Appendix Q

VISUAL RESOURCES MANAGEMENT PLAN

VISUAL ANALYSIS REPORT AND GLARE ASSESSMENT

Easley Renewable Energy Project

Prepared for

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FIGURES

ATTACHMENTS

1. METHODOLOGY FOR VISUAL ANALYSIS

This report provides the visual contrast analysis and simulations for the Easley Renewable Energy Project (Project).

An *adverse visual effect* typically occurs within public view when: (1) an action perceptibly changes existing features of the physical environment so that they no longer appear to be characteristic of the subject locality or region; (2) an action introduces new features to the physical environment that are perceptibly uncharacteristic of the region and/or locale; or (3) visually prominent natural or cultural features of the landscape become less visible (e.g., partially or totally blocked from view) or are removed. Changes that seem uncharacteristic are those that appear out of place, discordant, or distracting. The degree of the visual effect depends upon how noticeable the adverse change is. The noticeability of a visual effect is a function of Project features, context, and viewing conditions (angle of view, distance, primary viewing directions, and duration of view).

The factors considered in determining adverse effects on visual resources included: (1) scenic quality of the Project site and vicinity; (2) available visual access and visibility and the frequency and duration under which the landscape is viewed (see Figure 3.2-1A); (3) viewing conditions (distance, angle of observation, relative size or scale, spatial relationships, motion, light conditions, seasonable variability and use, atmospheric conditions, and recovery time) and the degree to which the Project's components would dominate the view of the observer; (4) resulting contrast (form, line, color, and texture) of the Project's facilities or activities with existing landscape characteristics; (5) the extent to which the Project's features or activities would block views of higher value landscape features; and (6) the level of public interest in the existing landscape characteristics and concern over potential changes.

After review of the Project, the BLM selected seven Key Observation Points (KOPs) that would represent key views of the Project (see Figure 3.2-1B). Digital techniques were used to produce simulations of the Project as they would appear with implementation as seen from the KOPs. The Project's simulations assisted in the on-site assessment of the contrast of the Project with existing landscape elements.

1.1. BLM VRM Contrast Analysis Methodology

Under the BLM's Visual Resource Management (VRM) Visual Contrast Rating (VCR) System, the Proposed Action (Project) and alternatives are analyzed for their effects on visual resources using an assessment of the visual contrast within the landscape created by components of the Project. Impacts to the visual resource values and conformance with VRM Class Objectives are evaluated through a contrast rating process described below. The degree to which the Project and alternatives adversely affect the visual quality of a landscape is directly related to the amount of visual contrast between the action alternatives and the existing landscape character.

VCRs were determined at each KOP using the BLM's VRM System manual (BLM, 1986). The VCR forms are provided in Section 3 of this appendix. Under the VRM VCR System, the degree to which a project or activity affects the visual quality of a landscape depends on the visual contrast created between the project components and the major features, or predominant qualities, in the existing landscape. Visual contrast evaluates a project's consistency with the visual elements of form, line, color, and texture already established in the viewshed. In a sense, visual contrast indirectly indicates a particular landscape's ability to absorb a project's components and location without resulting in an uncharacteristic appearance. Other elements that are considered in evaluating visual contrast include the degree of natural screening by vegetation and landforms; placement of structures relative to existing vegetation, landforms, and other structures; observer's angle of view relative to the project; distance from the point of observation; viewing duration/spatial relationships; atmospheric conditions; season of use; lighting conditions; and relative size

or scale of a project. Once the degree of anticipated contrast is determined (ranging from none to strong), a conclusion on the overall level of change is made (ranging from very low to high) and compared to the applicable VRM Class for a determination of project conformance with the VRM Class Objectives.

For the Project, the applicable VRM Class is **VRM Class IV**. The management objective for this VRM Class is as follows.

> ***VRM Class IV****. The objective is to provide for management activities that require major modification of the landscape character. The level of change to the characteristic landscape can be high. Management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic landscape elements.*

2. KEY OBSERVATION POINTS

Seven representative KOPs were established to assess the various factors that are considered in the evaluation of a landscape's existing visual resources. These KOPs were selected in consultation with the BLM and are representative of the most critical locations from which the Project would be seen. KOPs were located based on their usefulness in evaluating existing landscapes and potential impacts on various viewing populations. KOP locations included: (1) a sensitive residential community (Lake Tamarisk Desert Resort); (2) an important recreation facility (Alligator Rock ACEC); and (3) important travel routes (eastbound and westbound I-10 and northbound and southbound SR 177). These locations provide representative examples of the existing landscape context and viewing conditions for the Project and are shown on Figure 3.2-1B. At each KOP, the existing landscape was characterized and photographed. The following paragraphs describe each of the seven KOPs.

KOP 1 – Eastbound I-10. This viewpoint is representative of the Project's views from eastbound I-10, which is a County Eligible Scenic Corridor. Figure 3.2-2A presents the existing view to the north from KOP 1, which is approximately 1.6 miles west of the Desert Center/SR 177 (Rice Road) overpass. The view presented in Figure 3.2-2A captures the western portion of the greater Chuckwalla Valley and most of the Project area between Kaiser Road to just east of SR 177 (Rice Road). This expansive view also captures several existing solar fields and a backdrop consisting of the horizontal angular forms of the Coxcomb and more distant Granite and Palen mountains, features that contribute visual interest to the views from I-10. Landform colors range from light-tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as patchy clumps to irregular and continuous forms at distance. Vegetation colors include tans and pale to golden yellow for grasses with muted greens, tans, and some reddish hues for shrubs. The most prominent structures in this view beyond the linear, diagonal form of I-10 are the noticeable foreground, vertical, wood utility poles and several existing solar fields that appear as dark horizontal streaks along the valley floor. From this viewing distance, the landscape of the Project site appears rather non-descript and generally lacking in visual variety, though the adjacent scenery (surrounding mountains) enhances the broader landscape scenic quality. The applicable VRM Class Rating is Class IV. The KOP 1 Contrast Rating Form is provided in Section 3.

KOP 2 – Westbound I-10. This viewpoint is representative of the Project's views from westbound I-10 (a County Eligible Scenic Corridor). Figure 3.2-3A presents the existing view to the northwest from KOP 2, which is approximately 1.9 miles east of the Desert Center/SR 177 (Rice Road) overpass. The view presented in Figure 3A encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view also captures several existing solar fields (in the background) and gen-tie lines (in the foreground) backdropped by the horizontal to angular forms of the Eagle and Coxcomb mountains, features that contribute visual interest. Landform colors range from light tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as

patchy clumps to irregular and more continuous forms at distance. Vegetation colors include tans and pale to golden yellow for grasses with muted greens and tans with reddish hues for shrubs. The most prominent structures in this view beyond the roadside fencing adjacent to I-10 are the noticeable vertical, dark, rust-colored, tubular Corten-steel Gen-tie poles associated with the existing solar projects that are also visible as dark horizontal streaks along the valley floor in the background. As noted previously, the landscape of the Project site is rather non-descript and generally lacking in visual variety, though the adjacent scenery (surrounding mountains) contributes visual interest to the views from westbound I-10 and enhances the broader landscape scenic quality. The applicable VRM Class Rating is Class IV. The KOP 2 Contrast Rating Form is provided in Section 3.

KOP 3 – Alligator Rock ACEC. This viewpoint is representative of the Project's views from the slightly elevated crest of Alligator Rock in the Alligator Rock ACEC. Figure 3.2-4A presents the existing view to the north from KOP 3, on the crest of Alligator Rock. The view presented in Figure 3.2-4A overlooks the central portion of Desert Center and the western portion of the greater Chuckwalla Valley in the vicinity of SR 177, north of I-10. This expansive view also captures several existing solar fields, the Lake Tamarisk Desert Resort, and a backdrop consisting of the horizontal to angular forms of the Coxcomb and Granite mountains, features that contribute visual interest to the landscape. Landform colors range from light tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as patchy clumps to irregular and continuous forms at distance. Vegetation colors include tan and pale to golden yellow for grasses and muted greens with reddish hues for shrubs. The most prominent built features in this view are the linear, diagonal forms of eastbound and westbound I-10 (lower portion of the image), the curvilinear form of SR 177 (heading northeast in the right-center of the image), and the numerous dark streaks along the valley floor that indicate the locations of existing solar projects. The landscape of the Project site visible from this location is rather non-descript and generally lacking in visual variety, though this expansive and somewhat elevated view incorporates adjacent scenery (surrounding mountains) that imparts a higher scenic quality of the broader landscape. The applicable VRM Class Rating is Class IV. The KOP 3 Contrast Rating Form is provided in Section 3.

KOP 4 – Lake Tamarisk Desert Resort – East Side. This viewpoint is representative of the Project's views from the eastern portion of Lake Tamarisk Desert Resort. Figure 3.2-5A presents the existing panoramic view to the northeast through the southeast from KOP 4 at the park and play area near the eastern perimeter of the resort. This view captures a central portion of the Project site within the western Chuckwalla Valley, backdropped by the rugged Coxcomb and Granite mountains to the northeast and Palen Mountains to the east. From this viewpoint, the landscape presents a predominantly natural appearance. Landform textures appear smooth to granular and coarse. Landform colors range from light tan to lavender and bluish hues at distance. Natural vegetation appears as patchy clumps to irregular and continuous forms at distance. Vegetation colors include tans and pale yellow for grasses with muted greens, tans, grays, and some reddish hues for shrubs. Very small portions of existing or under construction solar facilities are visible in the distance as dark patches on the valley floor. Other built features visible from this view include the numerous interconnecting (gen-tie) electric transmission lines, Red Bluff Substation south of I-10, and two telecommunications towers. Much of the Project site landscape that would be otherwise visible from the resort is effectively screened from view by intervening vegetation. The applicable VRM Class Rating is Class IV. The KOP 4 Contrast Rating Form is provided in Section 3.

KOP 5 – Northbound SR 177. This viewpoint is representative of the Project's views from northbound SR 177 (Rice Road). Figure 3.2-6A presents the existing view to the north-northeast from KOP 5, approximately 1.5 miles northeast of Desert Center. This expansive view of the western portion of the Greater Chuckwalla Valley is backdropped by the horizontal to angular forms of the Coxcomb and more distant Granite mountains that rise abruptly from the valley floor, providing features of visual interest.

Landform colors range from light tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as patchy to sequential clumps to irregular and continuous forms at distance. Vegetation colors include tans and pale to golden yellow for grasses with muted greens, tans, and some reddish hues for shrubs. The most prominent structure in this view, beyond the linear form of SR 177, is a wood-pole utility line paralleling the west side of SR 177. A distant communications tower on the east side of SR 177 is also faintly visible. In the distance to the north, two existing solar projects are visible as horizontal, medium-gray streaks along the valley floor. Although, travelers on SR 177 experience a predominantly natural desert landscape at this location, there are a number of existing or under construction solar energy facilities that are screened from this view by vegetation the highway. Overall, the landscape of the Project site visible from this location is indistinct but appears similar to other portions of the valley floor. The applicable VRM Class Rating is Class IV. The KOP 5 Contrast Rating Form is provided in Section 3.

KOP 6 – Southbound SR 177. This viewpoint is representative of the Project's views from southbound SR 177 (Rice Road). Figure 3.2-7A presents the existing view to the southwest from KOP 6, approximately five miles northeast of Desert Center. This expansive view of the western portion of the Greater Chuckwalla Valley is backdropped by the horizontal to angular form of the Chuckwalla Mountains that rise abruptly from the valley floor, providing a feature of visual interest. Landform colors range from tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as patchy to sequential clumps to irregular and continuous forms at distance. Vegetation colors include tans and pale to golden yellow for grasses with muted greens, tans, and some reddish hues for shrubs. The most prominent structures in this view, beyond the linear form of SR 177, is a wood-pole utility line paralleling the west side of SR 177 and a communications tower on the east side of SR 177. A distant solar project is also faintly visible on the east (left) side of SR 177 as a dark streak on the valley floor. Overall, the landscape of the Project site visible from this location is indistinct but appears similar to other portions of the valley floor. The applicable VRM Class Rating is Class IV. The KOP 6 Contrast Rating Form is provided in Section 3.

KOP 7 – Lake Tamarisk Desert Resort – North Side This viewpoint is representative of the Project's views from the northern portion of Lake Tamarisk Desert Resort. Figure 3.2-8A presents the existing view to the north from KOP 7 at the northern end of Shasta Drive, along the north perimeter of the resort. The view presented in Figure 3.2-8A encompasses the northwestern portion of the greater Chuckwalla Valley north of the resort and between Kaiser Road and SR 177 (Rice Road). This view also captures distant (approximately 3.4 to 6.9 miles to the north) existing solar fields and their associated gen-tie lines, backdropped by the horizontal to angular forms of the Eagle and Coxcomb mountains, features that contribute visual interest. Landform colors range from light tan to lavender and bluish hues at distance. Landform textures appear smooth to granular and coarse. Vegetation appears as patchy clumps to irregular and more continuous forms at distance. Vegetation colors include tans and pale to golden yellow for grasses with muted greens and tans with reddish hues for shrubs. The most prominent structures in this view are the noticeable vertical, dark, rust-colored, tubular Corten-steel gen-tie poles associated with the existing solar projects that are also visible as distant, dark, horizontal streaks along the valley floor in the background. As noted previously, the landscape of the Project site is rather non-descript and generally lacking in visual variety, though the adjacent scenery (surrounding mountains) contributes visual interest to the north views from the resort and enhances the broader landscape scenic quality. The applicable VRM Class Rating is Class IV. The KOP 7 Contrast Rating Form is provided in Section 3.

3. CONTRAST RATING FORMS

The following pages provide the Proposed Action (Project) Contrast Rating Forms for each of the KOPs.

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point **1**	
Location Eastbound I-10, approximately 1.6 miles west of the Desert Center/SR 177 exit, viewing north toward the western Chuckwalla Valley and Project area.	
VRM Class **IV**	
Analyst Michael Clayton	
Date December 8, 2022	

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular rugged ridges and mountains	Patchy clumps to irregular and continuous at distance	Distant linear solar fields, linear road and utility poles (indistinct)
Line	Horizontal to diagonal and irregular	Irregular and indistinct to horizontal as defined by valley floor	Horizontal, diagonal, vertical
Color	Tan to lavender and bluish hues at distance	Tans and golden yellow grasses, muted greens with reddish hues for shrubs	Medium to dark gray solar fields and road, with white and yellow (road), and brown
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Simple linear for arrays and gen-tie poles
Line	Same	Horizontal lines as defined by solar fields	Prominent horizontal for arrays, noticeable vertical for gen-tie poles
Color	Same	Same	Medium to very dark gray and blue / black for arrays, brown for gen-tie poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓						✓	
Line	✓					✓					✓	
Color	✓				✓						✓	✓
Texture	✓				✓					✓	✓	

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long** | **Level of Change:** ☐ **Very Low** ☐ **Low** ☒ **Moderate** ☒ **High**

Does the Project Design Meet VRM Objectives? ☒ **Yes** ☐ **No** ☐ **Not Applicable**

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point	**2**
Location	Westbound I-10, approximately 1.9 miles east of the Desert Center/SR 177 exit, viewing northwest toward the western Chuckwalla Valley and Project area.
VRM Class	**IV**
Analyst	Michael Clayton
Date	December 8, 2022

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular rugged ridges and mountains	Patchy clumps to irregular and continuous at distance	Distant linear solar fields, linear utility poles
Line	Horizontal to diagonal, irregular, and curvilinear	Irregular and indistinct to horizontal as defined by valley floor	Horizontal to vertical
Color	Tan to lavender and bluish hues at distance	Tans and golden yellow grasses, muted greens with reddish hues for shrubs	Medium to dark gray and bluish/black solar fields, brown utility poles
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Simple linear for arrays and gen-tie poles
Line	Same	Horizontal lines as defined by solar fields	Prominent horizontal for arrays and vertical for gen-tie poles
Color	Same	Same	Medium to very dark gray and blue / black for arrays, brown for gen-tie poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓						✓	
Line	✓					✓					✓	
Color	✓				✓						✓	
Texture	✓				✓					✓	✓	

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long** | **Level of Change:** ☐ **Very Low** ☐ **Low** ☒ **Moderate** ☐ **High**

Does the Project Design Meet VRM Objectives? ☒ **Yes** ☐ **No** ☐ **Not Applicable**

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point **3**	
Location Crest of Alligator Rock, just south of I-10 and Desert Center, viewing north across Chuckwalla Valley and the Project area to the Coxcomb Mountains beyond.	
VRM Class **IV**	
Analyst Michael Clayton	
Date December 10, 2022	

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular rugged ridges and mountains	Patchy clumps to irregular and continuous at distance	Distant linear solar fields, linear utility poles, geometric buildings
Line	Horizontal to diagonal, irregular, and curvilinear	Irregular and indistinct to horizontal and well defined by solar fields and I-10.	Horizontal to vertical and diagonal
Color	Tan to lavender and bluish hues at distance	Tans and golden yellow grasses, muted greens with reddish hues for shrubs	Medium to dark gray and bluish/black solar fields, brown utility poles
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Simple linear for arrays and gen-tie poles
Line	Same	Same	Prominent horizontal for arrays and vertical for gen-tie poles
Color	Same	Same	Medium to very dark gray and blue / black for arrays, brown for gen-tie poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓					✓	✓	
Line	✓				✓					✓	✓	
Color	✓				✓						✓	✓
Texture	✓				✓					✓		

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long**	**Level of Change:** ☐ **Very Low** ☐ **Low** ☒ **Moderate** ☐ **High**
Does the Project Design Meet VRM Objectives?	☒ **Yes** ☐ **No** ☐ **Not Applicable**

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point **4**	
Location Near the eastern boundary of the Lake Tamarisk Desert Resort, with a panoramic view from northeast to southeast across the western Chuckwalla Valley.	
VRM Class **IV**	
Analyst Michael Clayton	
Date December 9, 2022	

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular rugged ridges and mountains	Foreground areal mass; patchy clumps to irregular and continuous at distance	Foreground playground equipment, distant linear solar fields (under construction), and
Line	Horizontal to diagonal, irregular, and curvilinear	Irregular and indistinct to horizontal as defined by valley floor	Horizontal to vertical and diagonal
Color	Tan to lavender and bluish hues at distance	Tans and pale to golden yellow grasses, muted greens and tan for shrubs	Light to dark gray playground equipment, light gray solar fields (under construction),
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Simple linear for arrays and gen-tie poles
Line	Same	Same	Prominent horizontal for arrays and vertical for gen-tie poles
Color	Same	Same	Medium to very dark gray and blue / black for arrays, brown for gen-tie poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓						✓	
Line	✓				✓						✓	
Color	✓				✓						✓	
Texture	✓				✓					✓		

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long**	**Level of Change:** ☐ **Very Low** ☐ **Low** ☒ **Moderate** ☐ **High**
Does the Project Design Meet VRM Objectives?	☒ **Yes** ☐ **No** ☐ **Not Applicable**

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point **5**	
Location Northbound SR 177, approximately 1.5 miles northeast of Desert Center, viewing north-northeast across Chuckwalla Valley toward the Coxcomb / Granite Mts.	
VRM Class **IV**	
Analyst Michael Clayton	
Date December 10, 2022	

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular ridges and rounded mountains	Patchy to sequential clumps to irregular and continuous at distance	Linear road and utility poles, linear areal masses for distant solar fields
Line	Horizontal to diagonal, irregular, and curvilinear	Irregular and indistinct to horizontal as defined by valley floor and road	Horizontal to vertical and diagonal
Color	Tan to lavender and bluish hues at distance	Tans and pale to golden yellow grasses, muted greens and tan for shrubs	Dark gray to black with white and yellow (road), medium gray for distant solar fields,
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Complex and geometric for substation, simple linear for arrays and gen-tie poles
Line	Same	Same	Prominent horizontal for arrays, prominent vertical for gen-tie poles
Color	Same	Same	Light gray for substation, dark gray to bluish/black for arrays, dark brown for poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓						✓	
Line	✓				✓						✓	
Color	✓				✓						✓	✓
Texture	✓				✓					✓		

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long** | **Level of Change:** ☐ **Very Low** ☐ **Low** ☒ **Moderate** ☐ **High**

Does the Project Design Meet VRM Objectives? ☒ **Yes** ☐ **No** ☐ **Not Applicable**

Visual Contrast Rating Data Sheet

Easley Renewable Energy Project

KEY OBSERVATION POINT DESCRIPTION

Key Observation Point **6**	
Location Southbound SR 177, approximately five miles northeast of Desert Center, viewing southwest along the SR 177 corridor in western Chuckwalla Valley.	
VRM Class **IV**	
Analyst Michael Clayton	
Date December 9, 2022	

CHARACTERISTIC LANDSCAPE DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Horizontal valley floor; horizontal to angular ridges and rounded mountains	Patchy to sequential clumps to irregular and continuous at distance	Linear road and utility poles, linear areal masses for distant solar fields
Line	Horizontal to diagonal, irregular, and curvilinear	Irregular and indistinct to horizontal as defined by valley floor and road	Horizontal to vertical and diagonal
Color	Tan to lavender and bluish hues at distance	Tans and pale to golden yellow grasses, muted greens and tan for shrubs	Dark gray to black with white and yellow (road), medium gray for distant solar fields,
Texture	Smooth to granular and coarse	Matte	Smooth to matte

PROPOSED ACTIVITY DESCRIPTION

	LANDFORM / WATER	VEGETATION	STRUCTURES
Form	Same	Same	Complex and geometric for substation, simple linear for arrays and gen-tie poles
Line	Same	Same	Prominent horizontal for arrays, prominent vertical for gen-tie poles
Color	Same	Same	Light gray for substation, dark gray to bluish/black for arrays, dark brown for poles
Texture	Same	Same	Smooth to matte

DEGREE OF CONTRAST

	LANDFORM / WATER				VEGETATION				STRUCTURES			
	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG	NONE	WEAK	MODERATE	STRONG
Form	✓				✓							✓
Line	✓				✓							✓
Color	✓				✓							✓
Texture	✓				✓						✓	

LEVEL OF CHANGE & VRM CLASS CONSISTENCY

Term: ☐ **Short** ☒ **Long** | **Level of Change:** ☐ **Very Low** ☐ **Low** ☐ **Moderate** ☒ **High**

Does the Project Design Meet VRM Objectives? ☒ **Yes** ☐ **No** ☐ **Not Applicable**

4. KOP SIMULATIONS AND VRM CLASS CONSISTENCY

The following pages provide a viewshed map (Figure 3.2-1A), a KOP map (Figure 3.2-1B), a detailed discussion of each KOP simulation and VRM Class consistency, and the existing view photographs and visual simulations (Figures 3.2-2A through 3.2-8B) for the proposed Project as viewed from each of seven KOPs. Additionally, discussions of two alternatives specifically designed to reduce the visual impacts on the Lake Tamarisk Desert Resort (the "Reduced Footprint/Acreage Alternative" and the “Further Reduced Footprint/Community Buffer Alternative”) are presented under each KOP.

Although the visual impact on the resort would be reduced under the Reduced Footprint/Acreage Alternative, the overall Project visual change would remain moderate to high (when viewed from KOP 4), which is allowed under the VRM Class IV management objective that applies to the portion of the Project located on BLM lands. This would also be the case for KOPs 1, 2, 3, 5, and 6. When viewed from KOP 7, the moderate level of visual change that would occur under the proposed Project would be reduced to a low to moderate level under the Reduced Footprint/Acreage Alternative, which would be consistent with the VRM Class IV management objective.

Under the Further Reduced Footprint/Community Buffer Alternative, overall visual change would be reduced to low to moderate when viewed from KOP 4 (east side of resort) and low when viewed from KOP 7 (north side of resort), both of which would be consistent with the VRM Class IV management objective.

4.1. KOP 1 – Eastbound I-10

Figure 3.2-2A presents the existing view from KOP 1 on eastbound I-10. The view illustrated in Figure 3.2-2B presents a visual simulation that illustrates the introduction of the Project’s solar arrays and gen-tie line into the valley landscape. Specifically, the simulation depicts a majority of the Project between Kaiser Road and just east of SR 177. Viewing distances to the various Project components range from approximately 2.5 miles to approximately 5.6 miles. In this view, the BESS and substation would be substantially obscured from view by vegetation. The gen-tie line (visible in the right-center of the image) would be perceptible as it parallels SR 177 to the south. As shown in the simulation, the Project would present as a visually significant built feature introduced into a desert valley landscape already characterized by the increasing presence of energy infrastructure. The open landscape along this portion of I-10 would enable extended view durations of the Project for travelers on I-10 crossing Chuckwalla Valley. Portions of the Project’s solar arrays would be visible as continuous, linear, horizontal, medium- to dark-gray to bluish-black patches on the valley floor partially screened from I-10 views by intervening vegetation. The gen-tie line paralleling SR 177 would become increasingly prominent as the I-10 traveler approaches Desert Center.

In the context of an existing landscape that includes not only the natural landforms, vegetative patterns, and earth-tone colors and textures of a desert valley but also the industrial characteristics of several solar projects in the immediate vicinity of the Project site, the Project would result in various degrees of visual contrast. Specifically, the Project’s prominent linear form and horizontal to vertical lines associated with the solar arrays and gen-tie poles would cause moderate contrast with the horizontal to angular and irregular forms and lines of the existing landforms and the patchy and irregular forms and lines of the valley vegetation. However, the Project’s form and line contrast would be consistent with the adjacent solar facilities and gen-tie lines already established in the landscape. The Project’s dark array panels would result in strong contrast with the lighter earth tones of the valley’s soils and rock but minimal contrast with the existing solar facilities. The gen-tie poles would cause moderate contrast with the lighter earth tones of the valley’s soils and rock, background landforms, and sky but no contrast with the existing and

adjacent gen-tie lines. The resulting overall level of color contrast would be moderate to strong. The Project's smooth, manufactured surfaces would cause weak contrast with adjacent solar facilities but moderate contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation. The resulting overall visual change would be moderate to high and would degrade the existing visual character and quality of the landscape as viewed from KOP 1 and similar locations along eastbound I-10. Although the resulting visual effect would be adverse, the moderate to high level of visual change would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

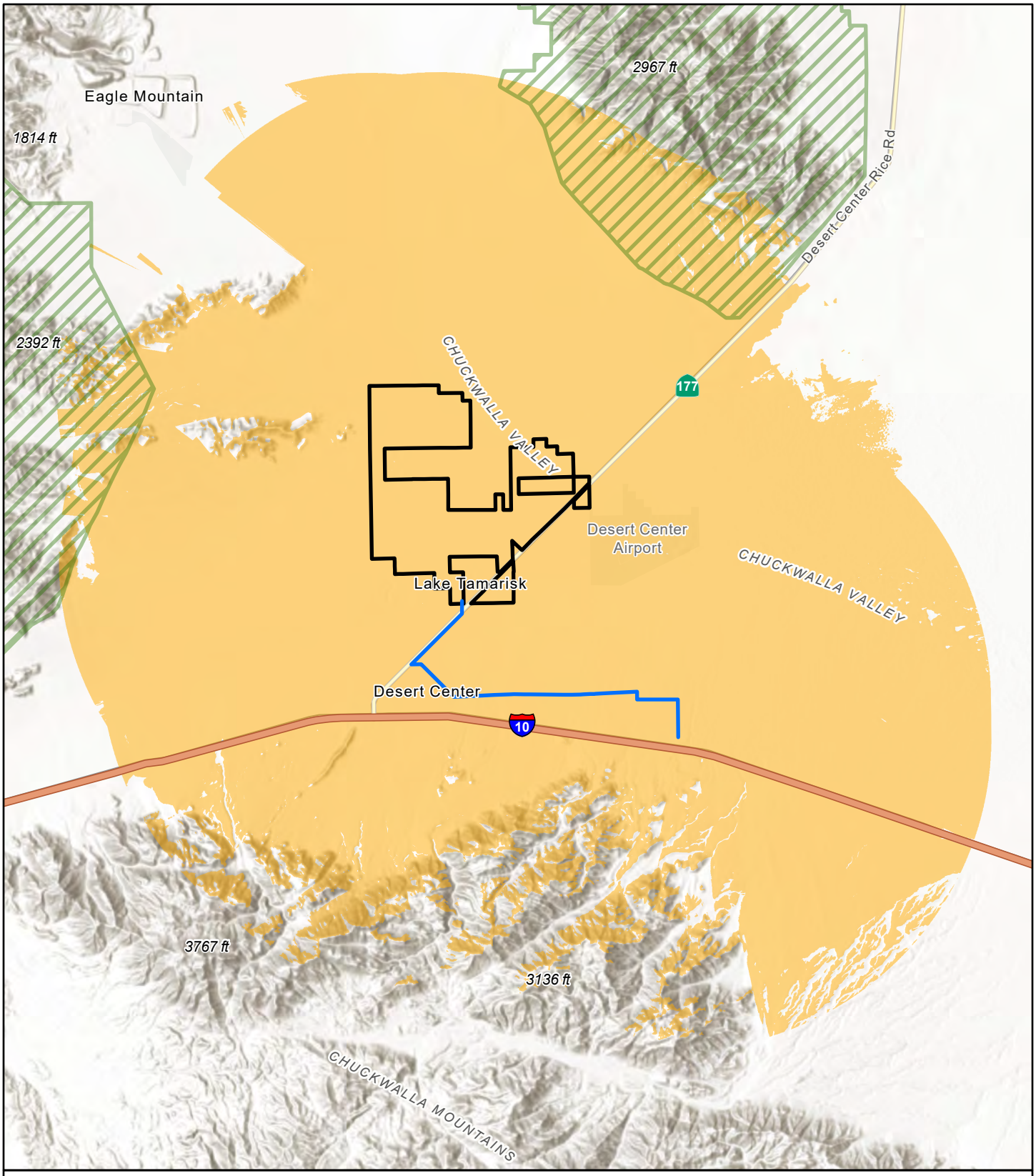

Figure 3.2-1A

Project Visibility Within 5 Miles

Sources: Aspen, 2023; Esri, 2023; Intersect Power, 2023.

LEGEND

- Project Solar Fields
- Proposed Gen-Tie Line
- Substation
- Battery Energy Storage System (BESS)
- 2 Key Observation Point (KOP)

KOP Map

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-1B

This image presents the **Existing View** to the north from **KOP 1** on eastbound I-10, approximately 1.6 miles west of the Desert Center exit. This view encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view also captures several existing solar fields and a backdrop consisting of the horizontal to angular forms of the Coxcomb and more distant Granite mountains.

KOP 1
Eastbound I-10
Existing View

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-2A

This image presents a **Visual Simulation** of the Proposed Project from **KOP 1** on eastbound I-10, approximately 1.6 miles west of the Desert Center (SR 177) exit. This view illustrates a majority of the Project between Kaiser Road and just east of SR 177 (Rice Road). Viewing distances to Project components range from approximately 2.5 miles to approximately 5.6 miles. The BESS and substation are substantially obscurred from view by vegetation. The gen-tie line is perceptible as it parallels SR 177 to the south.

KOP 1
Eastbound I-10
Visual Simulation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-2B

4.2. KOP 2 – Westbound I-10

Figure 3.2-3A presents the existing view from KOP 2 on westbound I-10, approximately 1.9 miles east of the Desert Center/SR 177 exit. Figure 3.2-3B presents a visual simulation that illustrates the introduction of the Project's solar arrays and gen-tie line into the valley landscape. Specifically, the simulation depicts a majority of the Project between Kaiser Road and just east of SR 177. Viewing distances to the various Project components would range from approximately 0.4 mile (foreground gen-tie line) to approximately five miles (most distant solar arrays). As shown in the simulation, the Project would present as a visually significant built feature introduced into a desert valley landscape with an increasing presence of energy infrastructure. The open landscape along this portion of I-10 would enable extended view durations of the Project for travelers on I-10 crossing Chuckwalla Valley. Portions of the Project's solar arrays would be prominently visible as continuous, linear, horizontal, medium- to dark-gray to bluish-black patches on the valley floor, partially screened from I-10 views by intervening vegetation. The BESS and substation would be substantially obscured from view by intervening vegetation. The gen-tie line paralleling SR 177, and then I-10, would be a visually prominent feature in the foreground views from I-10.

In the context of an existing landscape that includes not only the natural landforms, vegetative patterns, and earth-tone colors and textures of a desert valley but also the industrial characteristics of several solar projects in the immediate vicinity of the Project site, the Project would result in varying degrees of visual contrast. Specifically, the Project's prominent linear form and horizontal to vertical lines associated with the solar arrays, BESS, and gen-tie poles would cause moderate contrast with the horizontal to angular and irregular forms and lines of the existing landforms (valley floor and background mountains) and the patchy and irregular forms and lines of the valley vegetation. However, the Project's form and line contrast would be consistent with the adjacent solar facilities and gen-tie lines already established in the landscape. The Project's dark array panels would cause moderate contrast with the lighter earth tones of the valley's soils and rock but minimal contrast with the existing solar facilities. The dark-brown gen-tie poles would cause moderate contrast with the lighter earth tones of the valley's soils and rock, background landforms, and sky but no contrast with the existing and adjacent gen-tie lines. The resulting overall level of color contrast would be moderate. The Project's smooth, manufactured surfaces would cause weak contrast with adjacent solar facilities but moderate contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation. The resulting overall visual change caused by the Project would be moderate and would degrade the existing visual character and quality of the landscape as viewed from KOP 2 and similar locations along eastbound I-10. Although the resulting visual effect would be adverse, the moderate level of visual change that would occur from the Project would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

This image presents the **Existing View** to the northwest from **KOP 2** on westbound I-10, approximately 1.9 miles east of the Desert Center (SR 177) exit. This view encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view also captures several existing solar fields (background) and gen-tie lines (foreground), backdropped by the horizontal to angular forms of the Eagle and Coxcomb mountains.

KOP 2
Westbound I-10
Existing View

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-3A

This image presents a **Visual Simulation** of the proposed project from **KOP 2** on westbound I-10, approximately 1.9 miles east of the Desert Center (SR 177) exit. This view illustrates a majority of the Project between Kaiser Road and just east of SR 177 (Rice Road).Viewing distances to Project components range from approximately 0.4 mile (foreground gen-tie poles) to approximately five miles (most distant solar arrays). The BESS and substation are substantially obscured from view by intervening vegetation.

KOP 2
Westbound I-10
Visual Simulation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-3B

4.3. KOP 3 – Alligator Rock ACEC

Figure 3.2-4A presents the existing view from KOP 3 on the crest of Alligator Rock, approximately 0.5 mile southwest of Desert Center. As shown in the KOP 3 visual simulation presented in Figure 3.2-4B, the approximately three- to 5.6-mile distant solar arrays would present as visually co-dominant, dark- to light-colored areal masses (depending on panel orientation and time of day) extending across the floor of Chuckwalla Valley, east and west of SR 177 and north of I-10. Inset within this darker mass would be the prominently white, linear area of the BESS adjacent to the cluster of gray, vertical structural elements comprising the substation (barely visible in this view). The dark, rust-colored vertical poles of the gen-tie line would also be noticeable as it parallels the east side of SR 177 before turning east to parallel other existing gen-tie lines. The panoramic view from this elevated vantage point on Alligator Rock would enable extended view durations of the solar fields, BESS, substation, and gen-tie.

In the context of an existing landscape that includes not only the natural landforms, vegetative patterns, and earth-tone colors and textures of a desert valley but also the industrial characteristics of several solar projects in the immediate vicinity of the Project site, the Project would result in varying degrees of visual contrast. Specifically, the Project's prominent linear form and horizontal to vertical lines of the solar arrays, BESS, and gen-tie line would cause moderate contrast with the horizontal to angular and irregular forms and lines of the existing landforms (valley floor and background mountains) and the patchy and irregular forms and lines of the valley vegetation. The faintly visible substation and O&M building would contribute no meaningful contrast, and the Project's form and line contrast would be consistent with the adjacent solar facilities and gen-tie lines already established in the landscape, resulting in overall weak to moderate form and line contrast. The Project's dark array panels and white BESS would cause moderate to strong contrast with the lighter earth tones of the valley's soils and rock but no contrast with the existing solar facilities. At this viewing distance and angle of view, the dark brown color of the gen-tie poles would cause weak contrast with the lighter background sky and earth-tone colors of soils but would be consistent in color with the adjacent and nearby existing utility poles. The resulting overall level of color contrast would be moderate. At this viewing distance, the Project's smooth, manufactured surfaces would cause no contrast with adjacent solar facilities but weak contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation, resulting in an overall weak level of texture contrast. Additionally, the Project's dark, corten-steel poles would exhibit no contrast with the existing and adjacent corten-steel poles and weak contrast with the lighter earth tones of the valley's soils and rock. Although the resulting visual effect of the Project would be adverse and would degrade the existing visual character and quality of the landscape as viewed from KOP 3, the overall visual change would be moderate and would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

This image presents the **Existing View** to the north from **KOP 3** on the crest of Alligator Rock, just south of I-10 (which extends diagonally through the lower half of the image). This view overlooks the central portion of Desert Center and the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view also captures several existing solar fields, the Lake Tamarisk Desert Resort, and a backdrop consisting of the horizontal to angular forms of the Coxcomb and Granite mountains.

KOP 3
Alligator Rock
Existing View

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-4A

This image presents a **Visual Simulation** of the Project as viewed from **KOP 3** on the crest of Alligator Rock, just south of I-10. This frame of view encompasses a majority of the Project at viewing distances ranging from approximately 1.6 miles (a portion of the gen-tie line) to approximately 5.6 miles (the Project's most distant solar arrays). The BESS, substation, and gen-tie line are visible in the center-right of the image. The solar arrays appear as dark areal masses on the valley floor intermixed with other solar projects.

KOP 3
Alligator Rock
Visual Simulation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-4B

4.4. KOP 4 – Lake Tamarisk Desert Resort - East

Figure 3.2-5A presents the existing view from KOP 4 at the east park and play area near the eastern boundary of the Lake Tamarisk Desert Resort. The visual simulations presented as Figure 3.2-5B (Proposed Project) and Figure 3.2-5C (Reduced Footprint/Acreage Alternative) encompass an approximate 105^0 viewing arc that extends from 26^0 northeast to approximately 135^0 southeast. All three of these images are based on a setting image captured in December 2022 with a 5.5-foot camera elevation (above the ground).

While much of the proposed Project shown in Figure 3.2-5B would be screened from view by intervening vegetation, portions of the solar arrays along the valley floor would be visible to the northeast and east, with viewing distances ranging from approximately 0.3 to 1.5 miles. The arrays would present as a visually prominent dark- to light-colored horizontal band extending across the valley floor (depending on panel orientation and time of day). Portions of the white-colored BESS would be partially visible approximately 0.7 mile to the east. The visible portions of the BESS would present as a visually prominent but intermittent bright white horizontal band along the valley floor. While most of the Project's substation (approximately 0.7 mile to the east) would be screened from view by intervening vegetation, the proposed gen-tie line that would connect to it would present noticeable, dark, rust-colored vertical structures (at viewing distances ranging from approximately 0.8 to 0.9 mile for the four structures shown) as the line extends to the south and then east to connect with the existing Red Bluff Substation. The open landscape would enable extended view durations of the Project from the resort.

In the context of an existing landscape that is predominantly natural appearing from this location, the Project would result in varying degrees of visual contrast. Specifically, the prominent linear form and horizontal to vertical lines associated with the Project's solar arrays, BESS, and gen-tie line, would result in moderate contrast with the horizontal to angular and irregular forms and lines of the existing landforms (valley floor and background mountains) and the patchy and irregular forms and lines of the valley vegetation. The substantially obscured substation and O&M building would contribute no meaningful contrast. The Project's darker array panels and white BESS would result in moderate to strong contrast with the lighter earth tones of the valley's soils and rock. At this viewing distance, the Project's smooth, manufactured surfaces would cause weak texture contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation. Although the resulting visual effect of the Project would be adverse and would degrade the existing visual character and quality of the landscape as viewed from KOP 4, the overall visual change would be moderate and would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

Under the Reduced Footprint/Acreage Alternative (Figure 3.2-5C), the closest arrays to the immediate northeast of the resort would be scaled back toward the east. Also, the BESS, which previously appeared as a noticeable white, linear feature along the valley floor to the east of the resort, and was substantially screened by intervening vegetation, would now be relocated to the northeast away from the resort and would no longer be in view from KOP 4 due to screening by intervening array panels and vegetation. The substation would also be moved to the northeast farther away from the resort and would be partially screened from view by intervening array panels and vegetation. It is faintly visible as a cluster of vertical, gray structures at the end of the gen-tie line, to the left of the swing set. Because the substation would be moved to the northeast, the gen-tie line would now extend farther up SR 177 (to the northeast), with approximately seven additional structures.

In addition to the above three KOP 4 figures from December 2022 (Figures 3.2-5A, 5B, and 5C), a second series of three images (Figures 3.2-5D, 5E, and 5F) was captured in October 2023 with an 8-foot camera elevation (above the ground). This slightly elevated view was obtained and evaluated because it was thought to be more representative of the "porch-height" views that some of the private residences along

the eastern resort perimeter experience. The Existing View image presented in Figure 3.2-5D captures essentially the same landscape features that are shown in the same frame of view presented in the original existing view presented in Figure 3.2-5A at a 5.5-foot camera elevation. However, the new Figure 3.2-5D was captured almost a year later following substantial rain events. As a result, some vegetation is noticeably greener, and some vegetation growth has occurred providing a very slight increase in screening in some portions of the image. Also, additional solar facilities have been installed in the landscape since the December 2022 set of images, which adds to the existing structural context.

Figure 3.2-5E presents a panoramic visual simulation of the proposed Project as viewed with a camera height of 8 feet (i.e., approximate porch-height view). As shown in the simulation, there is a very slight increase in visibility of some project features due to the ability to "see over" some of the intervening screening vegetation. However, in other cases, the increased camera (viewing) height has been offset somewhat by additional vegetation growth that has occurred over the past year. Regardless, the overall visual change captured by the two different camera (viewing) heights is similar and would not change the overall impact conclusion or VRM Class consistency determination. Although the KOP 4 viewpoint is considered reasonably representative of publicly available project views from the eastern portion of the resort, it is acknowledged that some public views and private residential views within the resort may be more or less visually affected by the Proposed Project due to the presence of lesser or greater vegetative screening.

Figure 3.2-5F presents a panoramic visual simulation of Alternative 2 as viewed with a camera height of 8 feet. As with the Proposed Project simulation, the Alternative simulation illustrates a very slight increase in visibility of some project features due to the ability to "see over" some of the intervening screening vegetation with the elevated viewing perspective. However, in other cases, the increased camera (viewing) height has been offset somewhat by additional vegetation growth that has occurred over the past year. Similar to the proposed Project findings, the Alternative's overall visual change captured by the two different camera (viewing) heights is similar, and the 8-foot-high viewing perspective would not change the overall impact conclusion or VRM Class consistency determination. However, it is acknowledged that some public views and private residential views within the resort may be more or less visually affected by the Alternative due to the presence of lesser or greater vegetative screening.

VIEWING NORTHEAST (26°) | VIEWING EAST (90°) | VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents the **Existing Panoramic View** of the landscape northeast to southeast of the Lake Tamarisk Desert Resort, as viewed from **KOP 4** near the eastern boundary of the resort, from an approximate **5.5-foot camera elevation**. This view captures a central portion of the Chuckwalla Valley, backdropped by the Coxcomb Mountains to the north-northeast, Granite Mountains to the northeast, and Palen Mountains to the east. From this viewpoint, the landscape presents a predominantly natural appearance. However, while not substantially noticeable in this view, a considerable portion of the valley floor is undergoing a transition from a predominantly natural appearing desert landscape to that of a developed energy zone characterized by numerous solar energy projects either existing or under construction. Other built features that are contributing to the increasingly industrial character of the valley landscape include the numerous interconnecting (gen-tie) electric transmission lines, Red Bluff Substation south of I-10, and I-10 with its associated vehicle traffic.

KOP 4 - Existing View
Lake Tamarisk Desert Resort
5.5-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5A - Dec. 2022

VIEWING NORTHEAST (26°) | VIEWING EAST (90°) | VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents a panoramic **Visual Simulation** of the **Proposed Project** from **KOP 4** near the eastern boundary of the resort, from an approximate **5.5-foot camera elevation**. This view encompasses an approximate 105° panoramic viewing arc that extends from 26° (northeast) to approximately 135° (southeast). While much of the Project would be screened from view by intervening vegetation, portions of the solar arrays along the valley floor would be visible to the northeast and east, with viewing distances ranging from approximately 0.3 mile to 1.5 miles. Portions of the BESS, which would be white in color, would be partially visible approximately 0.7 mile to the east. While most of the Project's substation (approximately 0.7 mile to the east) would be screened from view by intervening vegetation. The proposed gen-tie line that would connect to the substation would present noticeable, dark rust-colored vertical structures (at viewing distances ranging from approximately 0.8 to 0.9 mile for the four structures shown), as the line extends to the south and then east to Red Bluff Substation.

KOP 4
Proposed Project Simulation
5.5-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5B - Dec. 2022

VIEWING NORTHEAST (26°) | VIEWING EAST (90°) | VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents a panoramic **Visual Simulation** of **Alternative 2** (Lake Tamarisk Alternative) from **KOP 4** near the eastern boundary of the resort, from an approximate **5.5-foot camera elevation**. As shown in the simulation, the closest arrays to the immediate northeast of the resort would be scaled back toward the east. Also, the BESS, which previously appeared as a noticeable white, linear feature along the valley floor to the east of the resort, and was substantially screened by intervening vegetation, would now be relocated to the northeast away from the resort and would no longer be in view from KOP 4, due to screening by intervening array panels and vegetation. The substation (faintly visible as a cluster of vertical, gray structures at the end of the gen-tie line, to the left of the swing set) would also be moved to the northeast farther away from the resort, and would be partially screened from view by intervening array panels and vegetation. Additionally (due to the substation shift), the gen-tie line would now extend farther up SR 177, with an approximate seven additional structures.

KOP 4
Alternative 2 Visual Simulation
5.5-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5C - Dec. 2022

VIEWING NORTHEAST (26°) VIEWING EAST (90°) VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents the **Existing Panoramic View** of the landscape northeast to southeast of the Lake Tamarisk Desert Resort, as viewed from **KOP 4,** near the eastern boundary of the resort, from an approximate **8-foot camera elevation**. This slightly elevated view is considered to be more representative of the "porch height" views that some of the residences along the eastern resort perimeter experience. This image captures essentially the same landscape features that are described for the same frame of view presented in Figure 3.2-5A. However, the image above was captured almost a year later following substantial rain events. As a result, some vegetation is noticeably greener and some vegetation growth has occurred, providing a very slight increase in screening in some portions of the image. Also, additional solar facilities have been installed in the landscape since the October 2022 set of images (Figures 3.2-5A through 5C). This image constitutes the current baseline viewing context for the two simulations that follow (Figures 3.2-5E and 5F).

KOP 4 - Existing View
Lake Tamarisk Desert Resort
8-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5D - Oct. 2023

VIEWING NORTHEAST (26°) | VIEWING EAST (90°) | VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents a panoramic **Visual Simulation** of the **Proposed Project** from **KOP 4**, near the eastern boundary of the resort, from an approximate **8-foot camera elevation**. This slightly elevated view is considered to be more representative of the "porch height" views that some of the residences along the eastern resort perimeter experience. In comparison to the 5.5-foot camera height simulation presented in Figure 3.2-5B, the 8-foot camera height simulation presented here captures a very slight increase in visible structures due to the ability to "see over" some of the intervening screening vegetation to more distant structures beyond. However, the resulting overall visual change captured by the two different camera heights is similar and would not change the overall impact conclusion. Although the KOP 4 viewpoint is considered representative of publicly available Project views within the resort, it is acknowledged that some locations within the resort (public areas and private residences) may be more or less visually affected by the Project due to greater or lesser available screening.

KOP 4
Proposed Project Simulation
8-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5E - Oct. 2023

VIEWING NORTHEAST (26°) VIEWING EAST (90°) VIEWING SOUTHEAST (135°)

Latitude: 33.740168° Longitude: -115.388955°

This image presents a panoramic **Visual Simulation** of **Alternative 2** from **KOP 4**, from an approximate **8-foot camera elevation** (considered to be more representative of the "porch height" views that some of the residences experience). In comparison to the 5.5-foot camera height simulation of Alternative 2 presented in Figure 3.2-5C, the 8-foot camera height simulation presented here captures a very slight increase in visible structures in some locations, due to the ability to "see over" some of the intervening screening vegetation. However, in other cases, the increased camera height has been offset somewhat by additional vegetation growth that has occurred since the Figure 3.2-5C simulation was prepared in December of 2022. Regardless, the resulting overall visual change captured by the two different camera heights is similar and would not change the overall impact conclusion. However, it is acknowledged that some public and private views within the resort may be more or less visually affected by the Project or Alternative due to greater or lesser available screening.

KOP 4
Alternative 2 Visual Simulation
8-foot Camera Elevation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-5F - Oct. 2023

4.5. KOP 5 – Northbound SR 177

Figure 3.2-6A presents the existing view of the central portion of Chuckwalla Valley from KOP 5 on northbound SR 177, approximately 1.5 miles northeast of Desert Center. Figure 3.2-6B presents a visual simulation that encompasses a portion of the Project in the vicinity of SR 177. While much of the Project would be screened from view by intervening vegetation (at this and similar viewing locations), portions of the solar arrays along the valley floor would be visible with viewing distances ranging from approximately 0.9 mile to approximately three miles. The arrays would present as a visually noticeable, dark- to light-colored horizontal band extending across the valley floor (depending on panel orientation and time of day). The Project substation (a termination point for the gen-tie line) would be partially visible to the west of SR 177 (left in this image) at a viewing distance of approximately 0.7 mile. A portion of the BESS, which would be white in color, would be partially visible behind and beyond the substation at a viewing distance ranging from approximately 0.7 to 0.9 mile. The proposed gen-tie line would present as dark, rust-colored, vertical structures at viewing distances (from this location) ranging from approximately 140 feet to approximately 0.7 mile (where it connects to the proposed substation). The gen-tie line would be the most visually prominent Project feature from KOP 5 as it extends south from the substation before turning southwest to parallel the east side of SR 177.

In the context of an existing landscape that includes not only the natural landform, vegetative patterns, and earth-tone colors and textures of a desert valley, but also the industrial characteristics of several solar projects in the immediate vicinity of the Project site, the Project would result in varying degrees of visual contrast. Specifically, the Project's prominent linear form and horizontal to vertical lines associated with the solar arrays, BESS, substation, and gen-tie line would cause moderate contrast with the horizontal to angular and irregular forms and lines of the existing landforms (valley floor and background mountains) and the patchy and irregular forms and lines of the valley vegetation. However, the Project's form and line contrast would be consistent with the nearby solar facilities and utility lines already established in the landscape, including the wood pole utility line that parallels the west side of SR 177. The Project's darker array panels would cause moderate contrast with the lighter earth tones of the valley's soils and rock and even vegetation but minimal contrast with the existing solar facilities and repaved roadway. The white color of the BESS would cause moderate contrast with the darker vegetation. The dark brown color of the gen-tie poles would cause moderate to strong contrast with the lighter background sky and earth-tone colors of soils and background landforms but would be consistent in color with the adjacent and nearby existing utility poles. The resulting overall color contrast would be moderate to strong. At this viewing distance, the Project's smooth, manufactured surfaces would cause weak contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation and weak contrast with adjacent solar facilities. Although the resulting visual effect would be adverse, the moderate level of change that would occur with Project implementation would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

This image presents the **Existing View** to the north-northeast from **KOP 5** on northbound SR 177, approximately 1.5 miles northeast of Desert Center. This view encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view also captures portions of several existing and under construction solar fields. The horizontal to angular forms of the Coxcomb and more distant Granite mountains that rise abruptly from the valley floor provide a backdrop of visual interest.

KOP 5
Northbound SR 177
Existing View

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-6A

This image presents a **Visual Simulation** of the Proposed Project from **KOP 5** on northbound SR 177, approximately 1.5 miles northeast of Desert Center. This view illustrates a majority of the Project in the vicinity of SR 177 (Rice Road). As shown in the simulation, while much of the Project (substation, solar arrays, and BESS) are partially to substantially screened by intervening vegetation, the connecting gen-tie line that spans and then parallels SR 177 would be prominently visible to travelers on SR 177.

KOP 5
Northbound SR 177
Visual Simulation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-6B

4.6. KOP 6 – Southbound SR 177

Figure 3.2-7A presents the existing view to the southwest from KOP 6 on southbound SR 177, approximately five miles northeast of Desert Center. This view encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This viewpoint is representative of the immediate foreground views of the Project area located immediately adjacent to both sides of SR 177. As illustrated in the KOP 6 visual simulation presented in Figure 3.2-7B, the Project would present as a visually significant built feature introduced into a desert valley landscape with an increasing presence of energy infrastructure.

In the context of an existing landscape that includes not only the natural landform, vegetative patterns, and earth-tone colors and textures of a desert valley, the Project would result in varying degrees of visual contrast. Specifically, the prominent linear form, horizontal lines, and darker color of the solar arrays would all exhibit strong visual contrast compared to the angular and irregular forms and lines of the existing landforms (valley floor and background mountains), the patchy and irregular forms and lines of the valley vegetation, and lighter earth tones of the valley's soils, rock, and vegetation, though the dark array panels would cause minimal contrast with the existing repaved roadway. At this viewing distance, the Project's smooth, manufactured surfaces would cause moderate contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation. The gen-tie line would be barely discernible in the distance and the BESS, substation, and other components would be substantially screened from view by the arrays and existing vegetation and would contribute no meaningful contrast. Therefore, the Project's overall visual contrast as experienced at KOP 5 and similar locations along SR 177 would be strong (high). Although the resulting visual effect would be adverse, the high level of change would be allowed under the VRM Class IV management objective that applies to the portion of the Project (i.e., the majority) that would be located on BLM lands.

This image presents the **Existing View** to the southwest from **KOP 6** on southbound SR 177, approximately five miles northeast of Desert Center. This view encompasses the western portion of the greater Chuckwalla Valley in the vicinity of SR 177. This expansive view captures existing infrastructure facilities including a communications tower, adjacent powerline, and solar projects under construction. The horizontal to angular form of the Chuckwalla Mountains provide a backdrop of visual interest.	**KOP 6** **Southbound SR 177** **Existing View**	**Easley Renewable Energy Project** **Aesthetics / Visual Resources** **Figure 3.2-7A**

This image presents a **Visual Simulation** of the Proposed Project from **KOP 6** on southbound SR 177, approximately five miles northeast of Desert Center. This view illustrates the eastern portion of the Project in close proximity to SR 177 (Rice Road). As shown in the simulation, the Project would appear as a prominent industrial facility in the immediate foreground of views from the road and assumes the retention of existing vegetation adjacent to the road to provide partial screening of the Project facilities.

KOP 6
Southbound SR 177
Visual Simulation

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-7B

4.7. KOP 7 – Lake Tamarisk Desert Resort - North

Figure 3.2-8A presents the existing view from KOP 7 at the northern end of Shasta Drive in Lake Tamarisk Desert Resort. The visual simulations presented as Figure 3.2-8B (Proposed Project), Figure 3.2-8C (Reduced Footprint/Acreage Alternative), and Figure 3.2-8D (Community Buffer Alternative) encompass the western-most portion of the Project area (north of the resort) and are based on a setting image with an 8-foot camera elevation (above the ground). This slightly elevated view was obtained and evaluated because it was thought to be more representative of the "porch-height" views that some of the private residences along the resort perimeter would experience. Although KOP 7 is considered reasonably representative of publicly available Project views from the northern portion of the resort, it is acknowledged that some public views and private residential views within the resort may be more or less visually affected by the proposed Project due to the presence of lesser or greater vegetative screening.

While much of the Project shown in Figure 3.2-8B would be screened from view by intervening vegetation, portions of the solar arrays along the valley floor would be partially visible, though at viewing distances ranging from approximately 0.5 to 0.85 mile to the nearest arrays. Where visible, the arrays would present as a visually noticeable medium-gray to dark-colored horizontal band (depending on panel orientation and time of day) extending across the valley floor. The open landscape would enable extended view durations of the Project from the resort.

In the context of an existing landscape that is predominantly natural appearing from this location, the Project would result in varying degrees of visual contrast. Specifically, the noticeable linear form and horizontal line associated with the Project's solar arrays would result in weak to moderate (form) to moderate (line) contrast with the horizontal to angular and irregular forms and lines of the existing landforms (valley floor and background mountains) and the patchy and irregular forms and lines of the valley vegetation. The Project's dark array panels, which would be substantially screened by intervening vegetation when viewed from the northern portion of the resort, would also result in moderate contrast with the lighter earth tones of the valley's soils and rock. At this viewing distance, the Project's smooth, manufactured surfaces would cause weak texture contrast with the matte to coarse textures attributable to valley soils, rock, and vegetation. Therefore, the Project's visual contrast would be moderate. Although the resulting visual effect of the Project would be adverse and would degrade the existing visual character and quality of the landscape as viewed from KOP 7 and similar locations along the northern perimeter of the resort, the overall visual change would be moderate and would be allowed under the VRM Class IV management objective that applies to the portion of the Project that would be located on BLM lands.

Under the Reduced Footprint/Acreage Alternative (Figure 3.2-8C), several groups of arrays north of the resort would be removed. The remaining, more distant, and less noticeable panel arrays would be partially screened from view by intervening vegetation as shown in the simulation. The resulting visual contrast would be weak to moderate, and the overall level of change would be low to moderate, which would be allowed under the VRM Class IV management objective.

Under the Further Reduced Footprint/Community Buffer Alternative (Figure 3.2-8D), all of the arrays within one mile of the resort would be eliminated, and an approximately 490-foot-long, 10-foot-high screening sand berm would be installed to partially screen panel arrays north of the berm. As shown in the simulation presented in Figure 3.2-8D, the remaining arrays to the north (beyond one mile) are barely perceptible. The sand berm is also barely visible as a light, horizontal line along the valley floor that is substantially screened from view by intervening vegetation. The resulting visual contrast would be weak, and the overall level of change would be low, which would be allowed under the VRM Class IV management objective.

This image presents the **Existing View** to the north from **KOP 7** at the northern end of Shasta Drive in Lake Tamarisk Desert Resort. This view encompasses the northwestern portion of the greater Chuckwalla Valley backdropped by the Eagle and Coxcomb Mountains. The nearest 1.5 miles of valley floor are relatively undeveloped. However, farther north (approximately 3.5 miles) existing solar developments span much of the valley floor. The existing gen-tie lines are visible along Kaiser Road.

KOP 7 - Existing View
Lake Tamarisk Resort-End of Shasta Dr.
CEQA - Proposed Project
NEPA - Alternative 2 - Proposed Action

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-8A

This image presents a **Visual Simulation** of the CEQA Proposed Project / NEPA Alternative 2 Proposed Action from **KOP 7** at the northern end of Shasta Drive in Lake Tamarisk Desert Resort. This 8-foot porch-height view captures a western portion of the Project, of which the closest solar panels would be approximately 0.43 miles north of the resort. As shown in the simulation, the relatively low-profile panels would be substantially screened from view by intervening vegetation.	**KOP 7 - Visual Simulation** **Lake Tamarisk Resort-End of Shasta Dr.** **CEQA - Proposed Project** **NEPA - Alternative 2 - Proposed Action**	**Easley Renewable Energy Project** **Aesthetics / Visual Resources** **Figure 3.2-8B**

This image presents a **Visual Simulation** of the CEQA Alternative B Reduced Footprint / NEPA Alternative 3 Reduced Acreage from **KOP 7** at the northern end of Shasta Drive in Lake Tamarisk Desert Resort. This 8-foot porch-height view illustrates the elimination of several groups of arrays that are north of the Resort. The result is a narrower (compared to the Proposed Project), linear, dark streak along the valley floor (distant panel arrays, which are substantially screened by vegetation).	**KOP 7 - Visual Simulation** **Lake Tamarisk Resort-End of Shasta Dr.** **CEQA - Alternative B - Reduced Footprint** **NEPA - Alternative 3 - Reduced Acreage**	**Easley Renewable Energy Project** **Aesthetics / Visual Resources** **Figure 3.2-8C**

This image presents a **Visual Simulation** of the CEQA Alternative C Further Reduced Footprint / NEPA Alternative 4 Community Buffer from **KOP 7** at the northern end of Shasta Drive in Lake Tamarisk Desert Resort. This 8-foot porch-height view illustrates the elimination of all solar panels within one mile of the Resort. Additionally, this alternative includes the installation of a 490-foot long, 10-foot-high screening sand berm that is partially visible as a horizontal light streak in the right center of the image.

KOP 7 - Visual Simulation
Lake Tamarisk Resort-End of Shasta Dr.
CEQA - Alt. C - Further Reduced Footprint
NEPA - Alternative 4 - Community Buffer

Easley Renewable Energy Project
Aesthetics / Visual Resources
Figure 3.2-8D

5. GLARE ASSESSMENT

5.1. Introduction and Methods

For the Easley Renewable Energy Project (Project), glare was modeled using ForgeSolar (2023) glare analysis tools. While the exact model of the PV panels has not been finalized, the parameters of the First Solar Series 7 technology were used as a best-guess technology to run the model to predict any potential impacts to pilots on approach to Desert Center or operators of motor vehicles in the Project area in eastern Riverside County. To determine whether military pilots in the area could experience adverse effects, the glare analysis (2024) also includes segments of two low-level military training routes (MTR), identified as ID-217 and ID-296, that intersect the airspace above the Project. The model assumed the use of single-axis rotation tracking solar PV panels with a portrait module orientation made of smooth glass without anti-reflective coating, and it used default direct normal irradiance (DNI), which varies and peaks at 1,000 Watts per square-meter (W/m^2). In addition, the model considered variations in panel reflectivity with respect to the position of the sun.

The following assumptions regarding the solar panel configuration for all PV panel arrays analyzed were also used:

- Tracking axis orientation: 180.0 degrees (tracker rows oriented north/south with tracking direction from east to west)
- Tracking axis tilt: 0 degrees (system on flat, level ground would have axis tilt of 0 degrees)
- Tracking axis panel offset: 0.0 degrees
- Maximum tracking angle: 60.0 degrees
- Resting angle: 60.0 degrees
- Height above ground: 5 feet

Default observer eye characteristics were used for glare analysis, as follows:

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

Vertex Parameters

- Latitude: 33°N
- Longitude: 115°W
- Elevation: approximately 550 to 720 feet
- Total Elevation (sum of height above ground and elevation): approximately 555 to 725 feet

5.2. Types of Glare

Green glare is defined as glare with a low potential to cause an after-image, or flash blindness, when observed prior to a typical blink response time. Yellow glare is defined as glare with a potential to cause an after-image when observed prior to a typical blink response time. Overall, there is a possibility of green glare that could result from the Project PV arrays. However, there is no yellow glare that would result from the solar panels.

5.3. Results

Modeled observation points included two route receptors along State Route (SR) 177/Rice Road and R2/Kaiser Road, and one flight path receptor at the Desert Center Runway Approach. Modeled receptors also include two low-level military training routes that intersect the airspace above the Project. Receptors are modeled for flight along MTR ID-217 at a low altitude limit of 200 feet above ground level, and along MTR ID-296 at 300 feet above ground level. Additionally, model runs were conducted for U.S. FAA 2013 and the 2021 Policy Adherence. There are no Air Traffic Control Towers (ATCTs) within two miles of the Project, therefore there were no ATCT receptors assessed. According to the model results, the flight path receptors on the Desert Center Runway Approach would not be impacted by glare from the solar panels; however, some portions of the ground-level routes and MTR receptors have a low potential of being impacted by glare.

5.3.1. Route and Flight Path Receptors (Attachment 1)

Green glare is predicted for the route receptor representing ground-level travelers along SR 177/Rice Road from the Project PV arrays adjacent to the road for 313,668 minutes (5,227 hours) of the year. Any potential glare impacts for this route receptor would occur year-round approximately between 5:30 am and 12:30 pm. Additionally, mid-March through the end of September, there is a potential for glare between the hours of 2:00 pm and 7:00 pm.

Similarly, green glare is predicted for the route receptor representing ground-level travelers along R2/Kaiser Road from the Project PV arrays east of Kaiser Road for 45,249 minutes (754 hours) of the year. Any potential glare impacts for this route receptor would occur from January to mid-May and from mid-July to December, with an approximate maximum duration of 12:00 pm to 5:00 pm. From May to August, potential glare impacts would occur from 6:00 pm to 7:00 pm.

5.3.2. Glare Policy Adherence (Attachment 2 and 3)

The Aviation Reports to analyze U.S. FAA policy adherence relative to the 2013 and 2021 policies concluded that there would be no glare of any kind for ATCTs, and that there would be no glare for the Desert Center Runway Approach flight path receptors within two miles. Military pilots at the low altitude limits of MTR in the area could receive green glare at a total annual rate of up to 322,336 minutes (5,372 hours), depending on location. The total annual green glare reported by the model for each receptor may include duplicate times of glare from multiple reflective surfaces.

5.4. Conclusions

Green glare, having a low potential for temporary after-image, is predicted at various levels along area roadways, MTR ID-217 at 200 feet above ground level, and MTR ID-296 at 300 feet above ground level, as a result of the Project. There is no yellow glare predicted.

Actual impacts may vary from these representative model results depending on the final types of PV panels selected and the array configurations within the Project parcels.

6. REFERENCES

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Attachment 1

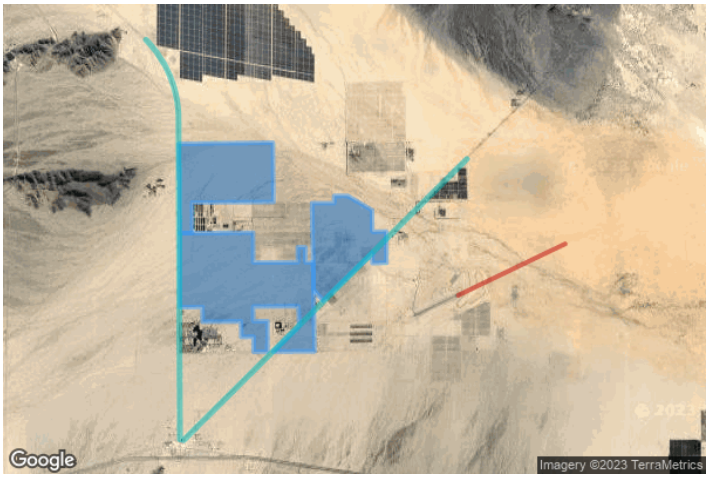
2023-04-17 EASLEY FORGESOLAR ANALYSIS REPORT

FORGESOLAR GLARE ANALYSIS

Project: **Easley Renewable Energy Project**
Site configuration: **Easley Renewable Energy Project**

Site description: Easley Renewable Energy Project. Approximated panel areas.

Created 07 Apr, 2023
Updated 18 Apr, 2023
Time-step 1 minute
Timezone offset UTC-8
Site ID 87914.15436
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
PV analysis methodology V2



Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	156,846	2,614.1	0	0.0	1,566,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,565,000,000.0
Easley SW	SA tracking	SA tracking	202,071	3,367.8	0	0.0	1,565,000,000.0

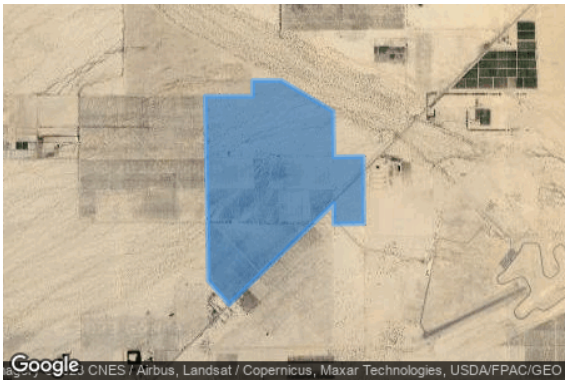
Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	313,668	5,227.8	0	0.0
R2 Kaiser Road	45,249	754.1	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

Component Data

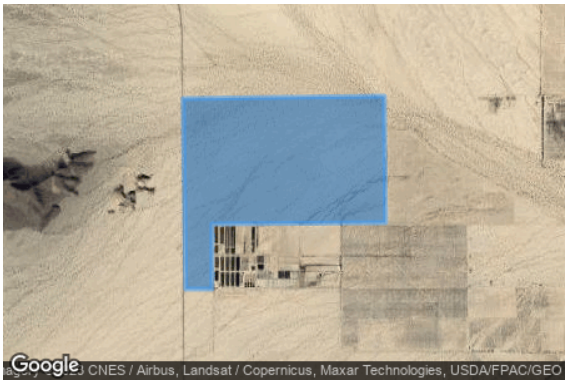
PV Arrays

Name: Easley E
Description: Eastern portion of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



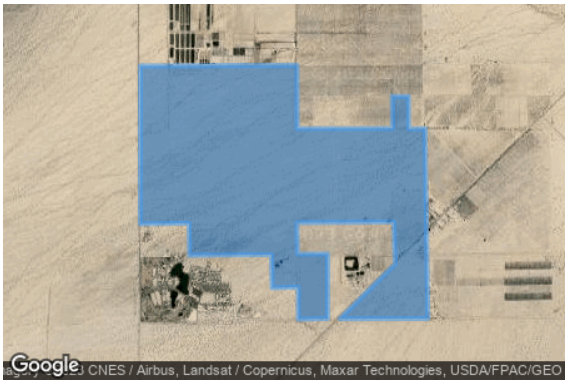
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.758290	-115.361519	602.02	0.00	602.02
2	33.751582	-115.361433	606.85	0.00	606.85
3	33.748870	-115.358601	608.64	0.00	608.64
4	33.760359	-115.344181	562.32	0.00	562.32
5	33.758005	-115.344181	562.62	0.00	562.62
6	33.758076	-115.340061	552.78	0.00	552.78
7	33.765711	-115.340147	548.19	0.00	548.19
8	33.765640	-115.344181	556.81	0.00	556.81
9	33.770848	-115.344267	553.26	0.00	553.26
10	33.774344	-115.351391	564.62	0.00	564.62
11	33.774344	-115.355339	573.17	0.00	573.17
12	33.772561	-115.355339	573.96	0.00	573.96
13	33.772561	-115.361862	588.16	0.00	588.16

Name: Easley NW
Description: Northwest quarter of Easley Approximate Panel Area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.787284	-115.373300	602.13	0.00	602.13
2	33.786999	-115.400938	662.26	0.00	662.26
3	33.765310	-115.400595	706.66	0.00	706.66
4	33.765310	-115.396990	695.09	0.00	695.09
5	33.772731	-115.396990	679.23	0.00	679.23
6	33.772873	-115.373129	617.32	0.00	617.32

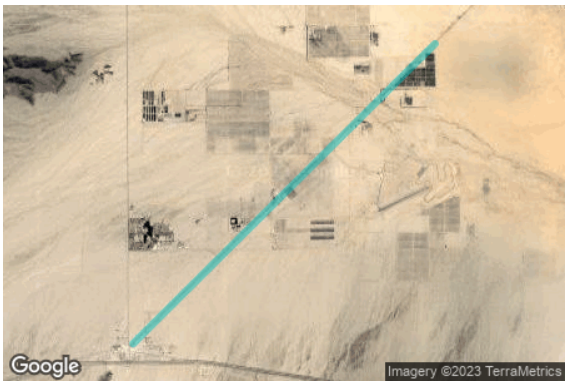
Name: Easley SW
Description: Southwest section of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.765325	-115.400635	706.69	0.00	706.69
2	33.765325	-115.398832	702.14	0.00	702.14
3	33.765325	-115.397008	695.11	0.00	695.11
4	33.765410	-115.379113	643.56	0.00	643.56
5	33.758167	-115.379070	651.88	0.00	651.88
6	33.758203	-115.365981	610.66	0.00	610.66
7	33.761842	-115.366024	608.00	0.00	608.00
8	33.761842	-115.363792	602.22	0.00	602.22
9	33.758132	-115.363749	605.70	0.00	605.70
10	33.758167	-115.361517	601.42	0.00	601.42
11	33.736554	-115.361133	641.65	0.00	641.65
12	33.736518	-115.373235	665.45	0.00	665.45
13	33.742763	-115.365639	637.25	0.00	637.25
14	33.747539	-115.365810	625.40	0.00	625.40
15	33.747467	-115.379114	663.60	0.00	663.60
16	33.743899	-115.379028	671.95	0.00	671.95
17	33.743899	-115.374908	658.31	0.00	658.31
18	33.736547	-115.374908	675.67	0.00	675.67
19	33.736476	-115.378942	687.02	0.00	687.02
20	33.740116	-115.378942	678.04	0.00	678.04
21	33.740045	-115.382547	690.32	0.00	690.32
22	33.743828	-115.382633	684.10	0.00	684.10
23	33.743756	-115.393877	722.93	0.00	722.93
24	33.747396	-115.393963	716.06	0.00	716.06
25	33.747325	-115.400658	741.35	0.00	741.35

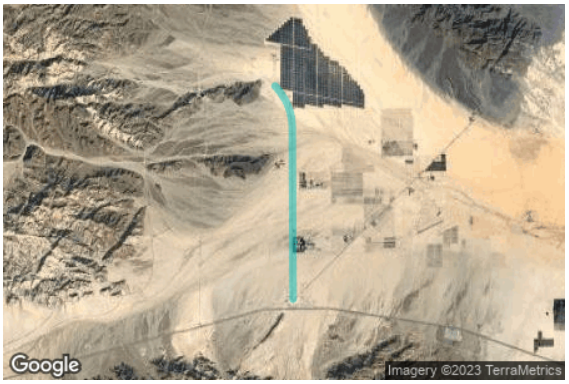
Route Receptors

Name: 177 Rice Road
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.714987	-115.399469	874.20	0.00	874.20
2	33.783304	-115.316462	533.39	0.00	533.39

Name: R2 Kaiser Road
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.715164	-115.400552	879.00	0.00	879.00
2	33.791922	-115.400963	660.29	0.00	660.29
3	33.793745	-115.400973	659.48	0.00	659.48
4	33.795493	-115.401107	662.34	0.00	662.34
5	33.796568	-115.401239	663.59	0.00	663.59
6	33.797149	-115.401347	663.96	0.00	663.96
7	33.797844	-115.401497	664.96	0.00	664.96
8	33.799110	-115.401797	668.27	0.00	668.27
9	33.800465	-115.402205	671.61	0.00	671.61
10	33.801187	-115.402484	670.28	0.00	670.28
11	33.801701	-115.402691	674.14	0.00	674.14
12	33.803163	-115.403335	681.07	0.00	681.07
13	33.804104	-115.403812	686.50	0.00	686.50
14	33.804648	-115.404102	688.41	0.00	688.41
15	33.804978	-115.404295	690.32	0.00	690.32
16	33.806288	-115.405111	701.63	0.00	701.63
17	33.809265	-115.407428	720.18	0.00	720.18
18	33.811408	-115.409525	734.07	0.00	734.07
19	33.812263	-115.410491	740.09	0.00	740.09

Flight Path Receptors

Name: Desert Center Airport Runway Approach
Description:
Threshold height: 50 ft
Direction: 244.4°
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	33.750173	-115.319063	518.50	50.00	568.50
Two-mile	33.762689	-115.287680	488.54	633.39	1121.93

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	156,846	2,614.1	0	0.0	1,566,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,565,000,000.0
Easley SW	SA tracking	SA tracking	202,071	3,367.8	0	0.0	1,565,000,000.0

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
177 Rice Road	313,668	5,227.8	0	0.0
R2 Kaiser Road	45,249	754.1	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

PV: Easley E

low potential for temporary after-image

Receptor results ordered by category of glare

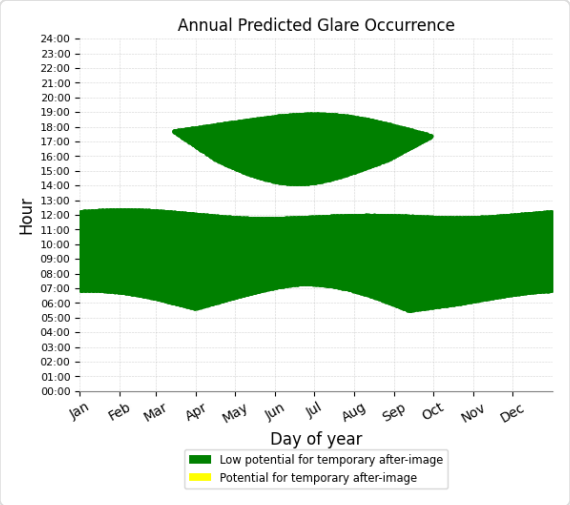
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	156,846	2,614.1	0	0.0
R2 Kaiser Road	0	0.0	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

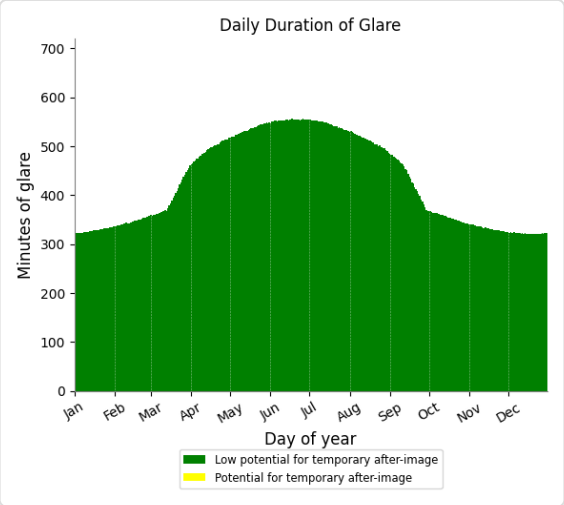
Easley E and 177 Rice Road

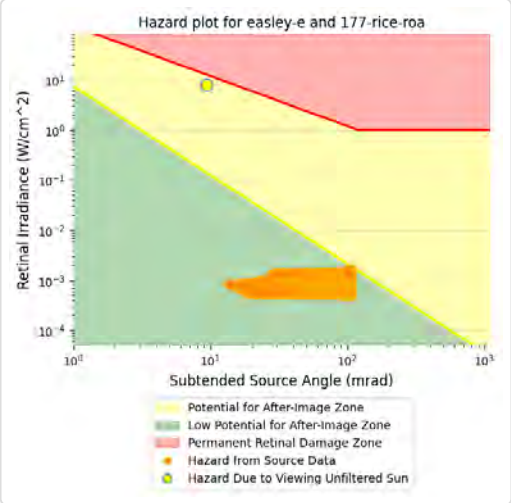
Receptor type: Route

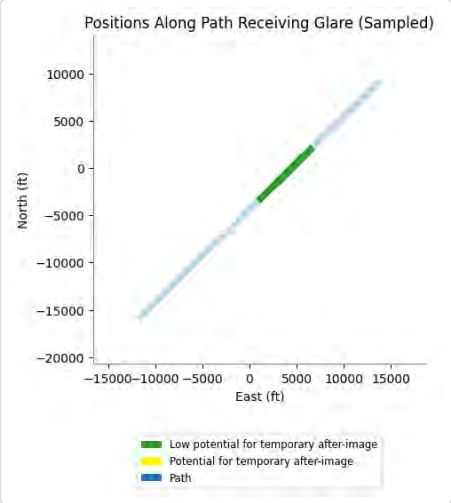
0 minutes of yellow glare

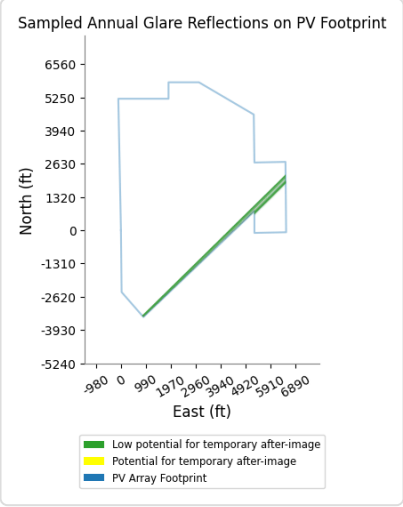
156,846 minutes of green glare











Easley E and R2 Kaiser Road

Receptor type: Route
No glare found

Easley E and Desert Center Airport Runway Approach

Receptor type: 2-mile Flight Path
No glare found

PV: Easley NW no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	0	0.0	0	0.0
R2 Kaiser Road	0	0.0	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

Easley NW and 177 Rice Road

Receptor type: Route
No glare found

Easley NW and R2 Kaiser Road

Receptor type: Route
No glare found

Easley NW and Desert Center Airport Runway Approach

Receptor type: 2-mile Flight Path
No glare found

PV: Easley SW low potential for temporary after-image

Receptor results ordered by category of glare

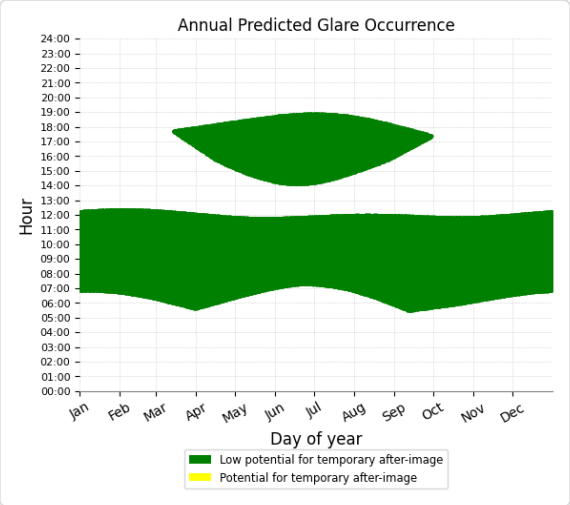
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	156,822	2,613.7	0	0.0
R2 Kaiser Road	45,249	754.1	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

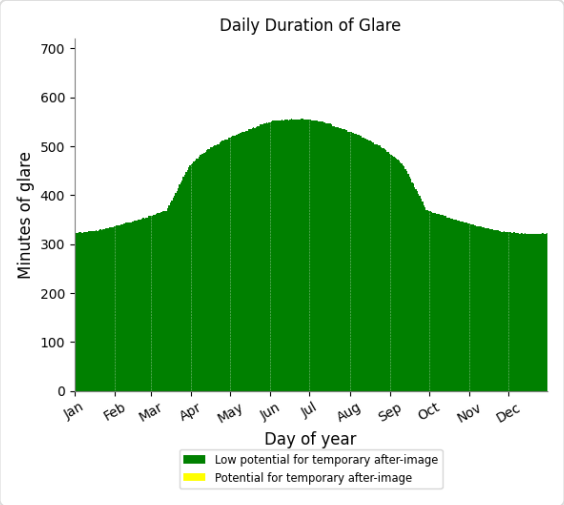
Easley SW and 177 Rice Road

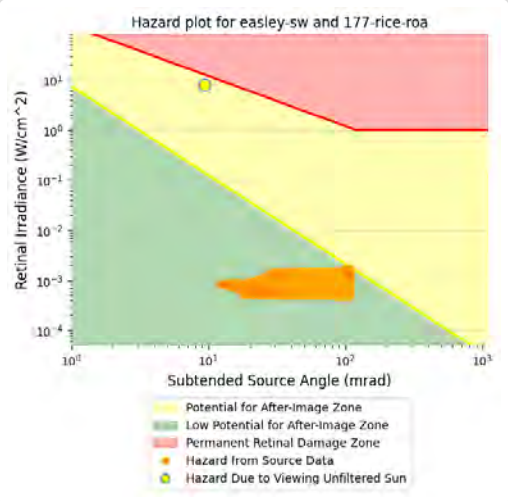
Receptor type: Route

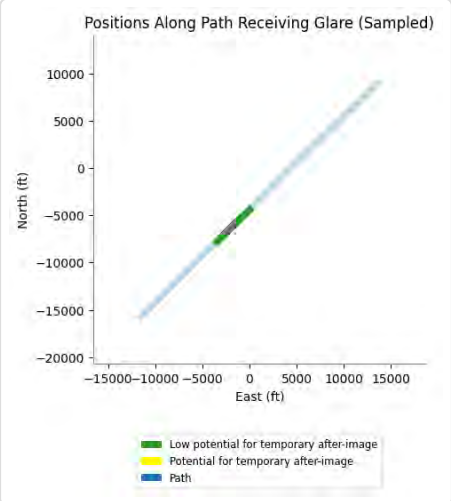
0 minutes of yellow glare

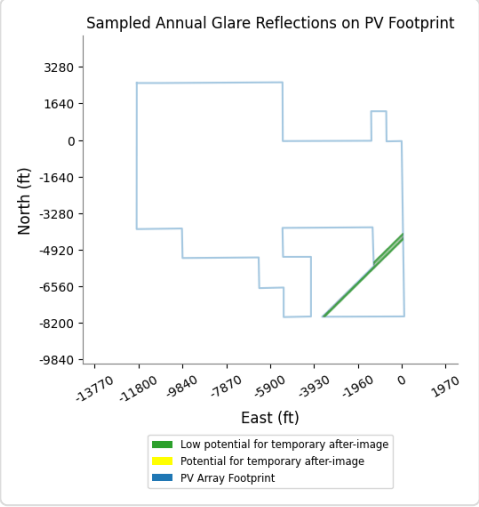
156,822 minutes of green glare









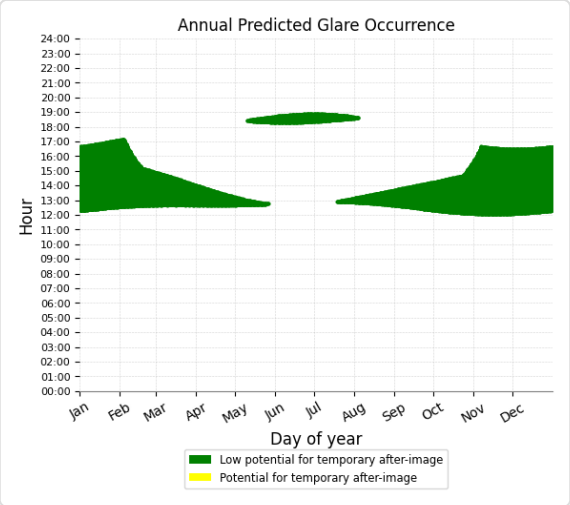


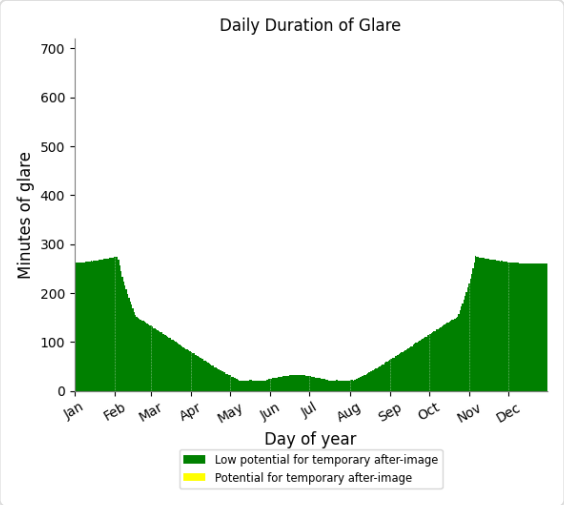
Easley SW and R2 Kaiser Road

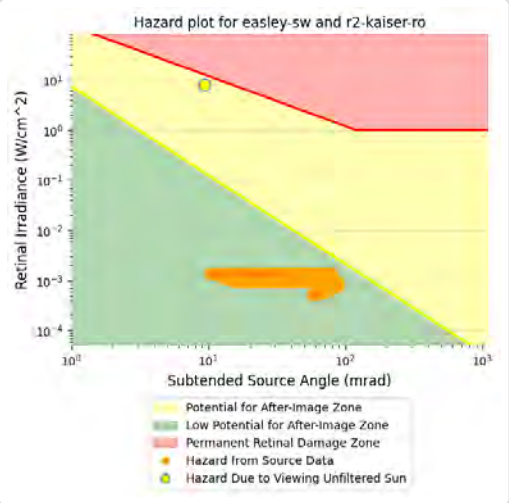
Receptor type: Route

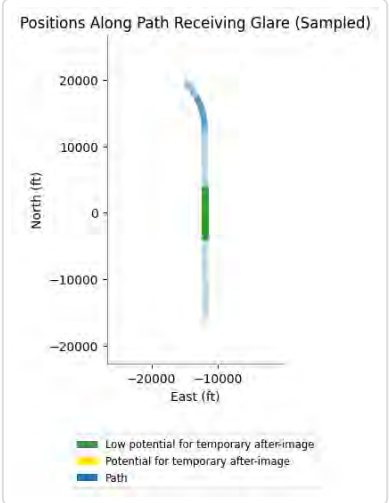
0 minutes of yellow glare

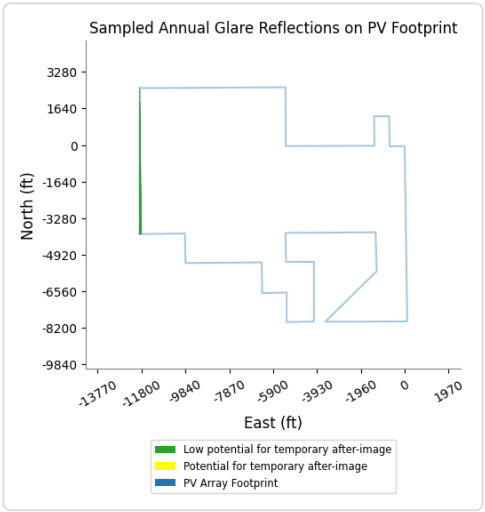
45,249 minutes of green glare











Easley SW and Desert Center

Airport Runway Approach

Receptor type: 2-mile Flight Path
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 automatically 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

Attachment 2

2023-04-17 EASLEY FORGESOLAR AVIATION REPORT (FAA 2013)

FORGESOLAR GLARE ANALYSIS

Project: **Easley Renewable Energy Project**
Site configuration: **Easley Renewable Energy Project**
Analysis conducted by Christopher Notto (cnotto@aspeneg.com) at 02:29 on 18 Apr, 2023.

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):

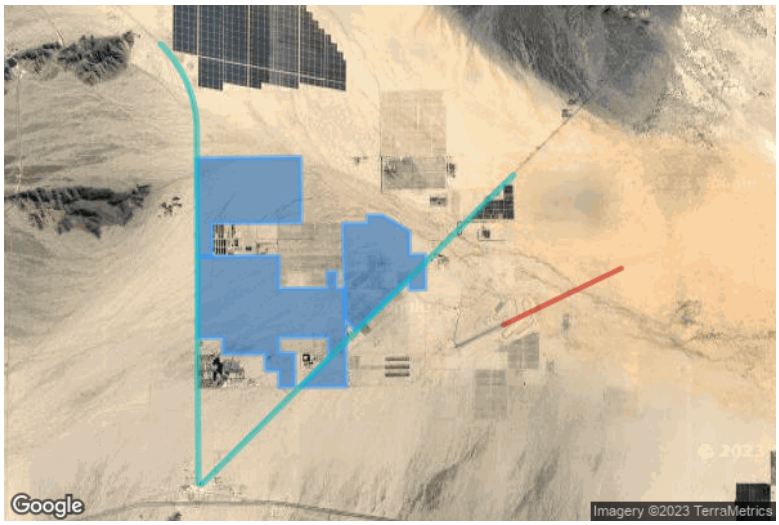
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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

SITE CONFIGURATION

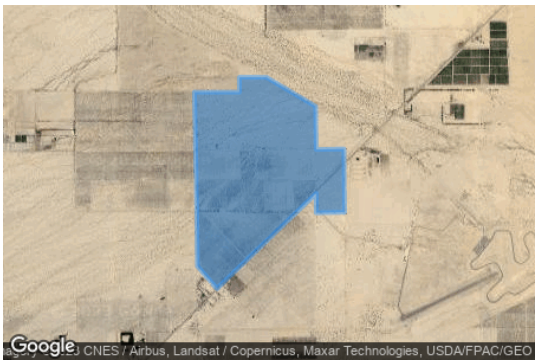
Analysis Parameters

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: 87914.15436
Methodology: V2



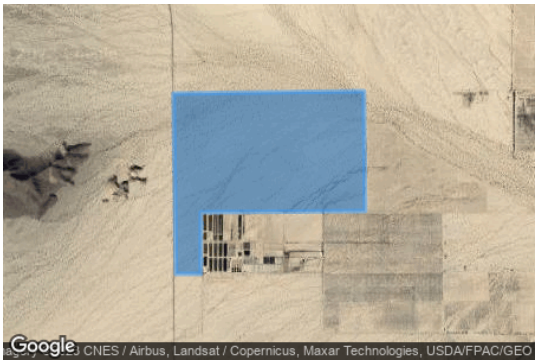
PV Array(s)

Name: Easley E
Description: Eastern portion of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



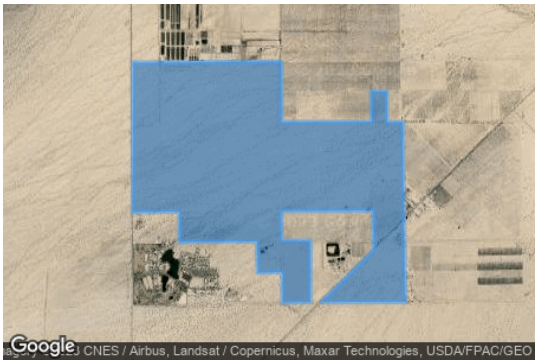
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.758290	-115.361519	602.02	0.00	602.02
2	33.751582	-115.361433	606.85	0.00	606.85
3	33.748870	-115.358601	608.64	0.00	608.64
4	33.760359	-115.344181	562.32	0.00	562.32
5	33.758005	-115.344181	562.62	0.00	562.62
6	33.758076	-115.340061	552.78	0.00	552.78
7	33.765711	-115.340147	548.19	0.00	548.19
8	33.765640	-115.344181	556.81	0.00	556.81
9	33.770848	-115.344267	553.26	0.00	553.26
10	33.774344	-115.351391	564.62	0.00	564.62
11	33.774344	-115.355339	573.17	0.00	573.17
12	33.772561	-115.355339	573.96	0.00	573.96
13	33.772561	-115.361862	588.16	0.00	588.16

Name: Easley NW
Description: Northwest quarter of Easley Approximate Panel Area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.787284	-115.373300	602.13	0.00	602.13
2	33.786999	-115.400938	662.26	0.00	662.26
3	33.765310	-115.400595	706.66	0.00	706.66
4	33.765310	-115.396990	695.09	0.00	695.09
5	33.772731	-115.396990	679.23	0.00	679.23
6	33.772873	-115.373129	617.32	0.00	617.32

Name: Easley SW
Description: Southwest section of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.765325	-115.400635	706.69	0.00	706.69
2	33.765325	-115.398832	702.14	0.00	702.14
3	33.765325	-115.397008	695.11	0.00	695.11
4	33.765410	-115.379113	643.56	0.00	643.56
5	33.758167	-115.379070	651.88	0.00	651.88
6	33.758203	-115.365981	610.66	0.00	610.66
7	33.761842	-115.366024	608.00	0.00	608.00
8	33.761842	-115.363792	602.22	0.00	602.22
9	33.758132	-115.363749	605.70	0.00	605.70
10	33.758167	-115.361517	601.42	0.00	601.42
11	33.736554	-115.361133	641.65	0.00	641.65
12	33.736518	-115.373235	665.45	0.00	665.45
13	33.742763	-115.365639	637.25	0.00	637.25
14	33.747539	-115.365810	625.40	0.00	625.40
15	33.747467	-115.379114	663.60	0.00	663.60
16	33.743899	-115.379028	671.95	0.00	671.95
17	33.743899	-115.374908	658.31	0.00	658.31
18	33.736547	-115.374908	675.67	0.00	675.67
19	33.736476	-115.378942	687.02	0.00	687.02
20	33.740116	-115.378942	678.04	0.00	678.04
21	33.740045	-115.382547	690.32	0.00	690.32
22	33.743828	-115.382633	684.10	0.00	684.10
23	33.743756	-115.393877	722.93	0.00	722.93
24	33.747396	-115.393963	716.06	0.00	716.06
25	33.747325	-115.400658	741.35	0.00	741.35

Flight Path Receptor(s)

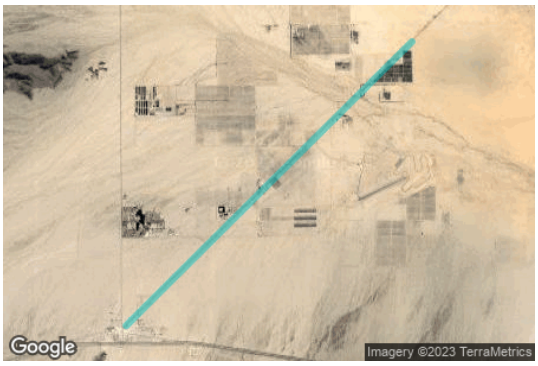
Name: Desert Center Airport Runway Approach
Description:
Threshold height: 50 ft
Direction: 244.4°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	33.750173	-115.319063	518.50	50.00	568.50
Two-mile	33.762689	-115.287680	488.54	633.39	1121.93

Route Receptor(s)

Name: 177 Rice Road
Path type: Two-way
Observer view angle: 50.0°

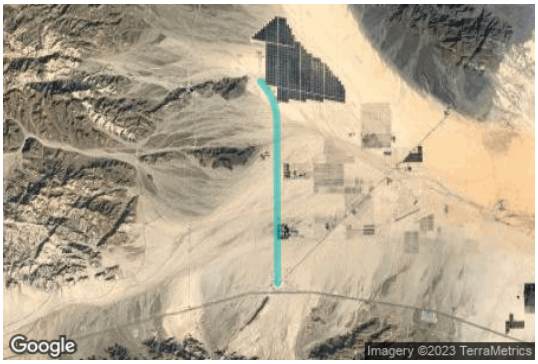
Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.714987	-115.399469	874.20	0.00	874.20
2	33.783304	-115.316462	533.39	0.00	533.39

Name: R2 Kaiser Road
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	33.715164	-115.400552	879.00	0.00	879.00
2	33.791922	-115.400963	660.29	0.00	660.29
3	33.793745	-115.400973	659.48	0.00	659.48
4	33.795493	-115.401107	662.34	0.00	662.34
5	33.796568	-115.401239	663.59	0.00	663.59
6	33.797149	-115.401347	663.96	0.00	663.96
7	33.797844	-115.401497	664.96	0.00	664.96
8	33.799110	-115.401797	668.27	0.00	668.27
9	33.800465	-115.402205	671.61	0.00	671.61
10	33.801187	-115.402484	670.28	0.00	670.28
11	33.801701	-115.402691	674.14	0.00	674.14
12	33.803163	-115.403335	681.07	0.00	681.07
13	33.804104	-115.403812	686.50	0.00	686.50
14	33.804648	-115.404102	688.41	0.00	688.41
15	33.804978	-115.404295	690.32	0.00	690.32
16	33.806288	-115.405111	701.63	0.00	701.63
17	33.809265	-115.407428	720.18	0.00	720.18
18	33.811408	-115.409525	734.07	0.00	734.07
19	33.812263	-115.410491	740.09	0.00	740.09

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
Easley E	SA tracking	SA tracking	156,846	0	1,566,000,000.0
Easley NW	SA tracking	SA tracking	0	0	1,565,000,000.0
Easley SW	SA tracking	SA tracking	202,071	0	1,565,000,000.0

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Desert Center Airport Runway Approach	0	0
177 Rice Road	313668	0
R2 Kaiser Road	45249	0

Results for: Easley E

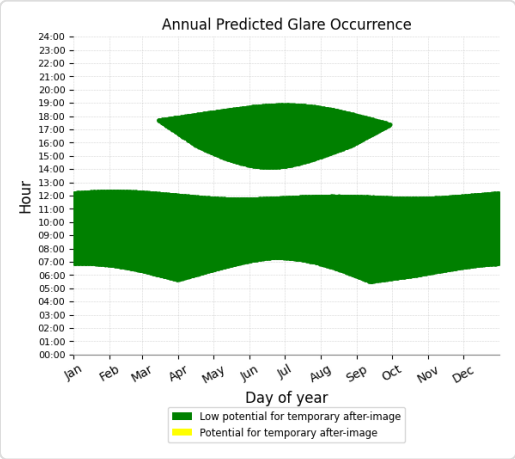
Receptor	Green Glare (min)	Yellow Glare (min)
Desert Center Airport Runway Approach	0	0
177 Rice Road	156846	0
R2 Kaiser Road	0	0

Flight Path: Desert Center Airport Runway Approach

0 minutes of yellow glare
0 minutes of green glare

Route: 177 Rice Road

0 minutes of yellow glare
156846 minutes of green glare



Route: R2 Kaiser Road

0 minutes of yellow glare
0 minutes of green glare

Results for: Easley NW

Receptor	Green Glare (min)	Yellow Glare (min)
Desert Center Airport Runway Approach	0	0
177 Rice Road	0	0
R2 Kaiser Road	0	0

Flight Path: Desert Center Airport Runway Approach

0 minutes of yellow glare
0 minutes of green glare

Route: 177 Rice Road

0 minutes of yellow glare
0 minutes of green glare

Route: R2 Kaiser Road

0 minutes of yellow glare
0 minutes of green glare

Results for: Easley SW

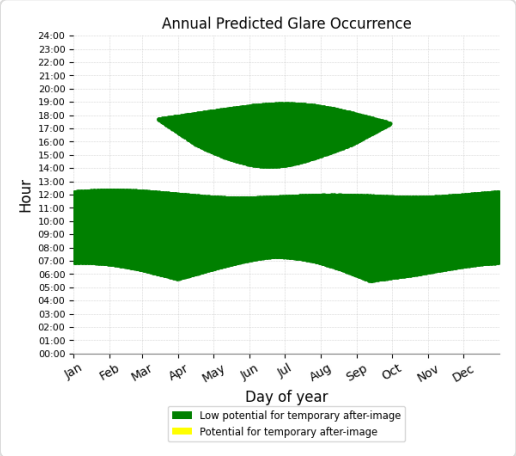
Receptor	Green Glare (min)	Yellow Glare (min)
Desert Center Airport Runway Approach	0	0
177 Rice Road	156822	0
R2 Kaiser Road	45249	0

Flight Path: Desert Center Airport Runway Approach

0 minutes of yellow glare
0 minutes of green glare

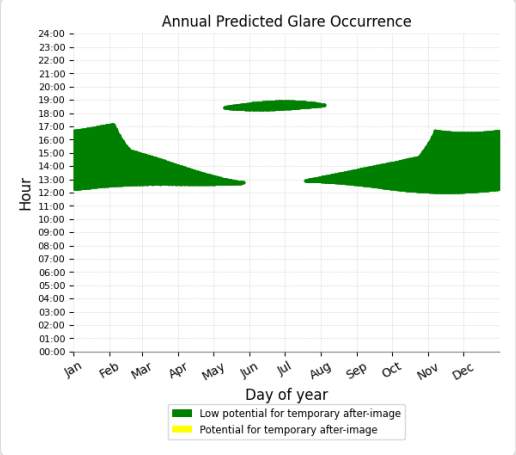
Route: 177 Rice Road

0 minutes of yellow glare
156822 minutes of green glare



Route: R2 Kaiser Road

0 minutes of yellow glare
45249 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 V1 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.

Attachment 3

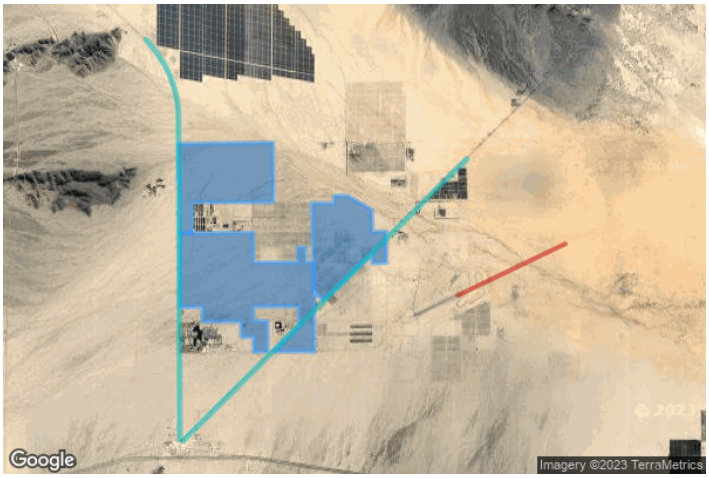
2023-04-17 EASLEY FORGESOLAR AVIATION REPORT (FAA 2021)

FORGESOLAR GLARE ANALYSIS

Project: **Easley Renewable Energy Project**
Site configuration: **Easley Renewable Energy Project**

Site description: Easley Renewable Energy Project. Approximated panel areas.

Created 07 Apr, 2023
Updated 18 Apr, 2023
Time-step 1 minute
Timezone offset UTC-8
Site ID 87914.15436
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
PV analysis methodology V2



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	N/A	No ATCT receptors assessed

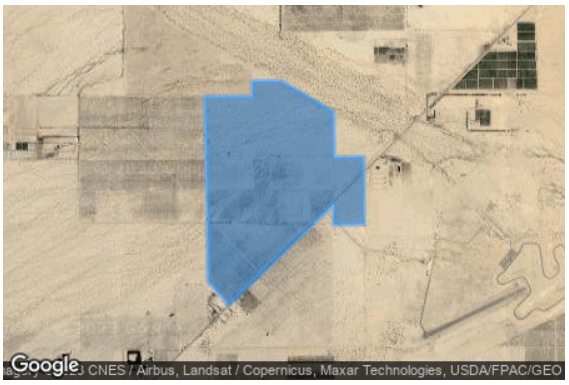
The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

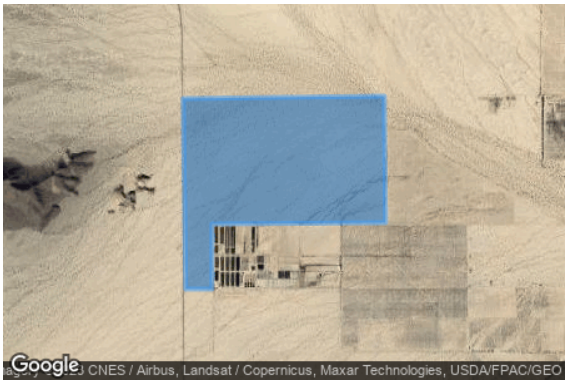
PV Arrays

Name: Easley E
Description: Eastern portion of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



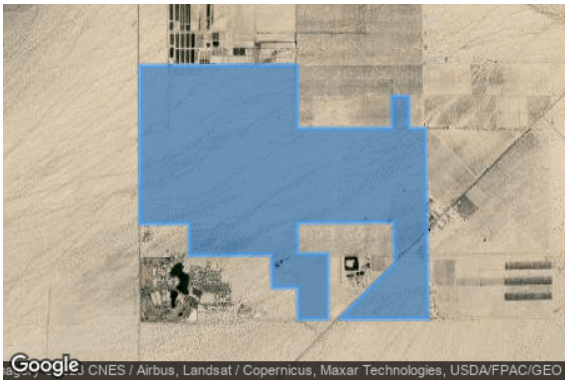
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.758290	-115.361519	602.02	0.00	602.02
2	33.751582	-115.361433	606.85	0.00	606.85
3	33.748870	-115.358601	608.64	0.00	608.64
4	33.760359	-115.344181	562.32	0.00	562.32
5	33.758005	-115.344181	562.62	0.00	562.62
6	33.758076	-115.340061	552.78	0.00	552.78
7	33.765711	-115.340147	548.19	0.00	548.19
8	33.765640	-115.344181	556.81	0.00	556.81
9	33.770848	-115.344267	553.26	0.00	553.26
10	33.774344	-115.351391	564.62	0.00	564.62
11	33.774344	-115.355339	573.17	0.00	573.17
12	33.772561	-115.355339	573.96	0.00	573.96
13	33.772561	-115.361862	588.16	0.00	588.16

Name: Easley NW
Description: Northwest quarter of Easley Approximate Panel Area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.787284	-115.373300	602.13	0.00	602.13
2	33.786999	-115.400938	662.26	0.00	662.26
3	33.765310	-115.400595	706.66	0.00	706.66
4	33.765310	-115.396990	695.09	0.00	695.09
5	33.772731	-115.396990	679.23	0.00	679.23
6	33.772873	-115.373129	617.32	0.00	617.32

Name: Easley SW
Description: Southwest section of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.765325	-115.400635	706.69	0.00	706.69
2	33.765325	-115.398832	702.14	0.00	702.14
3	33.765325	-115.397008	695.11	0.00	695.11
4	33.765410	-115.379113	643.56	0.00	643.56
5	33.758167	-115.379070	651.88	0.00	651.88
6	33.758203	-115.365981	610.66	0.00	610.66
7	33.761842	-115.366024	608.00	0.00	608.00
8	33.761842	-115.363792	602.22	0.00	602.22
9	33.758132	-115.363749	605.70	0.00	605.70
10	33.758167	-115.361517	601.42	0.00	601.42
11	33.736554	-115.361133	641.65	0.00	641.65
12	33.736518	-115.373235	665.45	0.00	665.45
13	33.742763	-115.365639	637.25	0.00	637.25
14	33.747539	-115.365810	625.40	0.00	625.40
15	33.747467	-115.379114	663.60	0.00	663.60
16	33.743899	-115.379028	671.95	0.00	671.95
17	33.743899	-115.374908	658.31	0.00	658.31
18	33.736547	-115.374908	675.67	0.00	675.67
19	33.736476	-115.378942	687.02	0.00	687.02
20	33.740116	-115.378942	678.04	0.00	678.04
21	33.740045	-115.382547	690.32	0.00	690.32
22	33.743828	-115.382633	684.10	0.00	684.10
23	33.743756	-115.393877	722.93	0.00	722.93
24	33.747396	-115.393963	716.06	0.00	716.06
25	33.747325	-115.400658	741.35	0.00	741.35

Observation Point ATCT Receptors

No ATCT receptors were included in the analysis.

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	0	0.0	0	0.0	1,566,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,565,000,000.0
Easley SW	SA tracking	SA tracking	0	0.0	0	0.0	1,565,000,000.0

No ATCT receptors were included in the analysis.

PV: Easley E

No ATCT receptors assessed.

PV: Easley NW

No ATCT receptors assessed.

PV: Easley SW

No ATCT receptors assessed.

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 automatically 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

Attachment 4

2024-04-22 EASLEY FORGESOLAR AVIATION REPORTS

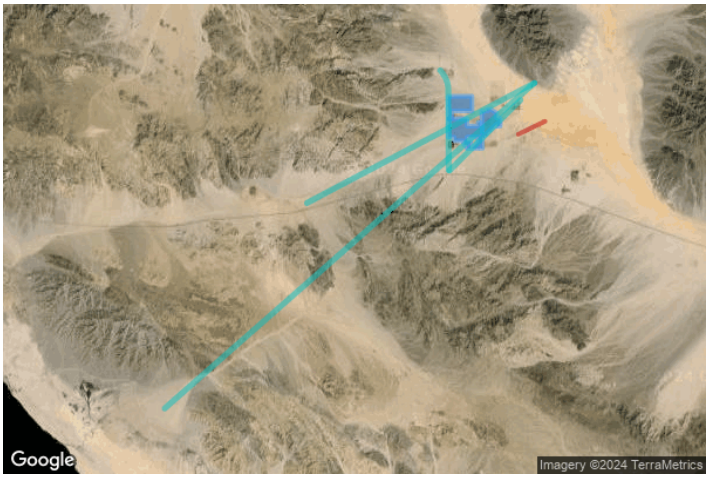
FORGESOLAR GLARE ANALYSIS

Project: **Easley Renewable Energy Project**
Site configuration: **Easley Renewable Energy Project**

Site description: Easley Renewable Energy Project. Approximated panel areas.

Created 07 Apr, 2023
Updated 22 Apr, 2024
Time-step 1 minute
Timezone offset UTC-8
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 100 MW to 1 GW
Site ID 87914.15436

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2



Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	416,078	6,934.6	0	0.0	1,568,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,568,000,000.0
Easley SW	SA tracking	SA tracking	538,045	8,967.4	0	0.0	1,568,000,000.0

Total 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
177 Rice Road	314,314	5,238.6	0	0.0
MTR Segment IDENT 217	322,336	5,372.3	0	0.0
MTR Segment IDENT 296	271,974	4,532.9	0	0.0
R2 Kaiser Road	45,499	758.3	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

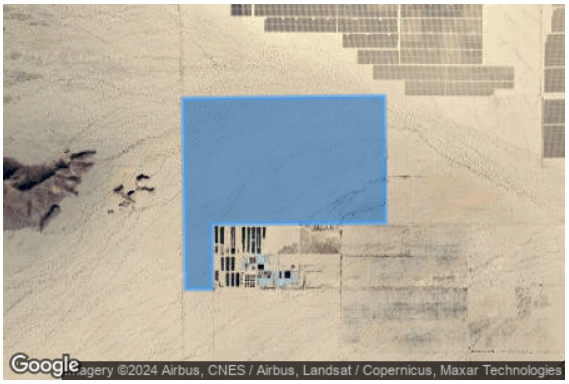
Component Data

PV Arrays

Name: Easley E
Description: Eastern portion of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

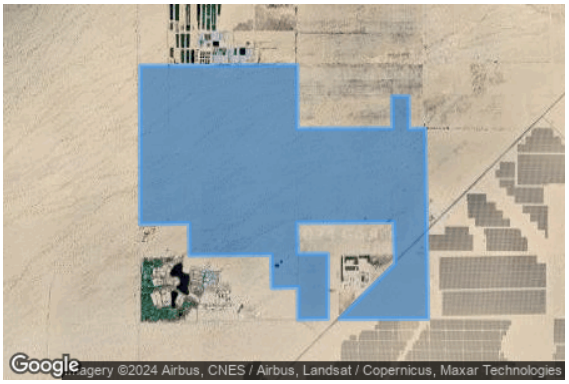
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.758290	-115.361519	602.02	0.00	602.02
2	33.751582	-115.361433	606.85	0.00	606.85
3	33.748870	-115.358601	608.64	0.00	608.64
4	33.760359	-115.344181	562.32	0.00	562.32
5	33.758005	-115.344181	562.62	0.00	562.62
6	33.758076	-115.340061	552.78	0.00	552.78
7	33.765711	-115.340147	548.19	0.00	548.19
8	33.765640	-115.344181	556.81	0.00	556.81
9	33.770848	-115.344267	553.26	0.00	553.26
10	33.774344	-115.351391	564.62	0.00	564.62
11	33.774344	-115.355339	573.17	0.00	573.17
12	33.772561	-115.355339	573.96	0.00	573.96
13	33.772561	-115.361862	588.16	0.00	588.16

Name: Easley NW
Description: Northwest quarter of Easley Approximate Panel Area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.787284	-115.373300	602.13	0.00	602.13
2	33.786999	-115.400938	662.26	0.00	662.26
3	33.765310	-115.400595	706.66	0.00	706.66
4	33.765310	-115.396990	695.09	0.00	695.09
5	33.772731	-115.396990	679.23	0.00	679.23
6	33.772873	-115.373129	617.32	0.00	617.32

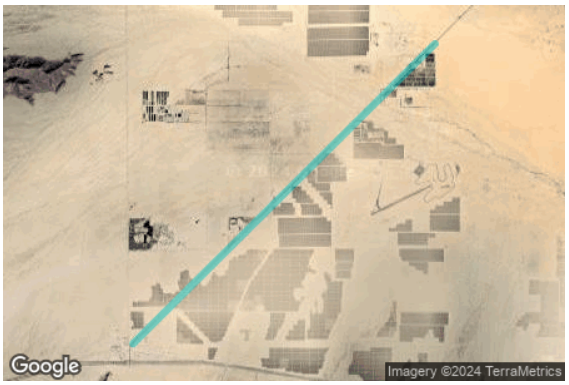
Name: Easley SW
Description: Southwest section of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.765325	-115.400635	706.69	0.00	706.69
2	33.765325	-115.398832	702.14	0.00	702.14
3	33.765325	-115.397008	695.11	0.00	695.11
4	33.765410	-115.379113	643.56	0.00	643.56
5	33.758167	-115.379070	651.88	0.00	651.88
6	33.758203	-115.365981	610.66	0.00	610.66
7	33.761842	-115.366024	608.00	0.00	608.00
8	33.761842	-115.363792	602.22	0.00	602.22
9	33.758132	-115.363749	605.70	0.00	605.70
10	33.758167	-115.361517	601.42	0.00	601.42
11	33.736554	-115.361133	641.65	0.00	641.65
12	33.736518	-115.373235	665.45	0.00	665.45
13	33.742763	-115.365639	637.25	0.00	637.25
14	33.747539	-115.365810	625.40	0.00	625.40
15	33.747467	-115.379114	663.60	0.00	663.60
16	33.743899	-115.379028	671.95	0.00	671.95
17	33.743899	-115.374908	658.31	0.00	658.31
18	33.736547	-115.374908	675.67	0.00	675.67
19	33.736476	-115.378942	687.02	0.00	687.02
20	33.740116	-115.378942	678.04	0.00	678.04
21	33.740045	-115.382547	690.32	0.00	690.32
22	33.743828	-115.382633	684.10	0.00	684.10
23	33.743756	-115.393877	722.93	0.00	722.93
24	33.747396	-115.393963	716.06	0.00	716.06
25	33.747325	-115.400658	741.35	0.00	741.35

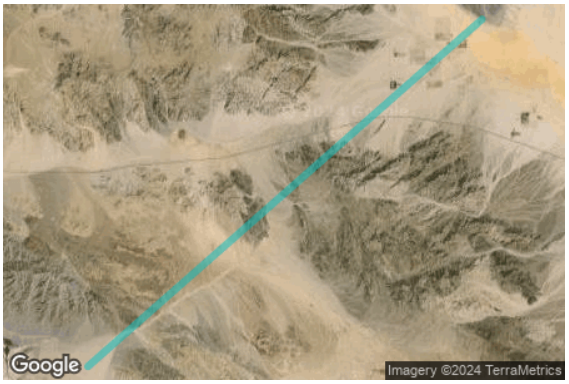
Route Receptors

Name: 177 Rice Road
Path type: Two-way
Observer view angle: 50.0°



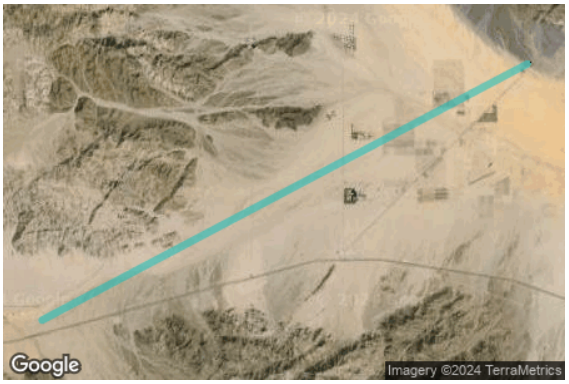
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.714987	-115.399469	874.20	0.00	874.20
2	33.783304	-115.316462	533.39	0.00	533.39

Name: MTR Segment IDENT 217
Path type: Two-way
Observer view angle: 50.0°



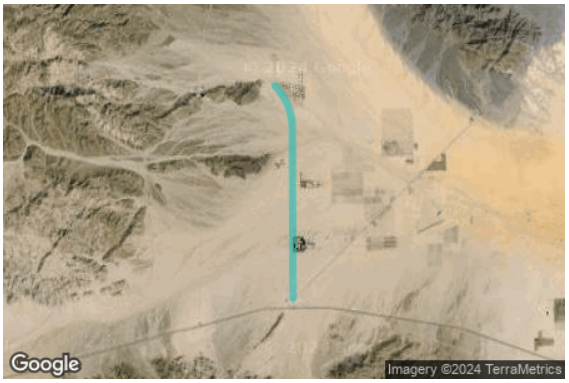
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.483334	-115.733333	248.94	200.00	448.94
2	33.799999	-115.300000	533.32	200.00	733.32

Name: MTR Segment IDENT 296
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.683333	-115.566667	1377.34	300.00	1677.34
2	33.800000	-115.300000	533.32	300.00	833.32

Name: R2 Kaiser Road
Path type: Two-way
Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.715164	-115.400552	879.00	0.00	879.00
2	33.791922	-115.400963	660.29	0.00	660.29
3	33.793745	-115.400973	659.48	0.00	659.48
4	33.795493	-115.401107	662.34	0.00	662.34
5	33.796568	-115.401239	663.59	0.00	663.59
6	33.797149	-115.401347	663.96	0.00	663.96
7	33.797844	-115.401497	664.96	0.00	664.96
8	33.799110	-115.401797	668.27	0.00	668.27
9	33.800465	-115.402205	671.61	0.00	671.61
10	33.801187	-115.402484	670.28	0.00	670.28
11	33.801701	-115.402691	674.14	0.00	674.14
12	33.803163	-115.403335	681.07	0.00	681.07
13	33.804104	-115.403812	686.50	0.00	686.50
14	33.804648	-115.404102	688.41	0.00	688.41
15	33.804978	-115.404295	690.32	0.00	690.32
16	33.806288	-115.405111	701.63	0.00	701.63
17	33.809265	-115.407428	720.18	0.00	720.18
18	33.811408	-115.409525	734.07	0.00	734.07
19	33.812263	-115.410491	740.09	0.00	740.09

Flight Path Receptors

Name: Desert Center Airport Runway Approach
Description:
Threshold height: 50 ft
Direction: 244.4°
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	33.750173	-115.319063	518.50	50.00	568.50
Two-mile	33.762689	-115.287680	488.54	633.39	1121.93

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	416,078	6,934.6	0	0.0	1,568,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,568,000,000.0
Easley SW	SA tracking	SA tracking	538,045	8,967.4	0	0.0	1,568,000,000.0

Total 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
177 Rice Road	314,314	5,238.6	0	0.0
MTR Segment IDENT 217	322,336	5,372.3	0	0.0
MTR Segment IDENT 296	271,974	4,532.9	0	0.0
R2 Kaiser Road	45,499	758.3	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

PV: Easley E

low potential for temporary after-image

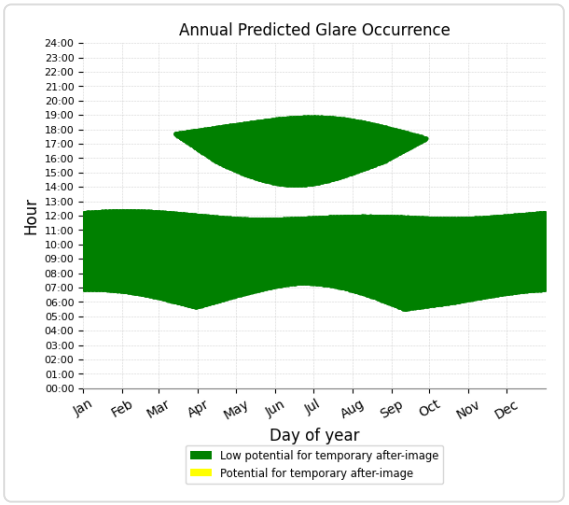
Receptor results ordered by category of glare

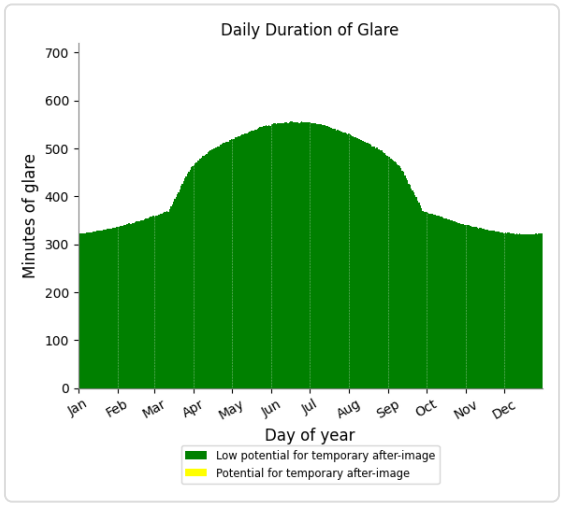
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	157,169	2,619.5	0	0.0
MTR Segment IDENT 217	161,169	2,686.2	0	0.0
MTR Segment IDENT 296	97,740	1,629.0	0	0.0
R2 Kaiser Road	0	0.0	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

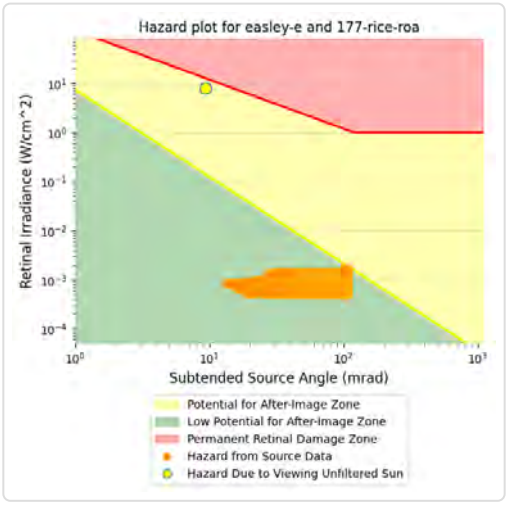
Easley E and Route: 177 Rice Road

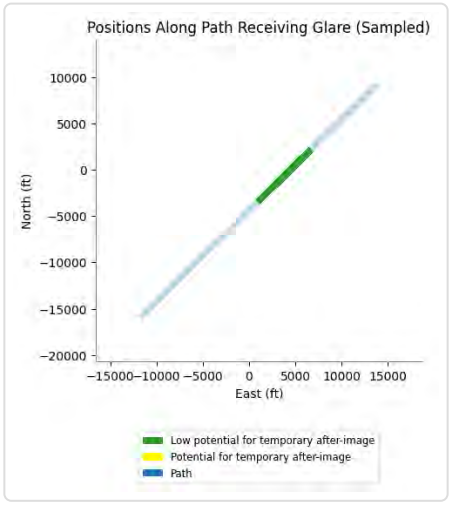
Yellow glare: none

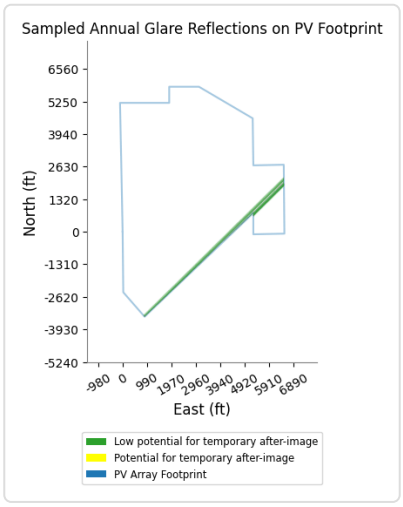
Green glare: 157,169 min.







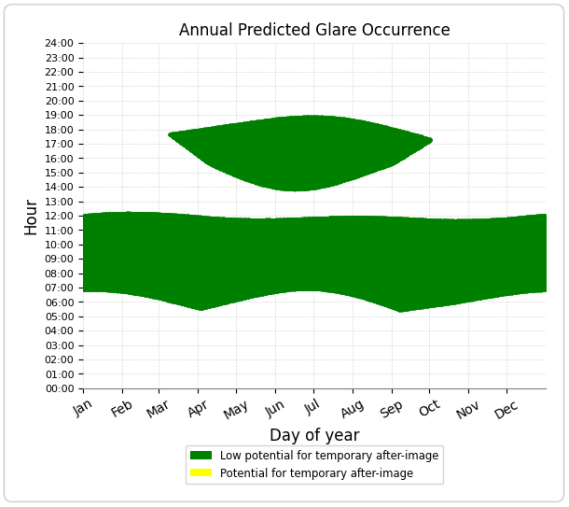


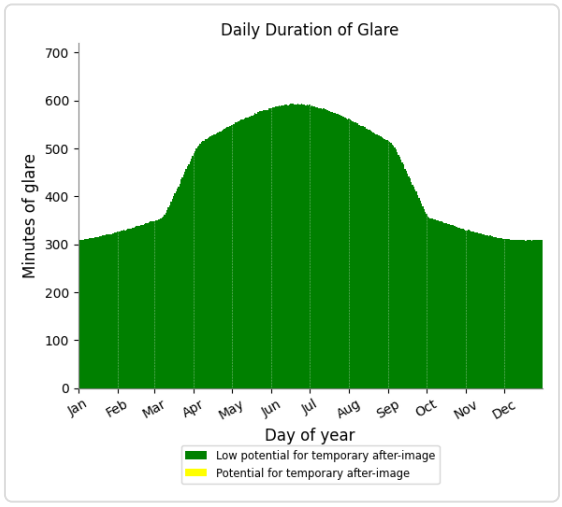


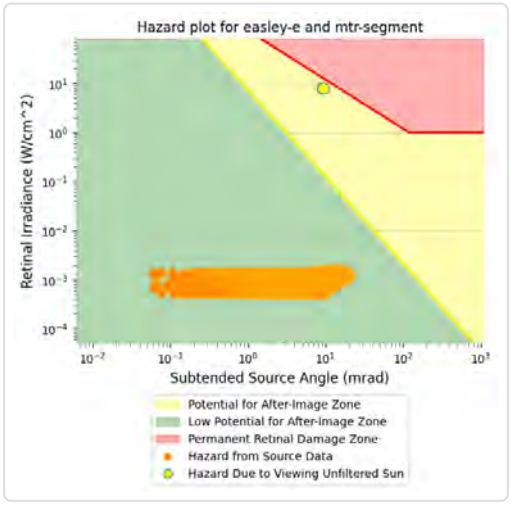
Easley E and Route: MTR Segment IDENT 217

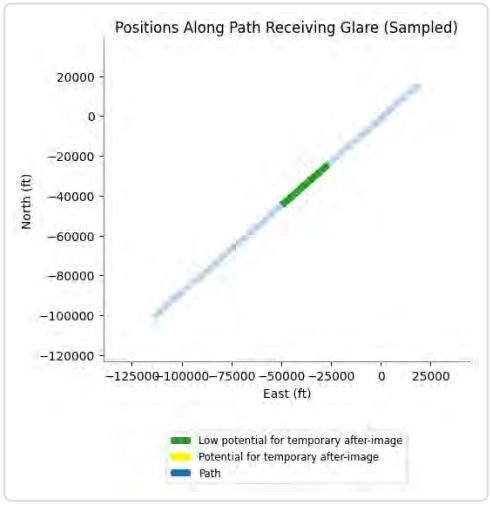
Yellow glare: none

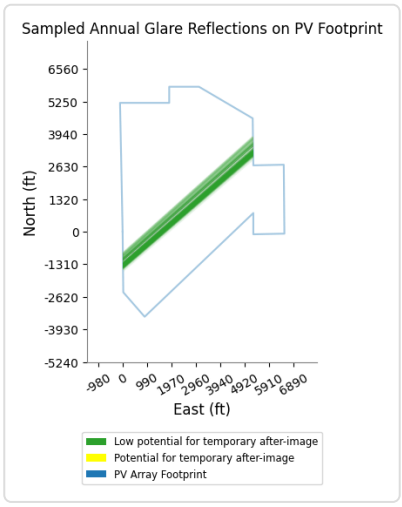
Green glare: 161,169 min.







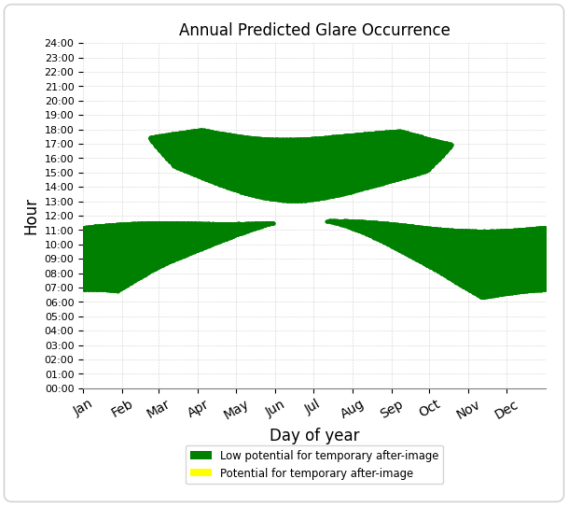


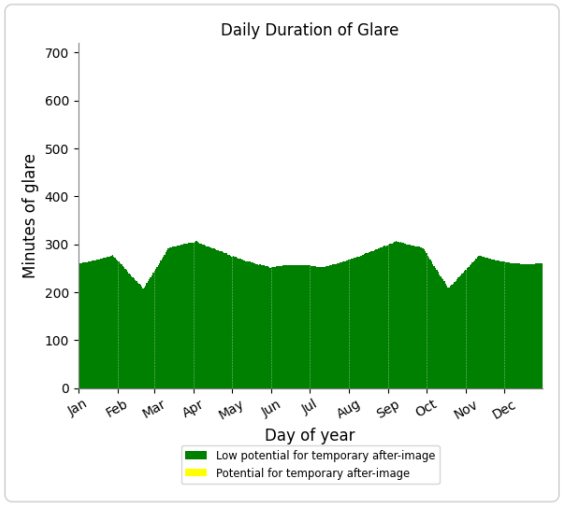


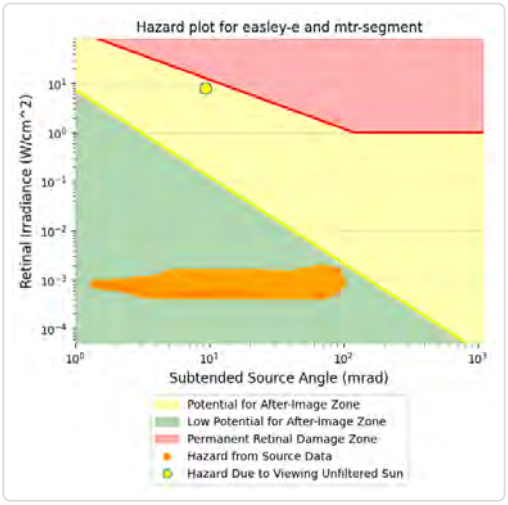
Easley E and Route: MTR Segment IDENT 296

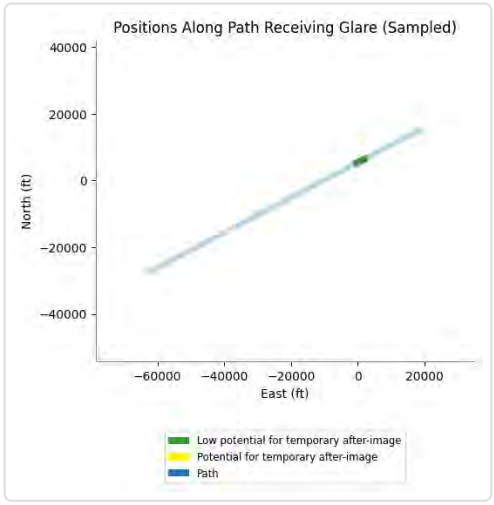
Yellow glare: none

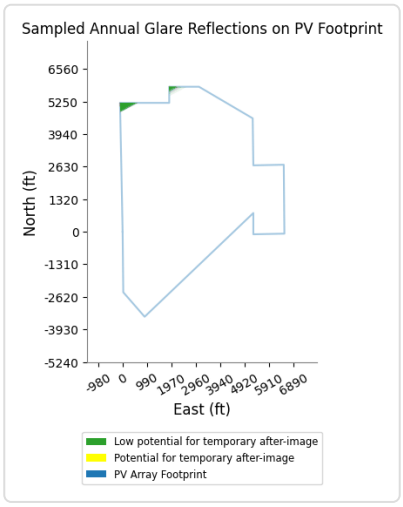
Green glare: 97,740 min.











Easley E and Route: R2 Kaiser Road

No glare found

Easley E and FP: Desert Center Airport Runway Approach

No glare found

PV: Easley NW no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	0	0.0	0	0.0
MTR Segment IDENT 217	0	0.0	0	0.0
MTR Segment IDENT 296	0	0.0	0	0.0
R2 Kaiser Road	0	0.0	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

Easley NW and Route: 177 Rice Road

No glare found

Easley NW and Route: MTR Segment IDENT 217

No glare found

Easley NW and Route: MTR Segment IDENT 296

No glare found

Easley NW and Route: R2 Kaiser Road

No glare found

Easley NW and FP: Desert Center Airport Runway Approach

No glare found

PV: Easley SW low potential for temporary after-image

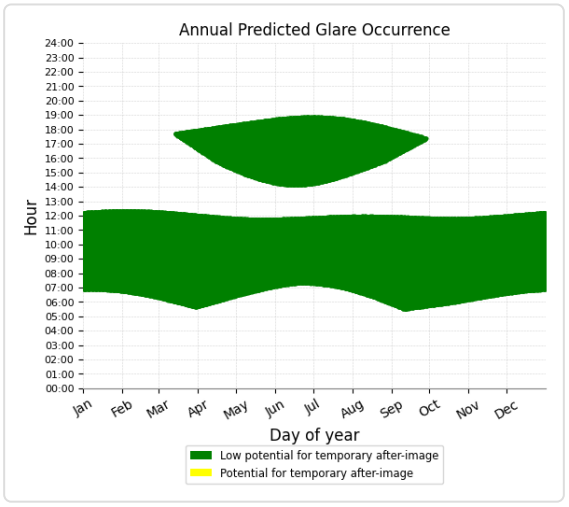
Receptor results ordered by category of glare

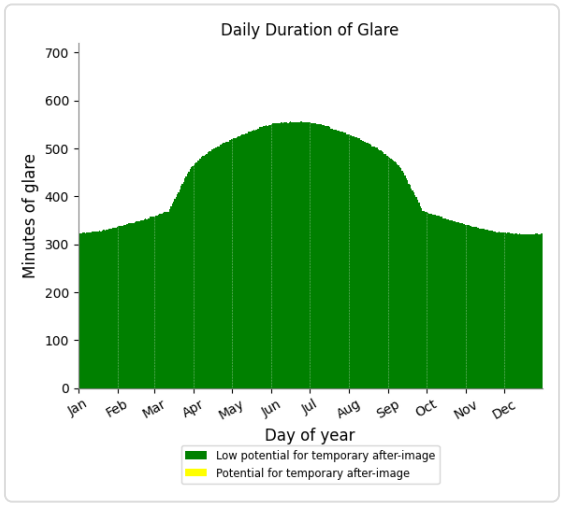
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
177 Rice Road	157,145	2,619.1	0	0.0
MTR Segment IDENT 217	161,167	2,686.1	0	0.0
MTR Segment IDENT 296	174,234	2,903.9	0	0.0
R2 Kaiser Road	45,499	758.3	0	0.0
Desert Center Airport Runway Approach	0	0.0	0	0.0

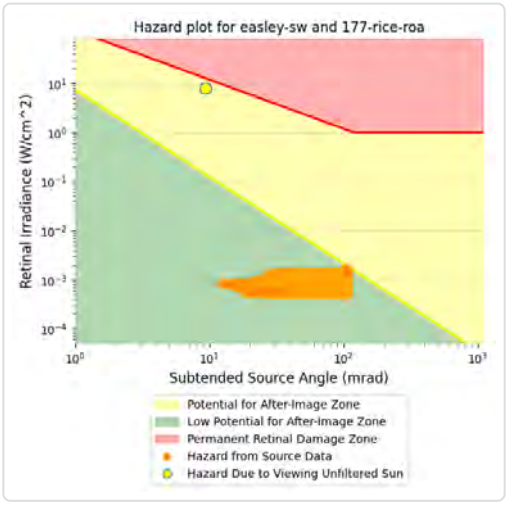
Easley SW and Route: 177 Rice Road

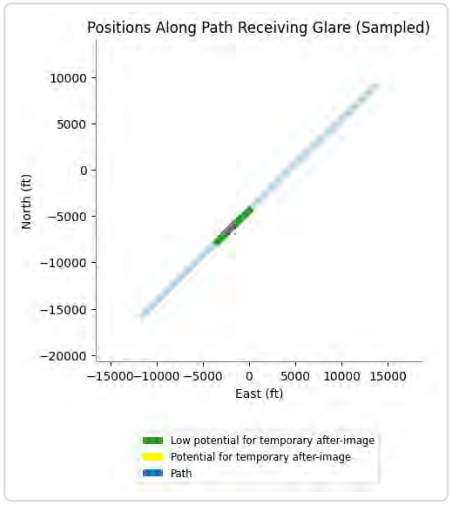
Yellow glare: none

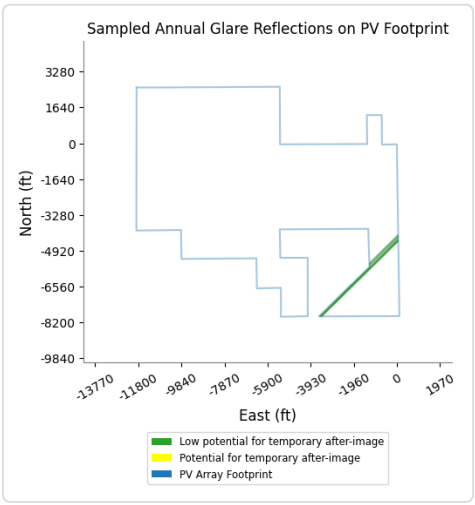
Green glare: 157,145 min.







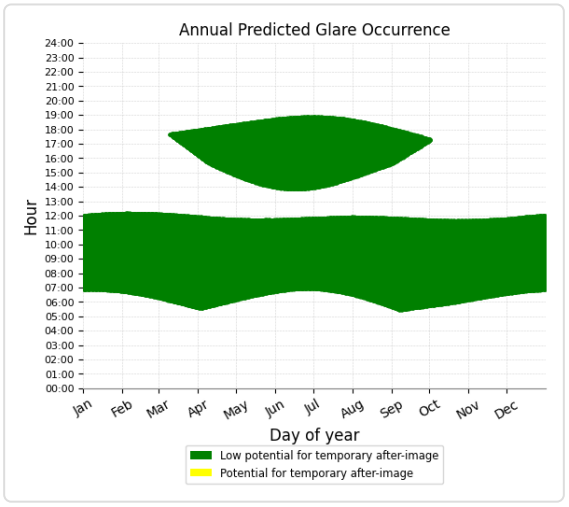


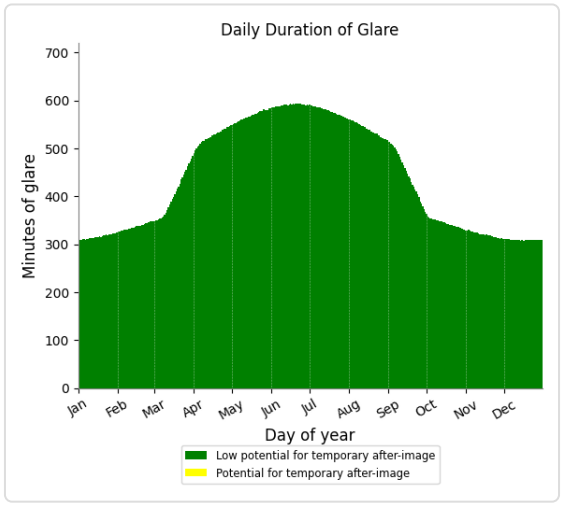


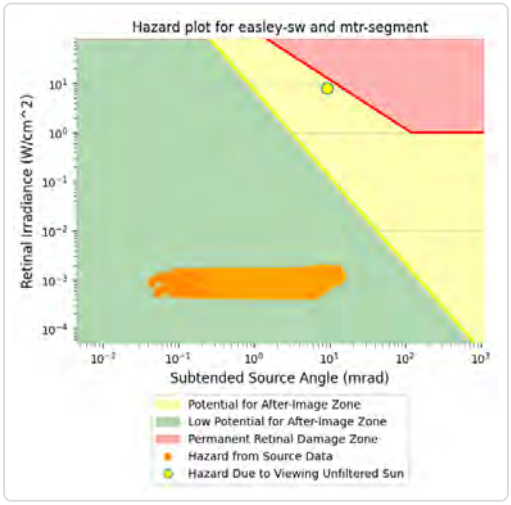
Easley SW and Route: MTR Segment IDENT 217

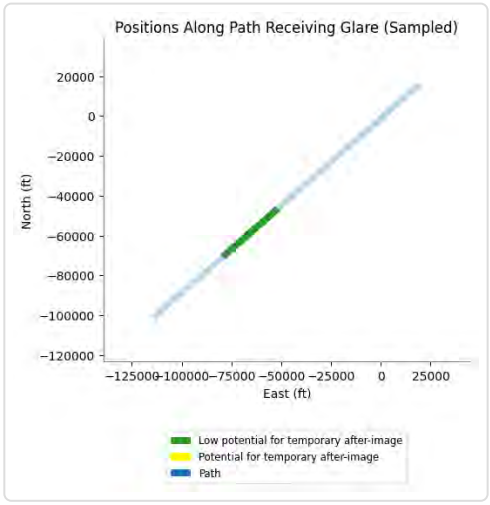
Yellow glare: none

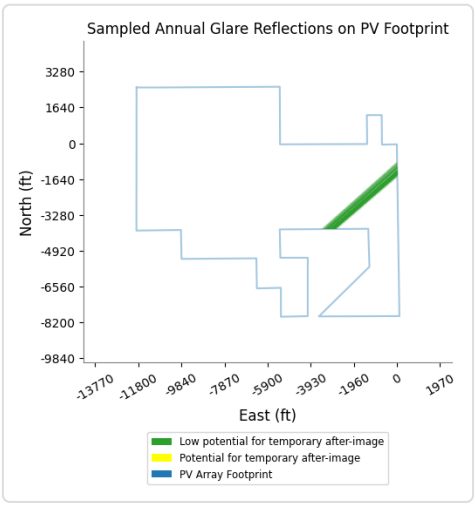
Green glare: 161,167 min.







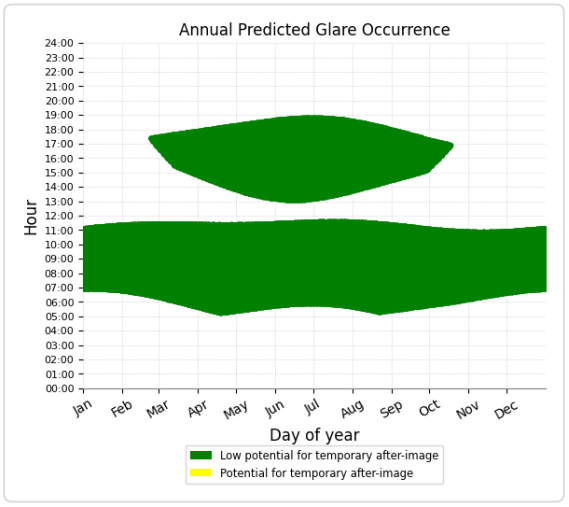


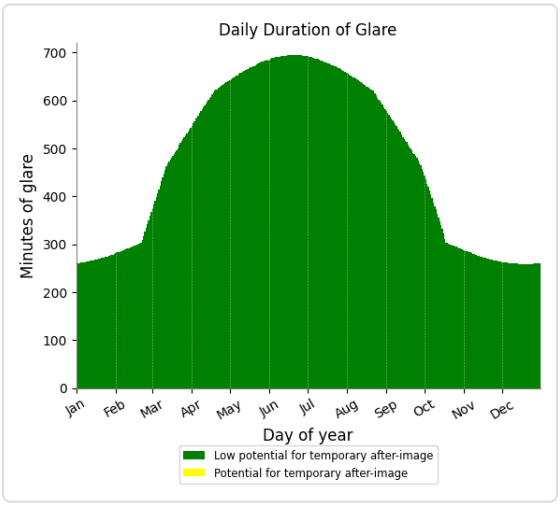


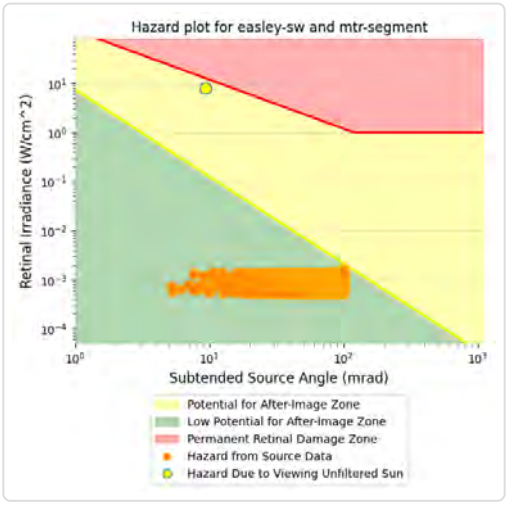
Easley SW and Route: MTR Segment IDENT 296

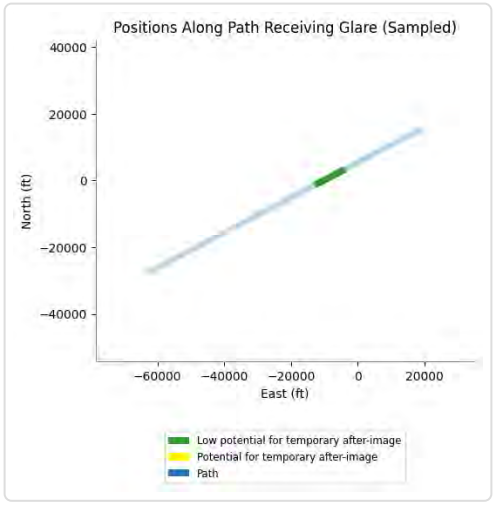
Yellow glare: none

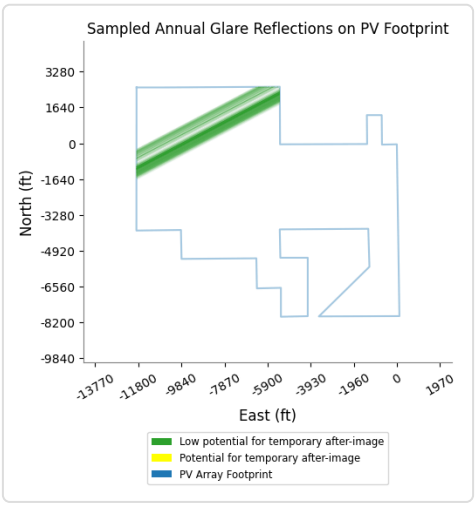
Green glare: 174,234 min.







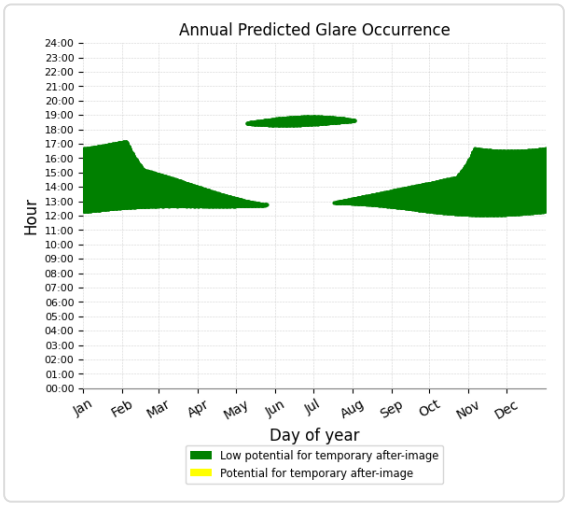


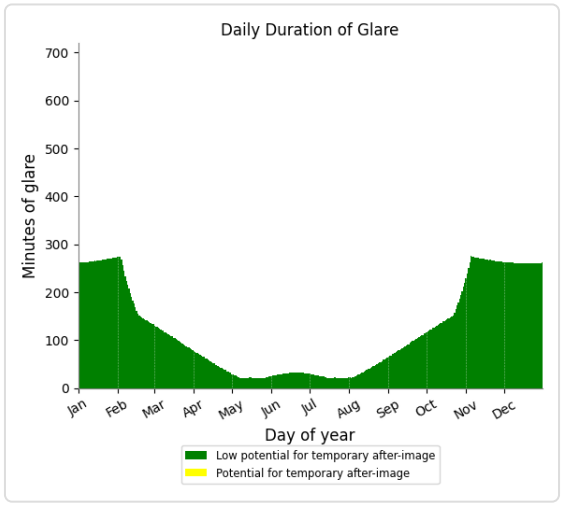


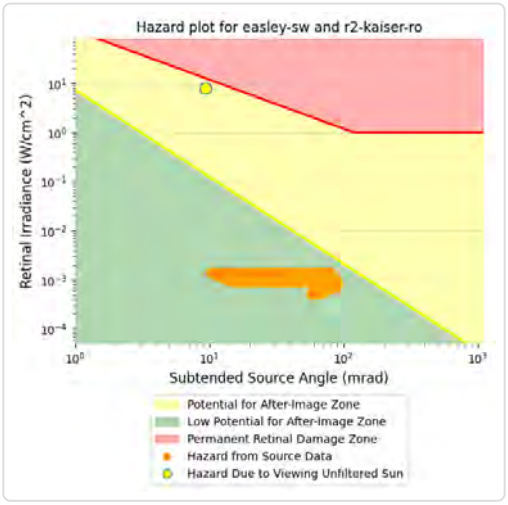
Easley SW and Route: R2 Kaiser Road

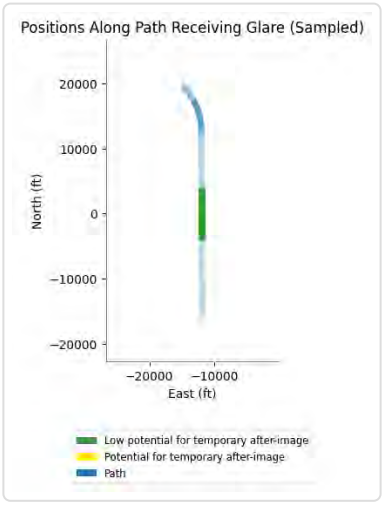
Yellow glare: none

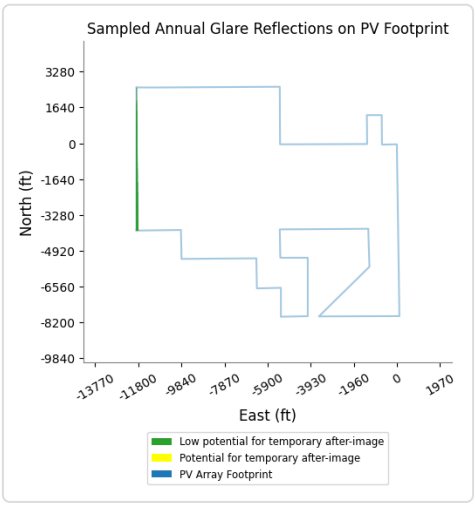
Green glare: 45,499 min.











Easley SW and FP: Desert Center Airport Runway Approach

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 automatically 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

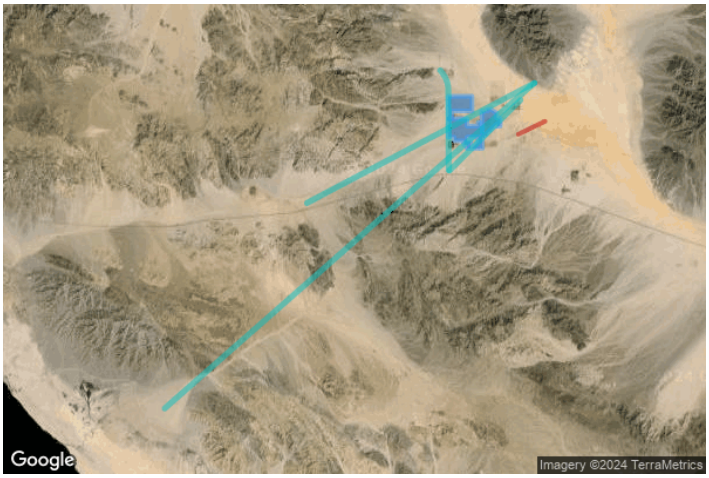
FORGESOLAR GLARE ANALYSIS

Project: **Easley Renewable Energy Project**
Site configuration: **Easley Renewable Energy Project**

Site description: Easley Renewable Energy Project. Approximated panel areas.

Created 07 Apr, 2023
Updated 22 Apr, 2024
Time-step 1 minute
Timezone offset UTC-8
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 87914.15436

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2



Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	N/A	No ATCT receptors assessed

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

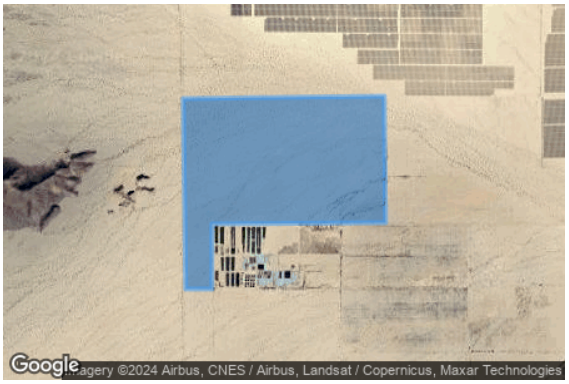
This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

Name: Easley E
Description: Eastern portion of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

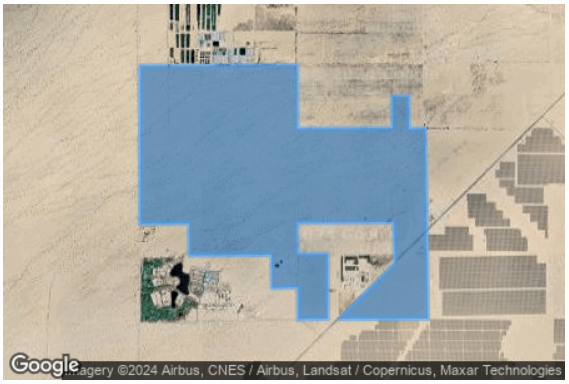
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	33.758290	-115.361519	602.02	0.00	602.02
2	33.751582	-115.361433	606.85	0.00	606.85
3	33.748870	-115.358601	608.64	0.00	608.64
4	33.760359	-115.344181	562.32	0.00	562.32
5	33.758005	-115.344181	562.62	0.00	562.62
6	33.758076	-115.340061	552.78	0.00	552.78
7	33.765711	-115.340147	548.19	0.00	548.19
8	33.765640	-115.344181	556.81	0.00	556.81
9	33.770848	-115.344267	553.26	0.00	553.26
10	33.774344	-115.351391	564.62	0.00	564.62
11	33.774344	-115.355339	573.17	0.00	573.17
12	33.772561	-115.355339	573.96	0.00	573.96
13	33.772561	-115.361862	588.16	0.00	588.16

Name: Easley NW
Description: Northwest quarter of Easley Approximate Panel Area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.787284	-115.373300	602.13	0.00	602.13
2	33.786999	-115.400938	662.26	0.00	662.26
3	33.765310	-115.400595	706.66	0.00	706.66
4	33.765310	-115.396990	695.09	0.00	695.09
5	33.772731	-115.396990	679.23	0.00	679.23
6	33.772873	-115.373129	617.32	0.00	617.32

Name: Easley SW
Description: Southwest section of Easley Renewable Energy Project approximate panel area
Axis tracking: Single-axis rotation
Backtracking: None
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Rated power: 490000.0 kW
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	33.765325	-115.400635	706.69	0.00	706.69
2	33.765325	-115.398832	702.14	0.00	702.14
3	33.765325	-115.397008	695.11	0.00	695.11
4	33.765410	-115.379113	643.56	0.00	643.56
5	33.758167	-115.379070	651.88	0.00	651.88
6	33.758203	-115.365981	610.66	0.00	610.66
7	33.761842	-115.366024	608.00	0.00	608.00
8	33.761842	-115.363792	602.22	0.00	602.22
9	33.758132	-115.363749	605.70	0.00	605.70
10	33.758167	-115.361517	601.42	0.00	601.42
11	33.736554	-115.361133	641.65	0.00	641.65
12	33.736518	-115.373235	665.45	0.00	665.45
13	33.742763	-115.365639	637.25	0.00	637.25
14	33.747539	-115.365810	625.40	0.00	625.40
15	33.747467	-115.379114	663.60	0.00	663.60
16	33.743899	-115.379028	671.95	0.00	671.95
17	33.743899	-115.374908	658.31	0.00	658.31
18	33.736547	-115.374908	675.67	0.00	675.67
19	33.736476	-115.378942	687.02	0.00	687.02
20	33.740116	-115.378942	678.04	0.00	678.04
21	33.740045	-115.382547	690.32	0.00	690.32
22	33.743828	-115.382633	684.10	0.00	684.10
23	33.743756	-115.393877	722.93	0.00	722.93
24	33.747396	-115.393963	716.06	0.00	716.06
25	33.747325	-115.400658	741.35	0.00	741.35

Observation Point ATCT Receptors

No ATCT receptors were included in the analysis.

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Easley E	SA tracking	SA tracking	0	0.0	0	0.0	1,568,000,000.0
Easley NW	SA tracking	SA tracking	0	0.0	0	0.0	1,568,000,000.0
Easley SW	SA tracking	SA tracking	0	0.0	0	0.0	1,568,000,000.0

No ATCT receptors were included in the analysis.

PV: Easley E

No ATCT receptors assessed.

PV: Easley NW

No ATCT receptors assessed.

PV: Easley SW

No ATCT receptors assessed.

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 automatically 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