glare result on aircraft on approach to each runway comply with the FAA's ocular impact standard as published in the Federal Register on October 23, 2013 and shown in **Table 2**.

Table 3 – GlareGauge Results (in minutes per year) for the Ross County Solar, LLC Project near Ross Field

Site	Fixed/Tracker System	(orientation/tilt)	ATCT	RWY 9	RWY 27	Comply with FAA Thresholds
Ross County Solar, LLC	Single Axis Tracker	180° (max tracker of 60°)	N/A	0	0	Yes

Notes:

G (Green) = Low Potential for Temporary After-Image
Y (Yellow) = Potential for Temporary After-Image
R (Red) = Potential for Permanent Eye-Damage

N/A = Not applicable, no analysis conducted.

None (Clear) = No Glare

Table 4 – GlareGauge Results (in minutes per year) for the Ross County Solar, LLC Project near Unger Field

Site	Fixed/Tracker System	(orientation/tilt)	ATCT	RWY 14	RWY 32	Comply with FAA Thresholds
Ross County Solar, LLC	Single Axis Tracker	180° (max tracker of 60°)	N/A	0	0	Yes

Notes:

G (Green) = Low Potential for Temporary After-Image
Y (Yellow) = Potential for Temporary After-Image
R (Red) = Potential for Permanent Eye-Damage

N/A = Not applicable, no analysis conducted.

None (Clear) = No Glare

Summary of Results for Nearby Roadway Observation Locations

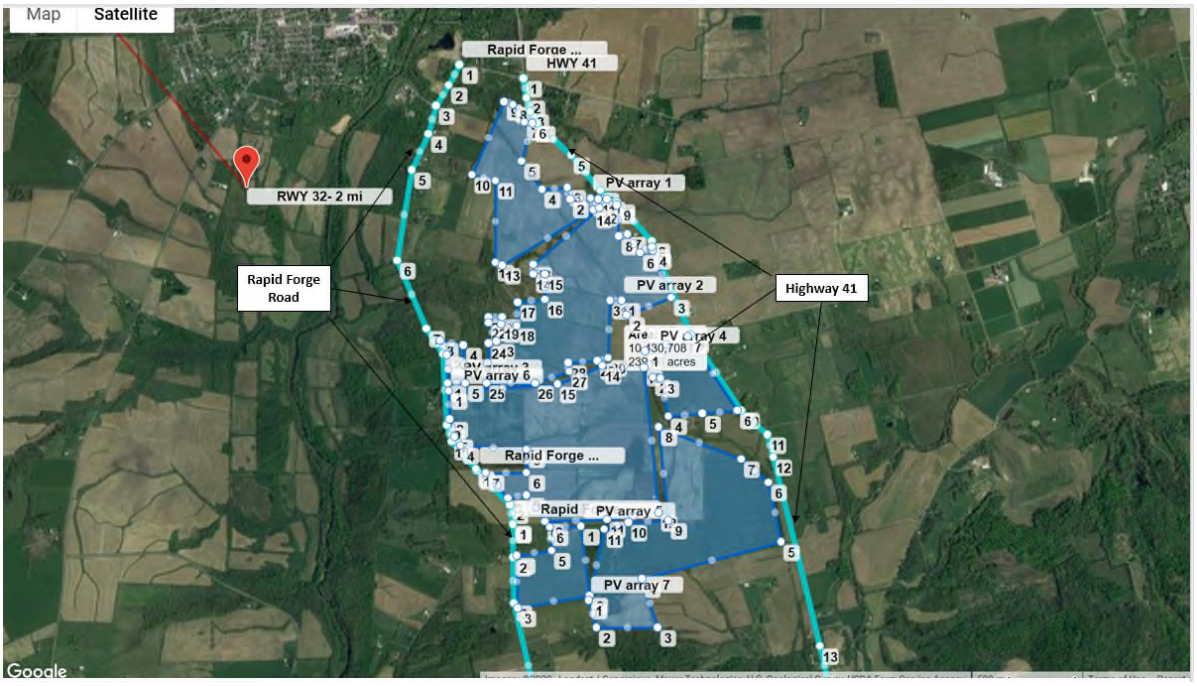
In addition to the airport observation locations, HMMH analyzed the potential for the Ross County Project to produce glare at nearby roadway observation locations using GlareGauge. The GlareGauge model is currently the best tool available for analyzing solar glare impacts from PV projects and is able to simulate glare to observers along a continuous roadway segment.

Methodology

For the roadway analysis, the two closest major roadways were analyzed. The nearby roadway locations included segments of:

- Highway 41, and
- Rapid Forge Road

Figure 4 shows the roadway segment locations from the GlareGauge model selected for analysis. The roadway segments Highway 41 to the east and Rapid Forge Road to the west are depicted in light blue in the figure.

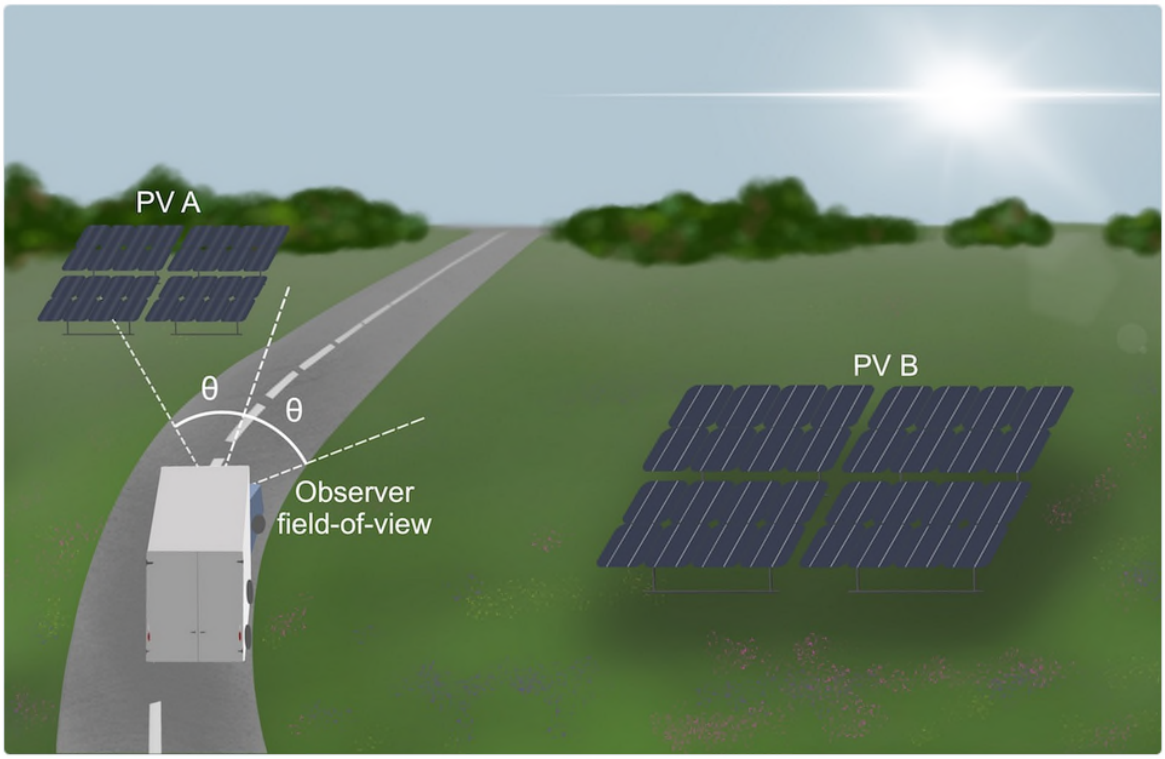


Source: GlareGauge

Figure 4. Roadway Segments Analyzed in GlareGauge

For the roadway analysis, HMMH input the same specifications of the preferred array as described above including single axis tracking system, orientation of 180°/0°, maximum tracking angle of 60°and panel height of 20 feet above ground level. A smooth panel surface without any anti-reflective coating was assumed to provide maximum flexibility in module selection.

Similar to the airport analysis, the model was run for a full calendar year to calculate information for every sun position scenario over a typical year and the model assessed potential for glare at one-minute intervals. A viewing height of 6 feet above ground level was chosen as the height of the roadway observer as well as assuming two-way viewing meaning the observers travel along the route in both directions. A viewer default angle of 50° was chosen as the field of view where the observer can see 50 degrees to the left and right for a total field of view of 100°. **Figure 5** shows a depiction of the route field of view in GlareGauge.



*Route receptor field-of-view is defined by view angle (theta) to left and right. Default FOV is 100° (i.e. 2 * 50° view angle).*

Source: GlareGauge

Figure 5. Route Receptor Field of View in GlareGauge

A summary of the model output is presented in **Table 4** for each roadway observer segment. The modeling result output sheets for the roadway locations are provided as **Attachment A** and denoted as Highway 41 (HW41) and Rapid Forge (North, Middle, South) in the model output. As shown in **Table 5**, no glare was detected by the model for any of the nearby roadway observer locations.

Table 5 – GlareGauge Results (in minutes per year) for the Ross County Solar, LLC Project for Portions of Highway 41 and Rapid Forge Road

Site	Fixed/Tracker System	(orientation/tilt)	Highway 41	Rapid Forge Road	Comply with FAA Thresholds for Pilots
Ross County Solar, LLC	Single Axis Tracker	180° (max tracker of 60°)	0	0	Yes

Notes:

G (Green) = Low Potential for Temporary After-Image
Y (Yellow) = Potential for Temporary After-Image
R (Red) = Potential for Permanent Eye-Damage

N/A = Not applicable, no analysis conducted.

None (Clear) = No Glare

As discussed above, measurement of Low Potential for After-Image or Green is acceptable for aircraft on final approach but greater levels (indicated in yellow and red) are not allowed.

Any potential solar glare to the vehicles traveling along the nearby roadways is very similar or representative to aircraft along final approach in the FAA standards. Therefore, for this analysis the standards of acceptable ocular impact as contained in the FAA policy for aircraft on final approach were applied to the vehicles traveling along the nearby roadways. It should be noted that the GlareGauge model does not consider potential obstacles associated with the landscape such as trees, buildings or hills which could block a direct view of the solar panels to the nearby observer locations.

Based on the design and layout of the Ross County Solar Project, the GlareGauge modeling showed no glare detected at any roadway observation points, accordingly, the proposed design meets the FAA Standard for aircraft at each modeled observer location. *Therefore, there is no evidence based upon our modeling that glare from the Project will cause an adverse impact for drivers along analyzed portions of Highway 41 and Rapid Forge Road.*

Conclusions

HMMH utilized the GlareGauge model developed by the Department of Energy's Sandia National Laboratories to evaluate potential glare from a proposed single axis tracking solar PV project to be located southwest of Ross Field (approximately 1.79 miles) and southeast of Unger Field (approximately 2.81 miles. The analysis focused on potential glare effects on aircraft arriving on final approach to runway ends 9, 27, 14, and 32.

While the project *is not located on airport property and therefore not subject to FAA jurisdiction under Federal Aviation Regulations Part 77 to protect airspace safety; and the project is located just beyond the two mile final approach to Unger Field as defined in the Interim Solar Policy,* the proponents have sought to voluntarily comply with FAA ocular hazard standards published in the FAA's Interim Solar Policy in the Federal Register on of October 23, 2013.

GlareGauge model results were compared to the FAA's ocular hazard standard. The model results provided in **Attachment A** show that for aircraft on final approach to Runways 9, 27, 14, and 32, GlareGauge model results for the project design result in no glare detected along the approach to each runway end. These results *comply* with the FAA standards described in the Interim Solar Policy.

In addition to the airport observation locations, HMMH analyzed the potential for the Ross County Project to produce glare at nearby roadway observation locations (Highway 41 and Rapid Forge Road) using GlareGauge. GlareGauge is used to assess glare impacts at airport observation locations from solar photovoltaic (PV) projects and is currently the best tool available for analyzing solar glare impacts from PV projects and has the ability to simulate glare to observers along a continuous roadway segment. **Attachment A** show the Glaregauge modeling results for the nearby roadway segments.

Based on the design and layout of Ross County Project, the GlareGauge modeling showed no glare detected at any roadway observation points, accordingly, the proposed design meets the FAA Standard for aircraft at each modeled observer location. *Therefore, there is no evidence based upon our modeling that glare from the Project will cause an adverse impact for drivers along portions of Highway 41 and Rapid Forge Road.*

Attachment A

GlareGauge Modeling Results – Ross County Solar Project Design

FORGESOLAR GLARE ANALYSIS

Project: **Ross County Solar Project**
Ross County

Site configuration: **Ross County LLC Revision 3 Prop Line**
Analysis conducted by Phil DeVita (pdevita@hmmh.com) at 17:24 on 24 Sep, 2020.

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
2-mile flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

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

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: 43715.7277

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°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.334902	-83.360642	890.29	20.00	910.29
2	39.334836	-83.362488	893.94	20.00	913.94
3	39.335616	-83.362681	896.97	20.00	916.97
4	39.335516	-83.364934	891.04	20.00	911.04
5	39.337435	-83.366726	891.93	20.00	911.93
6	39.339990	-83.365800	867.77	20.00	887.77
7	39.340102	-83.366497	861.38	20.00	881.38
8	39.341294	-83.367496	868.09	20.00	888.09
9	39.341497	-83.368300	862.39	20.00	882.39
10	39.336504	-83.371096	903.67	20.00	923.67
11	39.336084	-83.369092	904.13	20.00	924.13
12	39.330502	-83.369086	873.86	20.00	893.86
13	39.330286	-83.368496	873.46	20.00	893.46
14	39.334088	-83.360394	880.11	20.00	900.11

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°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.327900	-83.357938	887.88	20.00	907.88
2	39.326954	-83.357489	888.69	20.00	908.69
3	39.328125	-83.353498	906.19	20.00	926.19
4	39.331311	-83.355150	898.08	20.00	918.08
5	39.331560	-83.355279	897.46	20.00	917.46
6	39.331145	-83.356256	898.98	20.00	918.98
7	39.332410	-83.357421	895.04	20.00	915.04
8	39.332294	-83.358204	895.65	20.00	915.65
9	39.334417	-83.358332	886.65	20.00	906.65
10	39.334832	-83.359212	889.22	20.00	909.22
11	39.334857	-83.359952	887.48	20.00	907.48
12	39.334201	-83.359920	881.79	20.00	901.79
13	39.330402	-83.365720	883.36	20.00	903.36
14	39.329688	-83.365699	883.88	20.00	903.88
15	39.329705	-83.364701	881.07	20.00	901.07
16	39.327991	-83.364707	889.41	20.00	909.41
17	39.327792	-83.367110	888.03	20.00	908.03
18	39.326199	-83.367210	901.13	20.00	921.13
19	39.326299	-83.368508	900.46	20.00	920.46
20	39.326797	-83.368498	895.60	20.00	915.60
21	39.326797	-83.369624	894.99	20.00	914.99
22	39.326398	-83.369624	901.25	20.00	921.25
23	39.325120	-83.369002	899.20	20.00	919.21
24	39.324980	-83.369701	903.87	20.00	923.87
25	39.322309	-83.369811	927.10	20.00	947.10
26	39.322300	-83.365508	915.86	20.00	935.86
27	39.323090	-83.362579	896.46	20.00	916.47
28	39.323684	-83.362593	899.56	20.00	919.56
29	39.323800	-83.360093	893.19	20.00	913.20
30	39.323983	-83.359074	892.78	20.00	912.78
31	39.327907	-83.358948	889.22	20.00	909.22

Name: PV array 3
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.322295	-83.373247	933.39	20.00	953.39
2	39.324188	-83.373355	928.65	20.00	948.65
3	39.325184	-83.373977	927.40	20.00	947.40
4	39.324852	-83.371938	914.12	20.00	934.12
5	39.322295	-83.371702	924.36	20.00	944.36

Name: PV array 4
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.324440	-83.355887	887.20	20.00	907.20
2	39.322708	-83.355198	881.67	20.00	901.67
3	39.322608	-83.354490	880.93	20.00	900.94
4	39.320008	-83.353804	879.59	20.00	899.59
5	39.320199	-83.350810	879.66	20.00	899.66
6	39.320408	-83.347677	884.74	20.00	904.74
7	39.325492	-83.352053	904.50	20.00	924.51

Name: PV array 5
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.312527	-83.361497	935.28	20.00	955.28
2	39.307815	-83.360729	964.52	20.00	984.52
3	39.306935	-83.367102	1004.79	20.00	1024.79
4	39.310507	-83.367183	983.99	20.00	1003.99
5	39.310889	-83.364114	973.10	20.00	993.11
6	39.312464	-83.364296	941.32	20.00	961.33

Name: PV array 6
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.321759	-83.373222	931.78	20.00	951.78
2	39.319817	-83.373125	947.87	20.00	967.87
3	39.318630	-83.372702	945.23	20.00	965.23
4	39.318008	-83.372192	942.87	20.00	962.88
5	39.317775	-83.366356	911.99	20.00	932.00
6	39.316182	-83.366291	929.85	20.00	949.85
7	39.316173	-83.369929	944.91	20.00	964.91
8	39.314456	-83.367907	954.30	20.00	974.30
9	39.314664	-83.366319	961.95	20.00	981.95
10	39.312877	-83.364650	935.12	20.00	955.13
11	39.312977	-83.359157	910.45	20.00	930.45
12	39.313421	-83.354621	899.62	20.00	919.62
13	39.323364	-83.355895	885.72	20.00	905.72
14	39.323447	-83.359607	888.64	20.00	908.64
15	39.322202	-83.363534	902.61	20.00	922.61

Name: PV array 7
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass without 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	39.307461	-83.360809	963.60	20.00	983.60
2	39.305585	-83.360122	952.18	20.00	972.18
3	39.305602	-83.354724	934.25	20.00	954.26
4	39.308933	-83.356110	921.20	20.00	941.20
5	39.311460	-83.343799	863.74	20.00	883.74
6	39.315486	-83.344958	862.42	20.00	882.42
7	39.317113	-83.347361	871.91	20.00	891.91
8	39.319325	-83.354663	877.36	20.00	897.36
9	39.312924	-83.353807	903.20	20.00	923.20
10	39.312791	-83.357310	920.18	20.00	940.18
11	39.312326	-83.359412	918.74	20.00	938.74

Flight Path Receptor(s)

Name: RWY 14
Description:
Threshold height: 50 ft
Direction: 140.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	39.361937	-83.420452	966.89	50.00	1016.89
Two-mile	39.384085	-83.444517	1019.00	551.35	1570.35

Name: RWY 27
Description:
Threshold height: 50 ft
Direction: 272.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	39.365015	-83.349763	961.25	50.00	1011.26
Two-mile	39.364006	-83.312345	917.30	647.41	1564.71

Name: RWY 32
Description:
Threshold height: 50 ft
Direction: 320.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	39.357796	-83.415065	924.40	50.00	974.40
Two-mile	39.335647	-83.391001	864.58	663.28	1527.86

Name: RWY 9
Description:
Threshold height: 50 ft
Direction: 91.7°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	39.365253	-83.358904	967.06	50.00	1017.07
Two-mile	39.366110	-83.396328	937.93	632.59	1570.52

Route Receptor(s)

Name: HWY 41
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.343057	-83.366545	873.43	6.00	879.43
2	39.341713	-83.366330	868.82	6.00	874.82
3	39.340807	-83.365953	873.36	6.00	879.36
4	39.339977	-83.365374	878.87	6.00	884.87
5	39.337836	-83.362391	892.20	6.00	898.20
6	39.335426	-83.359773	895.43	6.00	901.43
7	39.334596	-83.358293	888.61	6.00	894.61
8	39.331974	-83.355267	898.63	6.00	904.63
9	39.325617	-83.351834	904.94	6.00	910.94
10	39.320388	-83.347306	886.49	6.00	892.49
11	39.318761	-83.345053	878.46	6.00	884.46
12	39.317234	-83.344474	870.20	6.00	876.20
13	39.304363	-83.340392	886.95	6.00	892.95
14	39.301723	-83.339598	846.42	6.00	852.42

Name: Rapid Forge Middle
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.316337	-83.370657	948.45	6.00	954.45
2	39.314012	-83.367803	962.31	6.00	968.31
3	39.312734	-83.367545	963.96	6.00	969.96

Name: Rapid Forge North
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.344011	-83.372217	886.67	6.00	892.67
2	39.342617	-83.373161	862.18	6.00	868.18
3	39.341223	-83.374299	845.92	6.00	851.92
4	39.339296	-83.374985	874.78	6.00	880.78
5	39.336840	-83.376466	898.96	6.00	904.96
6	39.330648	-83.377713	858.66	6.00	864.66
7	39.325989	-83.375161	917.57	6.00	923.57
8	39.324246	-83.373702	928.26	6.00	934.26
9	39.319416	-83.373337	945.47	6.00	951.47
10	39.318304	-83.372886	945.33	6.00	951.33
11	39.316461	-83.370762	949.82	6.00	955.82

Name: Rapid Forge South
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.312647	-83.367552	965.47	6.00	971.47
2	39.310372	-83.367509	985.84	6.00	991.84
3	39.307291	-83.367445	1001.08	6.00	1007.08
4	39.298707	-83.364827	998.14	6.00	1004.14
5	39.297392	-83.365127	990.79	6.00	996.79
6	39.293388	-83.363861	992.57	6.00	998.57
7	39.292005	-83.363089	992.96	6.00	998.96

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	SA tracking	SA tracking	0	0	-
PV array 2	SA tracking	SA tracking	0	0	-
PV array 3	SA tracking	SA tracking	0	0	-
PV array 4	SA tracking	SA tracking	0	0	-
PV array 5	SA tracking	SA tracking	0	0	-
PV array 6	SA tracking	SA tracking	0	0	-
PV array 7	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Results for: PV array 1

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 2

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare

0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 3

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 4

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare

0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 5

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 6

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare

0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

0 minutes of yellow glare
0 minutes of green glare

Results for: PV array 7

Receptor	Green Glare (min)	Yellow Glare (min)
RWY 14	0	0
RWY 27	0	0
RWY 32	0	0
RWY 9	0	0
HWY 41	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
Rapid Forge Middle	0	0
Rapid Forge North	0	0
Rapid Forge South	0	0

Flight Path: RWY 14

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 27

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 32

0 minutes of yellow glare
0 minutes of green glare

Flight Path: RWY 9

0 minutes of yellow glare
0 minutes of green glare

Route: HWY 41

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge Middle

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge North

0 minutes of yellow glare
0 minutes of green glare

Route: Rapid Forge South

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.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence 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.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Summary: Application Application Exhibit P electronically filed by Mr. Michael J. Settineri on behalf of Ross County Solar, LLC