Dunmore Solar Power Plant

Solar Glare Hazard Analysis Report

Client: Dunmore Solar Inc.
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Executive Summary

The Dunmore Solar Power Plant (the Project)[1] was originally submitted to the Alberta Utilities Commission (AUC) in 2021, as a 216-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant. Green Cat Renewables Canada Corporation (GCR) was retained by Dunmore Solar Inc. (Dunmore Solar) to prepare the original Solar Glare Hazard Analysis Report (SGHAR)[2] for the Project. The Project is located in Cypress County, Alberta, approximately 9km northeast of the Hamlet of Dunmore and obtained AUC approval in September 2021.[3]

Following AUC approval of the Project, revisions were made to the permitted design, including the use of a single-axis tracker system rather than fixed tilt panels. GCR was therefore retained to complete an updated SGHA for the Project, considering the revised Project design. The Project is now proposed to have a lower capacity of 172.8 MW_{AC}, consisting of ground mounted, single-axis tracking modules.

GCR utilizes ForgeSolar's GlareGauge software to assess user-input PV arrays for potential glare on identified roadways and aviation assets. The software evaluates the occurrence of glare on a minute-by-minute basis. If glare is predicted, each minute of glare as a function of retinal irradiance and subtended angle is plotted on a hazard plot. Retinal irradiance and subtended angle predict the ocular hazard associated with the glare as either green (low potential for after-image), yellow (potential for temporary after-image), or red (potential for retinal damage). The software does not consider obstacles such as trees, hills, buildings, etc. between the PV array and glare receptor.

GCR followed the guidelines provided in AUC Rule 007 for the receptors to be included in a solar glare assessment but Rule 007 does not specify any modelling parameters or glare threshold limits.[4] GCR also referred to the information provided in Zehndorfer Engineering's *Solar Glare and Glint Project Report*,[5] which was written to inform the AUC's update to Rule 007, Alberta Transportation guidelines,[6] and other relevant literature.

GCR evaluated the area within 4,000m of the Project for aerodromes and within 800m for any other receptors. The assessment considered the following receptors near the Project:

- Five observation points representing nearby dwellings;
- One highway;
- Four local roads; and
- One private, unregistered aerodrome.

The glare analysis indicates that the Project is not likely to have the potential to create hazardous glare conditions for the dwellings, roads, or flight paths that were assessed. The actual glare impacts that will be experienced by vehicle operators are anticipated to be only a fraction of the results presented in this report. The actual impact is expected to be less because vehicle operators will be travelling past the affected areas, not standing still while looking at the solar PV arrays. The impact of the glare on affected receptors may also be reduced by sun-masking as the glare occurs

[1] AUC Proceeding 26485

[2] AUC Exhibit 26485_X0012

[3] AUC Power Plant Approval #26485-D02-2021

[4] AUC Rule 007: *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations, Hydro Developments and Gas Utility Pipelines* (April 2022), subsection 4.4.2 SP14.

[5] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).

[6] *Assessment requirements for solar development near provincial highways* (Alberta Transportation, December 2021).

around sunrise/sunset when the sun aligns with the glare spot and observer, and the sunlight glances across the arrays at a shallow angle.

Based on the assessment results, glare from Dunmore Solar Power Plant is not expected to present a hazard to drivers along nearby roads, pilots landing at the unregistered aerodrome, or have a significant adverse effect on a resident's use of their home.

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1 Introduction

The Dunmore Solar Power Plant (the Project)[7] was originally submitted to the Alberta Utilities Commission (AUC) in 2021, as a 216-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant. Green Cat Renewables Canada Corporation (GCR) was retained by Dunmore Solar Inc. (Dunmore Solar) to prepare the original Solar Glare Hazard Analysis Report (SGHAR)[8] for the Project. The Project is located in Cypress County, Alberta, approximately 9km northeast of the Hamlet of Dunmore and obtained AUC approval in September 2021.[9]

Following AUC approval of the Project, revisions were made to the permitted design, including the use of a single-axis tracker system rather than fixed tilt racking. GCR was therefore retained to complete an additional SGHA for the Project, considering the revised Project design. The Project is now proposed to have a lower capacity of 172.8 MW_{AC}, consisting of ground mounted, single-axis tracking modules.

It is considered that a developer, in this case Dunmore Solar, should provide safety assurances regarding the full potential impact of the installation on nearby receptors in the form of a glare assessment.

Glint and glare refer to light reflected off smooth surfaces, either momentarily and intense (glint) or less intense for a more sustained period (glare). Solar PV technology is specifically designed to absorb as much sunlight as possible and modules are generally coated in an anti-reflective coating, as is the case with the modules selected for the Project. Solar PV sites have been developed alongside major transport routes and airports around the world, including adjacent to road infrastructure. This suggests that solar PV technology, such as that being used for the Project, can safely coexist with roads and aerodromes.

The assessment considers the glare impact of the Project on dwellings and ground transportation routes within 800m of the Project. The nearest registered aerodrome, Medicine Hat Regional Airport, is approximately 16km west of the Project. Due to its distance, this aerodrome was not considered in this analysis. One private, unregistered aerodrome was identified within 4,000m of the Project, so it has been analyzed in this assessment.

[7] AUC Proceeding 26485

[8] AUC Exhibit 26485_X0012

[9] AUC Power Plant Approval #26485-D02-2021

2 Background Information

The potential for glint and glare from solar PV modules on the surrounding roads, residential properties and nearby aerodromes should be fully considered when planning a solar project.

Glint and glare are both caused by the reflection of light from a surface, in this case sunlight from a solar module. Glare is caused by a continuous but less intense reflection of a bright light, whereas glint is caused by a strong, momentary reflection of sunlight. Reflections from smooth surfaces produce more direct "specular" reflections, and rougher surfaces disperse the light in multiple directions, creating "diffuse" reflections. Figure 2-1 shows these two types of reflections from a solar PV module.

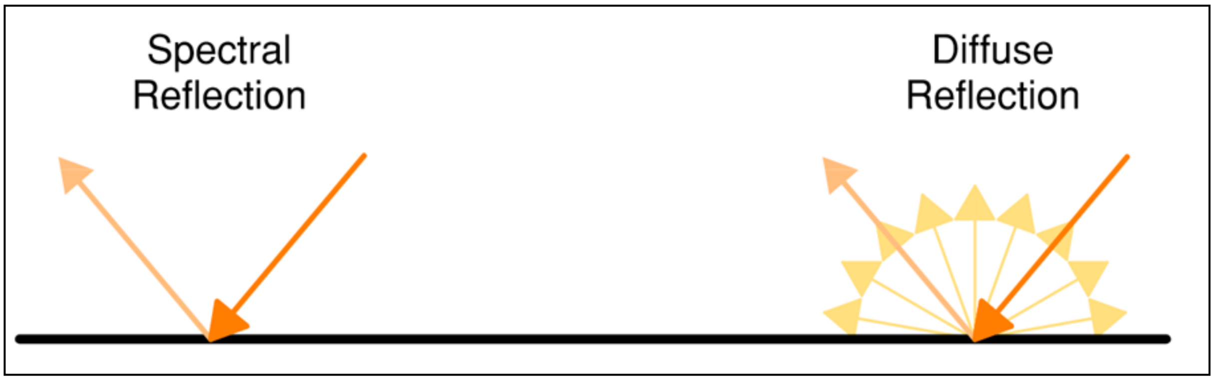

Figure 2-1 – Types of Light Reflection from Solar Modules

Calculation of potential glare requires the azimuth and elevation angle of the sun, and the consequent angles of incidence and reflection at the array, at all times throughout the year.

The angle of incidence is the angle at which the sun strikes the module (measured from normal/perpendicular to the surface). The angle of reflection is equal and opposite the angle of incidence. Light transmission through the glass and absorption by the PV module is greatest when the light is normal to the glass surface, while more light is reflected at shallower angles. As shown in Figure 2-2 a low incidence angle in a fixed tilt system is associated with the sun being high in the sky such that the sun's rays are shining at close to a right angle with the module surface. The highest incidence angles will occur in the early morning and late evening when the sun is low in the sky.

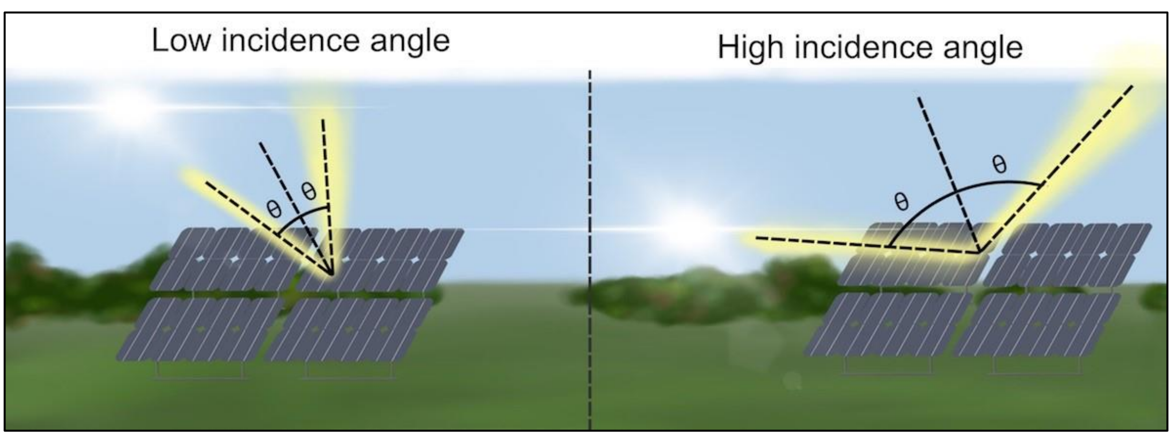

Figure 2-2 – Angles of Incidence relative to the Sun's Position

Throughout the day the sun will track across the sky; therefore, the angle at which the light is incident on the module will vary. Figure 2-3 shows the two angles (azimuth and elevation/zenith) required to define the orientation of the sun with respect to the solar module.

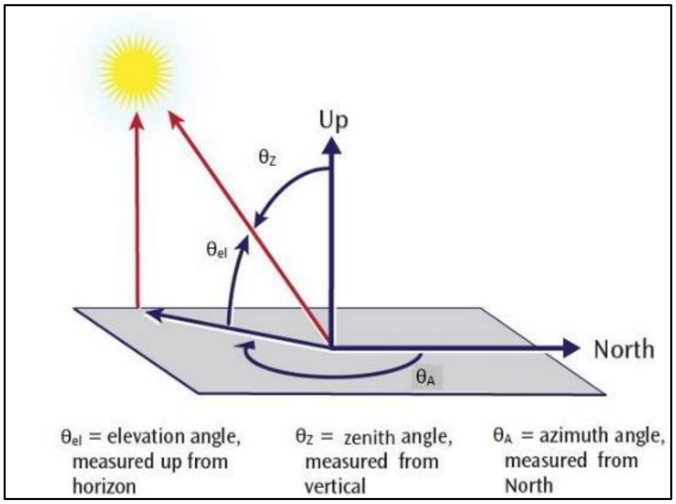

Figure 2-3 – Sun's Position relative to Solar Module

There are many factors that affect the glare level. These include but are not limited to:

- The type of solar module
- The module's tilt angle and orientation
- Size of solar development
- Shape of solar development
- Location of solar development
- Distance between solar development and observer
- Angle to observer
- Relative height of observer

Single-axis tracking systems will often include a backtracking function, as is the case with the system selected for the Project. At low sun elevation angles, high array tilt angles will result in shading from rows nearer the sun on those behind them. To mitigate consequent production losses, the trackers will gradually tilt away from the sun back toward horizontal.

The following section describes the proposed development and the associated infrastructure in detail.

3 Project Description

The proposed Project site is located in Cypress County, Alberta, approximately 9km northeast of the Hamlet of Dunmore, and 13km east of the City of Medicine Hat. The Project location relative to Dunmore and Medicine Hat is shown in **Figure 3-1**.

The Project has a total fenced area of approximately 703 acres with a total capacity of 172.8 MW_{AC}. The PV modules will be mounted on single-axis trackers secured to the ground with piles.

Figure 3-1 – Dunmore Solar Power Plant Location

4 Legislation and Guidelines

There is currently no adopted legislation for assessing the impacts of glare for solar energy development in Alberta or Canada, and standardized guidance only specifies what receptors to include in an assessment without specifying acceptable thresholds. Transport Canada publication TP1247E indicates that glare from solar arrays should be evaluated when proposed near aerodromes but does not provide additional specifications.[10]

The AUC's Rule 007 states that solar glare assessment reports must include receptors within 800m from the boundary of the project and aerodromes within 4,000m from the boundary of the project.[11] It continues to state the following requirements:

- Describe the time, location, duration, and intensity of solar glare predicted to be caused by the project.
- Describe the software or tools used in the assessment, the assumptions, and the input parameters (equipment-specific and environmental) utilized.
- Describe the qualification of the individual(s) performing the assessment.
- Identify the potential solar glare at critical points along highways, major roadways, and railways.
- Identify the potential solar glare at any aerodrome within 4,000 metres from the boundary of the project, including the potential effect on runways, flight paths and air traffic control towers.
- Include a map (or maps) identifying the solar glare receptors, critical points along highways, major roadways and railways, and aerodromes that were assessed.
- Include a table that provides the expected intensity of the solar glare (e.g., green, yellow, or red) and the expected duration of solar glare at each identified receptor, critical points along highways, major roadways and railways, and any registered and known unregistered aerodromes that were assessed.

Alberta Transportation developed requirements for the assessment of solar PV projects being proposed near provincial highways. The guideline is based on AUC Rule 007 with additional specifications for the assessment of roads. This includes vehicle heights, consideration of potential shading and sun-masking, and discussion of potential mitigation for glare predicted within ±15° of a driver's heading.[12]

This report will abide by: requirements in AUC Rule 007; suggestions made in Zehndorfer Engineering's *Solar Glare and Glint Project Report* from September 2019;[13] Alberta Transportation guidelines; and other relevant literature.

As observed in the Zehndorfer document, solar glare assessments in Canada typically utilize Sandia National Laboratories' Solar Glare Hazard Analysis Tool (SGHAT) through ForgeSolar's software called GlareGauge. The Zehndorfer report notes that: "*the typical Solar Glare Assessment in Canada consists of more than just the plain SGHAT report. It describes the geometric situation, highlights glare duration and suggests glare-reducing measures.*"[14] This approach has been adopted for this assessment.

[10] *Aviation – Land Use in the Vicinity of Aerodromes – TP1247E* (Transport Canada, 2013/14).

[11] AUC Rule 007: *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations, Hydro Developments and Gas Utility Pipelines* (April 2022), subsection 4.4.2 SP14.

[12] *Assessment requirements for solar development near provincial highways* (Alberta Transportation, December 2021).

[13] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).

[14] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019), PDF page 8.

The Zehndorfer report also comments that: "*with respect to dwellings, geometrical considerations can be useful. The inclination angle towards a window makes a difference, because light rays perpendicular towards the glass will penetrate the window, while window recesses will shade flat-angled rays of light.*"[15]

In addition to Zehndorfer's report, the US Federal Aviation Administration (FAA) have provided the *Technical Guidance for Evaluating Selected Solar Technologies on Airports*.[16] This document states that potential for glare might vary depending on site specifics such as existing land uses, location, and size of the project.

A geometric analysis may be required to assess any reflectivity issues coming from the solar modules. FAA guidelines have also been informed by the 2015 study, *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach*, by Rogers, et al. This study concludes that glare of sufficient size and intensity in an airplane pilot's view, within ±25° of heading, may have an adverse impact on the pilot's ability to read their instruments or land their plane. The study also indicates that glare beyond ±50° of heading is not likely to impair a pilot.[17]

4.1 Geometric Analysis – Use of the Solar Glare Hazard Analysis Tool

The SGHAT is a validated tool specifically designed to estimate potential glare according to a Solar Glare Hazard Analysis Plot at a certain module height, tilt, type, and observer location. ForgeSolar's GlareGauge/SGHAT software allows for the analysis of potential glare on flight paths, routes, and stationary observation points. It is widely accepted as the most comprehensive tool to assess potential glare impacts on receptors near solar power projects. The Zehndorfer report reviewed several glare software packages that may be used to assess solar PV glare, including ForgeSolar's GlareGauge/SGHAT. The report does not make a specific recommendation, but the findings suggest that the SGHAT is the most accessible tool of those evaluated, and the most robust with respect to the output information.[18]

[15] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019), PDF page 6.
[16] *Technical Guidance for Evaluating Selected Solar Technologies on Airports* (FAA, April 2018), pg. 40.
[17] *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach* (Rogers, J. A., et al., July 2015).
[18] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).

5 Assessment Methodology

The SGHAT is configured to enable an analysis on flight paths using a 2-mile approach to a runway when landing. A private, unregistered aerodrome is located within 4,000m of the Project and was assessed.

The decision for Proceeding 25296 set out the AUC's understanding of the viewing angles relevant to pilots: "*The Commission understands the FAA study to conclude that yellow-grade glare has an adverse effect on pilots within a +/- 25 degree viewing angle range and that yellow-grade glare between 25 and 50 degrees has the potential to adversely affect pilots*".[19] This suggests that flight paths approaching a runway should model a pilot's perspective looking straight out the cockpit windshield with a peripheral range of ±50° and downward up to 30° below the approach vector to provide context on potential glare during final descent. Further analysis of a narrower ±25° field of view (FOV) encompasses the region where a pilot's vision is more susceptible to glare impacts. Glare occurring outside of this range is less likely or not expected to adversely impact a pilot.[20]

For ground-based routes, the Zehndorfer report recommends modelling the FOV within ±15° from the vehicle operator's heading.[21] This covers the region where a person's vision will be most focussed, which is the critical area of concern. A more conservative ±25° FOV can also be modelled to identify routes that may be peripherally impacted by glare. This wider FOV is based on the information presented in the Rogers FAA report for airplane pilots, adapted to suit vehicle operators using ground-based routes. In line with Alberta Transportation guidelines,[22] passenger, truck, and commercial vehicle heights are considered in the analysis.

In line with AUC Rule 007's guidelines for choosing receptors to include in a solar glare analysis, the assessment evaluated the receptors listed below.

- Five observation points representing nearby dwellings;
- One highway;
- Four local roads; and
- One private, unregistered aerodrome

There were no railways identified within 800m of the Project, so none were evaluated in this assessment. There are no other known solar power projects within the study area, so a cumulative assessment was not completed. The nearest solar power project is the Saamis Solar Project located approximately 12km northwest of the Project.

Note, if the modules are not visible to the individual receptor, then no glare can be observed at that receptor.

5.1 Assessment Input Parameters

The solar arrays and transportation routes were plotted using an interactive Google map, and site-specific data was entered into the software prior to modelling. The following sections provide details of the parameters specified for the analysis calculations in the GlareGauge software.

[19] *Decision 25296-D01-2021* (AUC, February 11, 2021), para. 53.
[20] *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach* (Rogers, J. A., et al., July 2015).
[21] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).
[22] *Assessment requirements for solar development near provincial highways* (Alberta Transportation, December 2021).

5.1.1 PV Array

The general PV array areas were plotted on the interactive Google map as shown in **Figure 5-1**. The Project was split into 9 sub-arrays to avoid conflict between complex array geometry and software calculations, while also providing additional detail in areas with greater topographical variation. The modelled arrays include more land than the proposed PV array coverage, which results in a more conservative analysis.

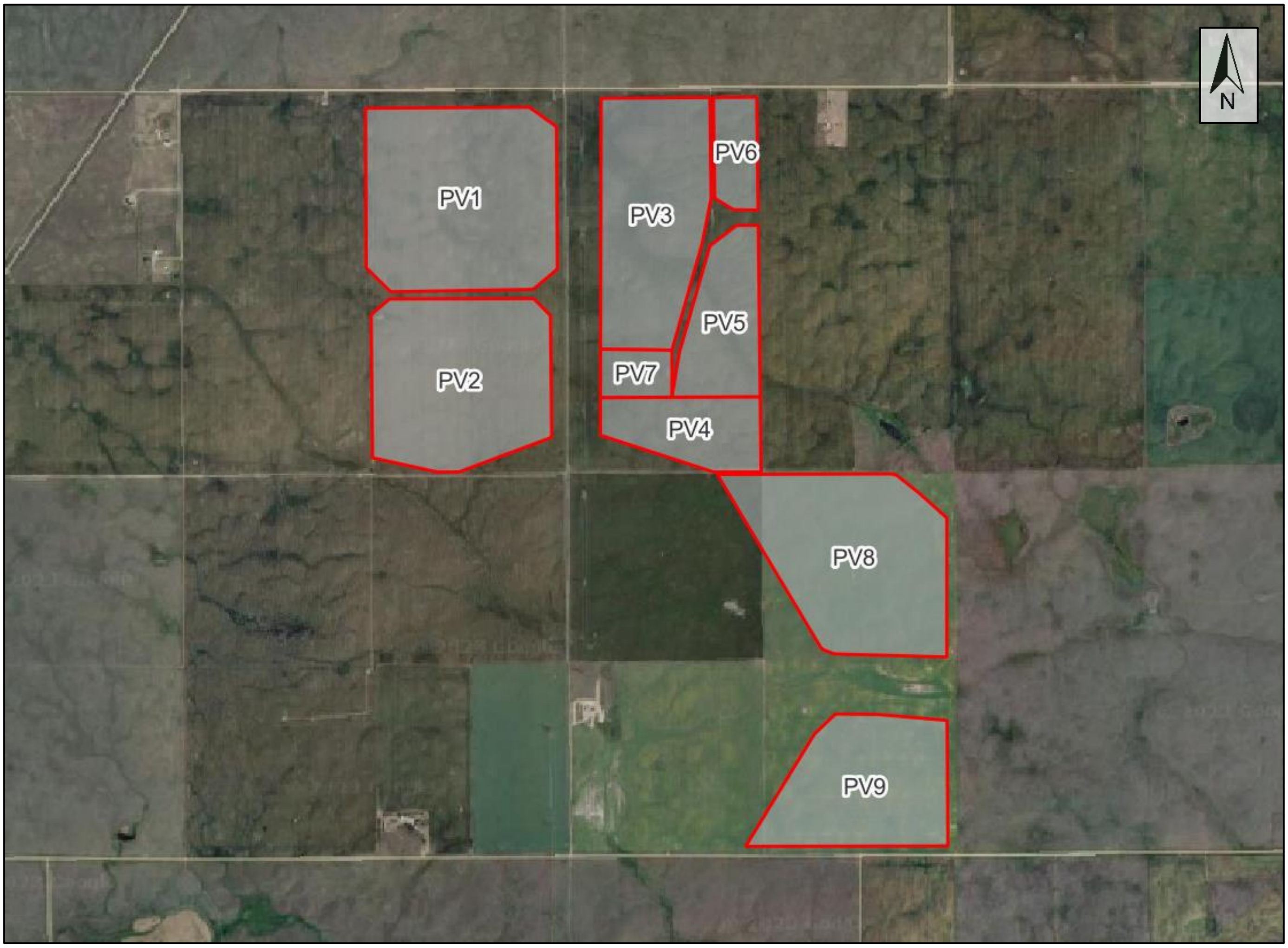

Figure 5-1 – General PV Array Areas Plotted in GlareGauge Software

The Project details in **Table 5-1** were specified in the model.

Table 5-1– PV Array Specified Parameters – Current Assessment

Required Inputs	Specified Parameters	Description
Axis Tracking	Single	Modules are mounted on single-axis trackers
Tilt of Tracking Axis	0°	Elevation angle of tracking axis with 0° being faced up (flat) parallel to the ground
Orientation	180°	Azimuthal position measured from true north
Maximum Tracking Angle	55°	Rotation limit of the arrays in each direction
Resting Angle, Backtracking	0°-10°	Minimum rotation angle of modules outside of the normal tracking range (during backtracking)
Ground Coverage Ratio	40.8%	Ratio between the PV module area and total ground area
Offset Angle	0°	Additional elevation angle between tracking axis and modules
Module Surface Material	Smooth glass with anti-reflective coating	Surface material of modules
Module Height Above Ground	1.50m	Array centroid height

The Project details in **Table 5-2** were specified in the model used in the previous report. The orientation remained the same between both reports, the main difference is the update from fixed tilt racking to single-axis tracking.

Table 5-2– PV Array Specified Parameters – Previous Assessment

Required Inputs	Specified Parameters	Description
Axis Tracking	None	Modules are mounted on fixed tilt racking
Orientation	180° (south)	Azimuthal position measured from true north
Fixed Tilt Angle	20°	Fixed tilt angle of modules
Module Surface Material	Smooth glass with anti-reflective coating	Surface material of modules
Minimum Module Height Above Ground	0.5m	Approximate height at the bottom of the array
Maximum Module Height Above Ground	2.0m	Approximate height at the top of the array

Solar PV modules are designed to maximize light absorption and conversion to electricity. Specifying different types of glass and coatings used on the modules can affect a system's energy production and glare potential. Smooth glass with anti-reflective coatings (typical of solar PV modules) will generally reflect less light, i.e., create less glare, than uncoated or conventional glass.

The backtracking operation of the single-axis tracking system has been considered in this analysis. The GlareGauge backtracking algorithms account for the geometry between arrays and the sun, as well as the slope of the plotted sub-arrays. In the morning and evening when the sun is outside of the normal tracking range, the rotation angle in the model will adjust to shallower angles to avoid inter-row shading. The user-specified resting angle sets the lower limit for backtracking rotation.

The elevation variation across the site is minimal, ranging from 745m to 770m above mean sea level (AMSL). Ground elevations are generally lower in the southern half of the Project than the north half.

5.1.2 Route Paths

Five route paths were evaluated for glare impacts from the Project: Highway 41, Range Road 42, Township Road 130, Township Road 124, and Route 1 within approximately 800m of the Project. **Figure 5-2** shows the routes in relation to the Project.

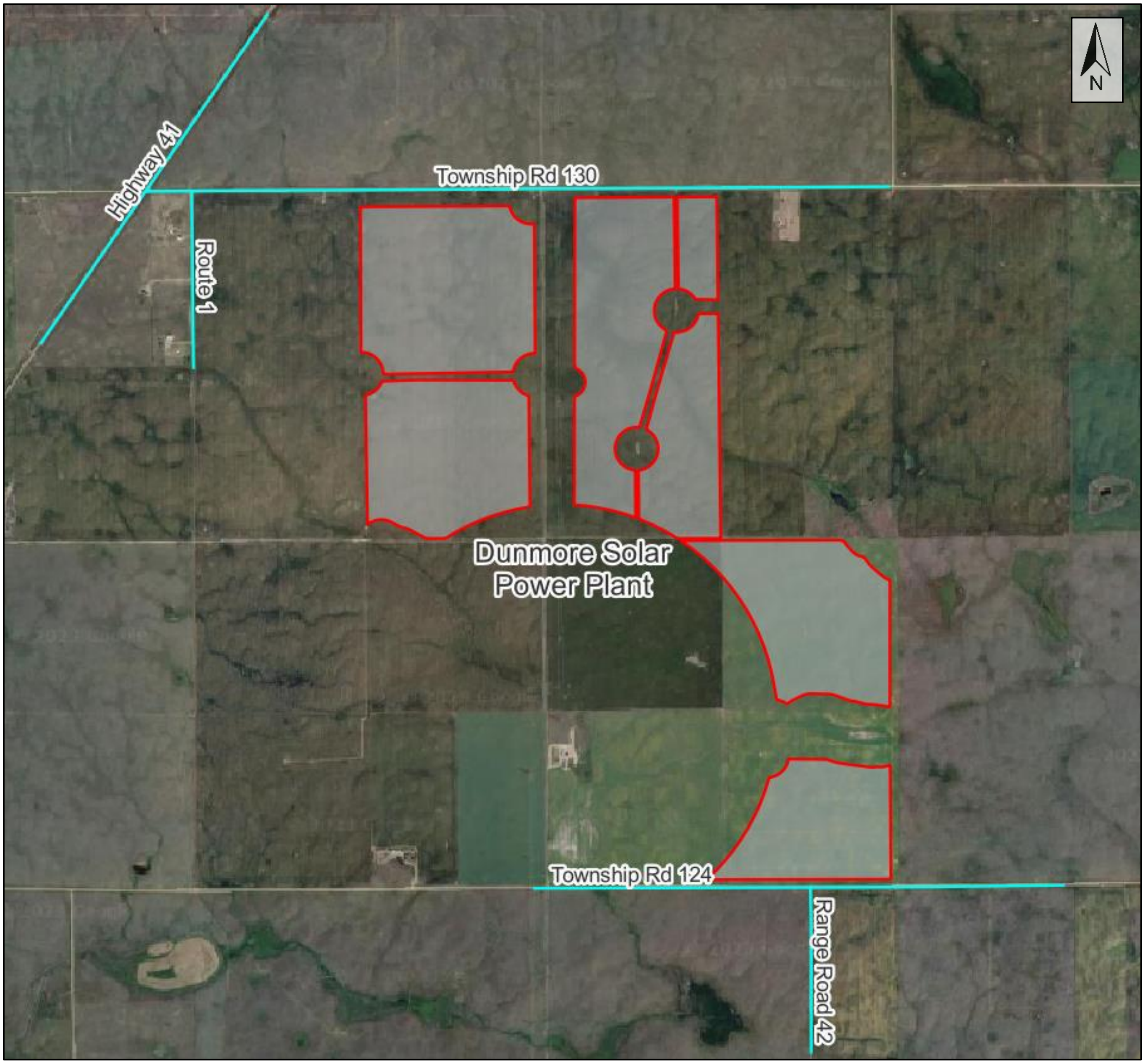

Figure 5-2 – Roads near the Project

All routes were modelled as two-way routes to represent vehicles travelling in both possible directions. Two horizontal viewing angles were evaluated for vehicle operators: ±15° and ±25° (30° and 50° total FOV). The ±15° range encompasses the region where a person's vision will be most focussed, which is the critical area of concern.[23] The ±25° range is a more conservative view representing a person's extended visual range that may be impacted by glare. The road routes were set at an elevation of 1.08m to represent the height of a typical passenger vehicle, 1.8m to represent the height of a typical truck or bus, and 2.3m to represent the height of a commercial truck in accordance with Alberta Transportation guidelines.[24] Commercial vehicles are typically more susceptible to glare than passenger vehicles due to their increased height.

[23] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).

[24] *Assessment requirements for solar development near provincial highways* (Alberta Transportation, December 2021).

5.1.3 Dwellings

Five receptors were assessed to represent dwellings near the Project. Dwellings were modelled at 4.5m above ground to conservatively represent two-storey buildings. The model assumes the receptors have an unobstructed view of the arrays, i.e., the view is not affected by any part of the building being evaluated, or by any objects between the receptor and the Project. **Figure 5-3** shows the dwellings in relation to the Project.

GCR followed the guidelines provided in AUC Rule 007 to identify dwellings within 800m of the Project. R1 is the only dwelling within 800m, R2-R5 are outside the required assessment zone but were included in the analysis to be consistent with the previous SGHAR.

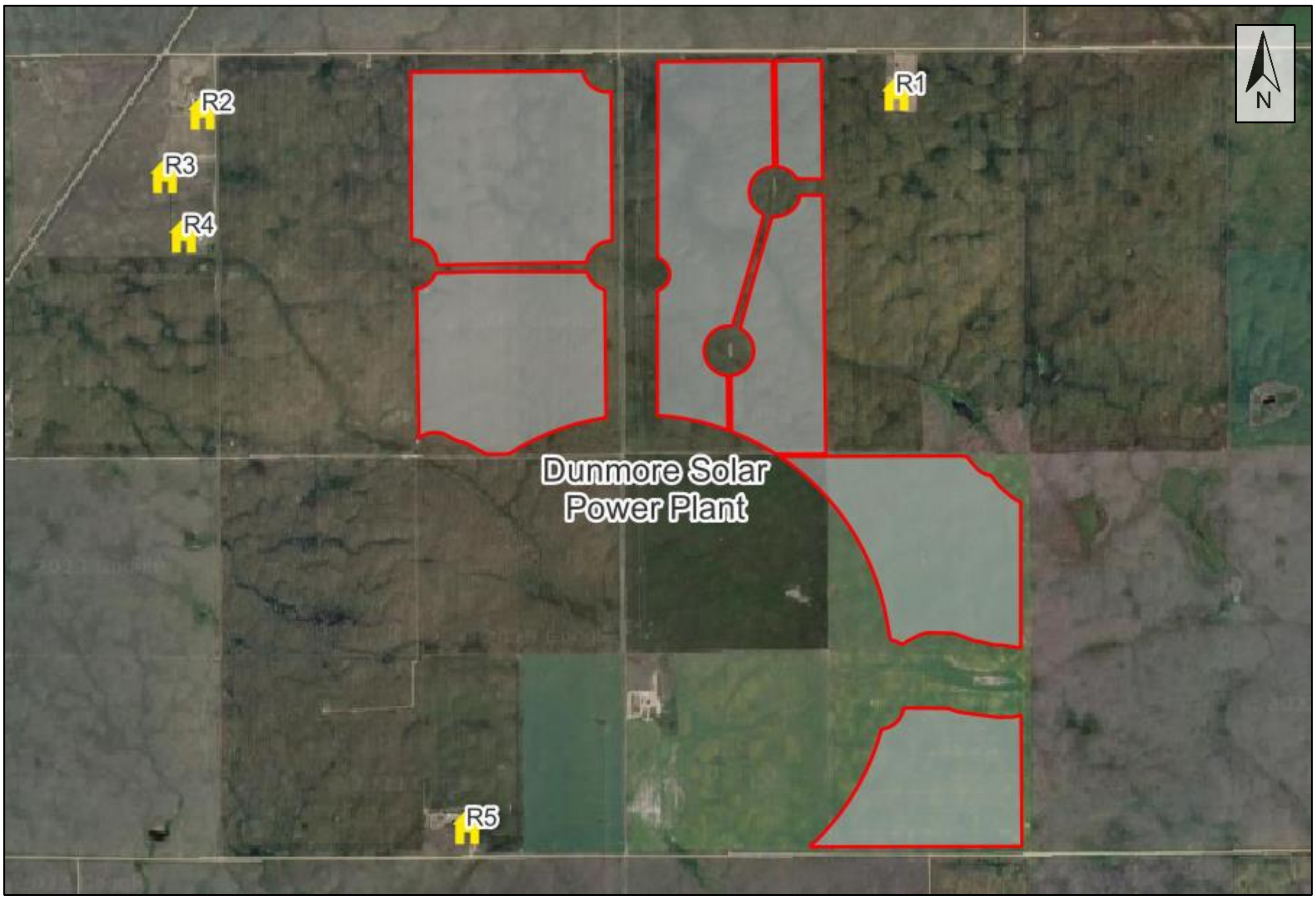

Figure 5-3 – Dwellings near the Project

5.1.4 Flight Paths

Two flight paths approaching a private, unregistered aerodrome 3,900m northwest of the Project were included in this glare assessment. This is an uncontrolled aerodrome, so it was not necessary to model an air traffic control tower. The receptors at the aerodrome can be seen in **Figure 5-4**.

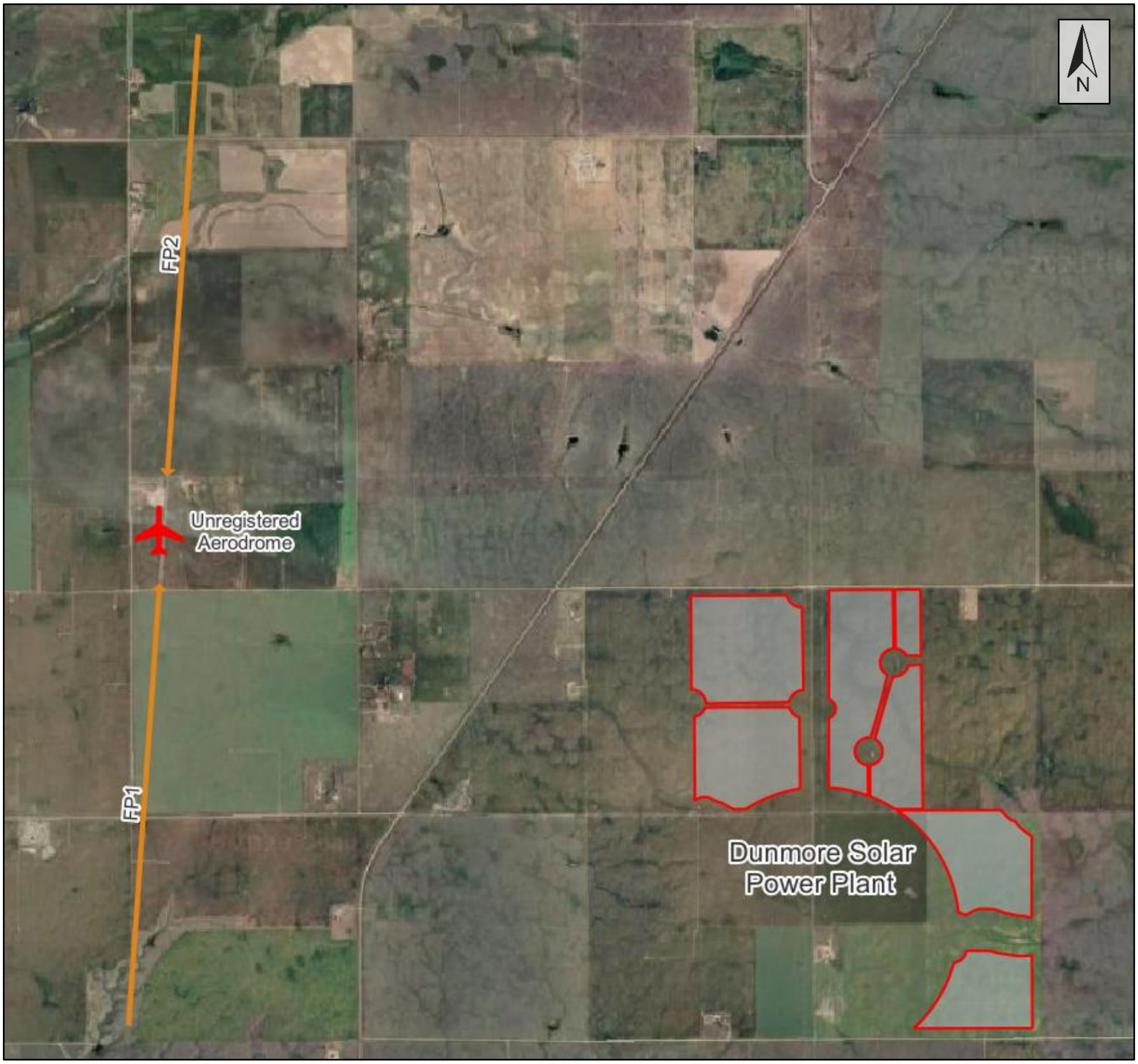

Figure 5-4 – Flight Paths near the Project

The two-mile (3.2km) long flight paths utilize a typical glide slope of three degrees, ending 50 feet (15m) above the runway threshold. The SGHAT simulates flight paths with a maximum downward viewing angle of 30° from horizontal, accounting for obstructions in the cockpit below the windshield. This analysis has set the horizontal viewing angle for airplane pilots to ±50° from center (100° total field-of-view). This encompasses a conservative region where glare may affect a pilot while landing their airplane. A ±25° horizontal range has also been modelled as this is the region where yellow-grade glare is expected to adversely impact pilots.[25] Glare occurring outside of this range is not expected to adversely impact the pilot.

5.1.5 Other Assumptions

The following assumptions have been made in setting the parameters for this analysis:

- 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 that may mitigate impacts. This includes buildings, tree cover and geographic obstructions.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare analysis does not account for change in weather patterns. It is assessed as clear sunny skies throughout the year.
- To increase accuracy of modelling results, parts of the array may be divided into sub-sections if the footprint covers a large surface area with drastic elevation changes, or to avoid concave outlines.
- Default parameters, as alluded to in the following section, highlight ocular metrics used in this assessment as has been acceptable according to the Sandia National Laboratories methodology on assessing potential glint and glare hazards.[26] These are shown below in **Table 5-3**.

Table 5-3 – Default Parameters

GlareGauge Parameters	
Direct Normal Irradiance, DNI (amount of solar radiation received in a collimated beam on a surface normal to the sun during a 60-minute period)	Varies and peaks at 1000 W/m^2
Ocular Transmission Coefficient (absorption of radiation within the eye before it reaches the retina)	0.5
Pupil Diameter (Typical daylight adjusted length)	0.002m
Eye Focal Length (distance where rays intersect in the eye)	0.017m
Sun Subtended Angle	9.3 mrad

[25] *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach* (Rogers, J. A., et al., July 2015).
[26] *Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation* (Ho, C.K., C.M. Ghanbari and R.B. Diver, Journal of Solar Energy Engineering-Transactions of the ASME, 133 (3), 2011).

5.2 Glare Analysis Procedure

GCR calculated the potential glare for observation points and route receptors using the SGHAT. Although effects from glare are subjective, depending on variables such as a person's ocular parameters and size/distance from the glare source, the SGHAT has a generalized approach to specify the hazard that glare may produce. GCR's commentary on the levels of glare found and related sources of mitigation, if required, are intended to help decision makers evaluate potential impacts.

The SGHAT User's Manual v3.0 states that: *"If glare is found, the tool calculates the retinal irradiance and subtended source angle (size/distance) of the glare source to predict potential ocular hazards ranging from temporary after-image to retinal burn. The results are presented in a simple, easy-to-interpret plot that specifies when glare will occur throughout the year, with color codes indicating the potential ocular hazard."*[27]

The colour codes are based on a red, yellow, and green structure to categorize the level of risk to a person's eyes. Glare classification is dependent on the glare intensity and the apparent size of the glare area as viewed from the eye. The severity of glare is proportional to the effects of an after-image, which can be described as a lingering image of glare in the field-of-view, or a flash blindness when observed prior to a typical blink response time. The descriptions for each category are as follows:

- Green: Glare is present but there is a low potential for temporary after-image;
- Yellow: Glare is present with the potential for temporary after-image; and
- Red: Glare is present with the potential for permanent eye damage.

The level of glare is derived using the graph below that plots the level of irradiance against the angle that is occupied by the glare in the field-of-view.

ForgeSolar have developed a plot to categorize glare based on its intensity at the eye and its size in the observer's FOV. The plot is divided into the red, yellow, and green regions described above. The hazard associated with directly viewing the sun unfiltered is also plotted for comparison. Figure 5-5 shows an example of the hazard plot.

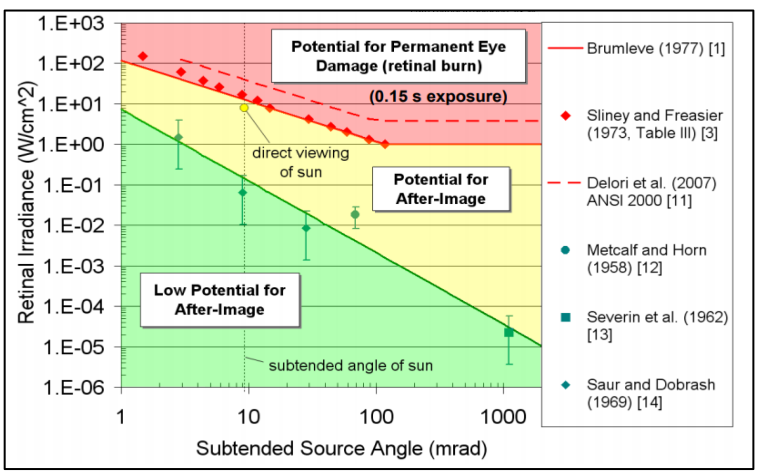

Figure 5-5 – Hazard Plot depicting the Retinal Effects of Light

[27] *Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v 3.0* (Ho and Sims, Sandia National Laboratories, 2016).

Ho et al. developed a model to estimate potential impacts to eyesight with regards to retinal irradiance (amount of light entering the eye and reaching the retina) and subtended source angle (the size of the glare divided by the distance from the emitting source). Significant damage, including retinal burn, may occur at high retinal irradiances and large subtended angles. This is highlighted in the red region. The yellow section denotes the potential for a temporary after-image. The size and impact of the after-image is dependent upon the subtended source angle.[28] At a low retinal irradiance and small subtended angle, the hazard will be in the green section where there is very low potential for after-image.

5.2.1 Limitations

The SGHAT may convert the footprint of a concave polygon to a convex polygon.[29] For example, an array that is in the shape of a 'C' has a concave section and GlareGauge will modify the 'C' shape into a semi-circle. By closing the 'C' shape, the size of the PV array is increased thus potentially over-estimating the size of the array, and consequently over-predicting the glare effects. This change in geometry is required by the glare-check algorithm during analysis. PV arrays with significant concavities should be modelled as multiple arrays to avoid over-estimating the size of the PV array and the resultant glare. The limitations of the software have been carefully considered to ensure the PV array is not concave in order to represent the glare impacts as accurately as possible.

An unavoidable limitation of the SGHAT is that "*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 [air traffic control towers].*"[30]

Wind probabilities are also not considered by the SGHAT, so special operations that change the tilt of a SAT system are not modelled by the software. This includes functions like "stow mode" where arrays will be tilted closer to horizontal to reduce wind loading during high wind events. Special SAT system operations will utilize different tilt angles than standard operations, causing glare results to deviate from the values predicted by the SGHAT; however, non-standard operations are expected to occur so infrequently that it is unreasonable to include them in a general glare assessment.

[28] *Evaluation of glare at the Ivanpah Solar Electric Generating System* (C.K. Ho et al., Elsevier Ltd., 2015).
[29] *ForgeSolar "Help" page*. Retrieved March 20, 2023.
[30] *ForgeSolar "Help" page*. Retrieved March 20, 2023.

6 Assessment of Impact

This section presents the findings of the glare assessment. The results are factual based on the model parameters used, which are considered to be conservative and as reasonable as possible. AUC Rule 007 provides guidelines for the receptors to be included in a solar glare assessment, but modelling parameters and glare threshold limits are not specified. Therefore, this analysis also considers the principles laid out in the Zehndorfer Engineering Report,[31] Alberta Transportation guidelines,[32] and other relevant literature.

The GlareGauge software considers the glare potential for a full one-year period in one-minute intervals to account for the variations between seasons, DNI, and sun angle.

The results showed that glare may be seen by the evaluated receptors if the resting angle is set between 0° to 8°, with the greatest potential impact in the case using a 0° resting angle. Models with resting angles of 9° or steeper did not predict any glare for the evaluated receptors. The following results come from the worst-case model using a 0° resting angle.

6.1 Route Path Results

The following tables present the glare results for the route paths assessed from the array centroid height. Results are shown for passenger, trucks, and commercial road vehicles at 1.08m, 1.8m, and 2.3m, respectively. Results in **Table 6-1** used a ±15° FOV, which was modelled to capture potential glare within a vehicle operator's critical visual range. Results in **Table 6-2** were evaluated with a ±25° horizontal FOV to highlight routes that may experience glare from an extended visual range. Equivalent levels of glare within ±15° will have a greater impact on the observer than glare outside that range.

Table 6-1 – Annual Route Path Glare Levels for Passenger Vehicles, Trucks/Buses, and Commercial Vehicles (±15° FOV, 0° Resting Angle)

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
Highway 41 (Passenger)	0	0	0	0
Highway 41 (Truck/Bus)	0	0	0	0
Highway 41 (Commercial)	0	0	0	0
Township Road 130 (Passenger)	783	0	0	15
Township Road 130 (Truck/Bus)	780	23	0	15
Township Road 130 (Commercial)	821	20	0	16
Township Road 124 (Passenger)	180	514	0	13
Township Road 124 (Truck/Bus)	213	507	0	15
Township Road 124 (Commercial)	189	562	0	15

[31] *Solar Glare and Glint Project* (Zehndorfer Engineering, September 2019).
[32] *Assessment requirements for solar development near provincial highways (Alberta Transportation, December 2021).*

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
Range Road 42 (Passenger)	0	0	0	0
Range Road 42 (Truck/Bus)	0	0	0	0
Range Road 42 (Commercial)	0	0	0	0
Route 1 (Passenger)	0	0	0	0
Route 1 (Truck/Bus)	0	0	0	0
Route 1 (Commercial)	0	0	0	0

Table 6-2 – Annual Route Path Glare Levels for Passenger Vehicles, Trucks/Buses, and Commercial Vehicles (±25° FOV, 0° Resting Angle)

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
Highway 41 (Passenger)	0	0	0	0
Highway 41 (Truck/Bus)	0	0	0	0
Highway 41 (Commercial)	0	0	0	0
Township Road 130 (Passenger)	1,298	88	0	18
Township Road 130 (Truck/Bus)	1,155	315	0	19
Township Road 130 (Commercial)	1,088	466	0	22
Township Road 124 (Passenger)	266	992	0	16
Township Road 124 (Truck/Bus)	269	1,076	0	18
Township Road 124 (Commercial)	272	1,140	0	19
Range Road 42 (Passenger)	0	0	0	0
Range Road 42 (Truck/Bus)	0	0	0	0
Range Road 42 (Commercial)	0	0	0	0
Route 1 (Passenger)	0	0	0	0
Route 1 (Truck/Bus)	0	0	0	0
Route 1 (Commercial)	0	0	0	0

Drivers travelling along the evaluated sections of Highway 41, Range Road 42, and Route 1 are not predicted to observe glare at any level from the Project, while Township Road 130 and 124 are predicted to observe minimal green and yellow glare from the Project. None of the route receptors are predicted to observe glare at any level from the Project in the models that used a resting angle of 4° or steeper. The following describes the results for the 0° resting angle model, which showed the most potential glare.

The assessed portion of Township Road 124 is the ground route predicted to observe the most glare from the Project. The results indicate that taller vehicles may see more glare than shorter vehicles. Along this route, observers are predicted to see yellow glare in the more critical ±15° FOV for a maximum of 562 minutes/year. The glare is predicted around sunrise and sunset between late March and late April, as well as mid-August and mid-September. Glare may be seen along this route between 04:26 and 05:08 MST and between 17:14 and 18:23 MST, for up to 15 minutes per day.[33] The glare is expected to originate from the same general direction as the sun for these periods, so glare impacts may be eclipsed by the direct effects of the sun if both can be seen simultaneously by the observer. This is an effect called "sun-masking". The actual impact is expected to be less because vehicle operators will be travelling past the affected areas, not standing still while looking at the solar PV arrays. Satellite imagery shows that this is a remote road that is likely to experience minimal traffic, which further reduces the likelihood that there will be observers to see glare from the Project.

The following figures represent the predicted glare within the ±15° FOV of commercial vehicle drivers travelling along Township Road 124. Figure 6-1 shows the daily time periods during which glare is predicted, and Figure 6-2 shows the daily duration of predicted glare.

Figure 6-3 presents the glare hazard plot for glare predicted to affect drivers of commercial vehicles using Township Road 124. The hazard plot shows that the glare seen from Township Road 124 will be approximately nine times the subtended angle of the sun, but it will be around 477 times dimmer. The glare is also around two orders of magnitude below the threshold for glare that has the potential to cause permanent eye damage at the same subtended angle. Glare at this level is not expected to create a hazardous situation.

If glare is determined to be an issue after the Project is built, specific mitigation measures can be developed in consultation with the affected stakeholder. Potential mitigation measures for glare to road users include: modified backtracking behaviour; installing road signs to warn motorists of the potential glare at particular times of day and year; or, installing a sufficiently tall and opaque visual barrier along the route at impacted points. Due to the predicted duration and level of glare, mitigation is not expected to be required. If mitigation were to be required, then it is expected that any glare could be completely mitigated by altering the backtracking behaviour of the arrays. Given the minor nature of the route, it is suggested that barrier mitigation would be an unnecessary intervention.

[33] These results apply to a portion of the route, not just a single point along the route. The results describe a time period during which a vehicle operator may see glare from the Project, but it is highly unlikely that an observer will be affected by the glare for the full duration.

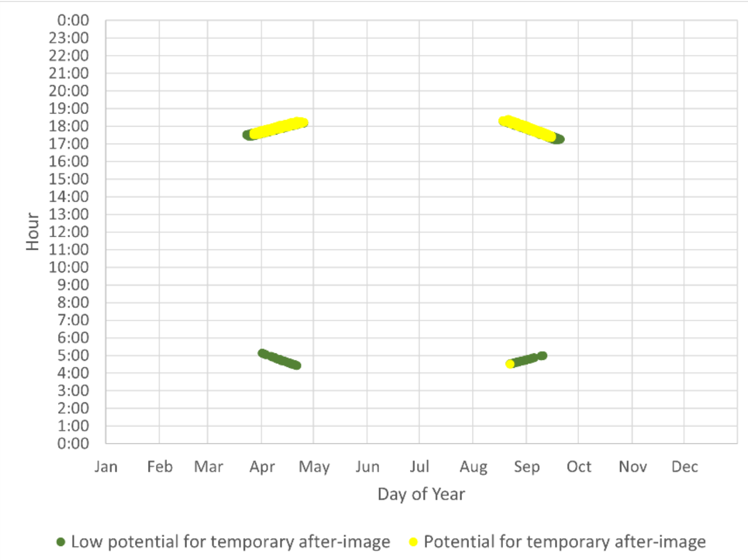

Figure 6-1 – Annual Predicted Glare occurrence for Township Road 124 (Commercial, ±15° FOV, 0° Resting Angle)

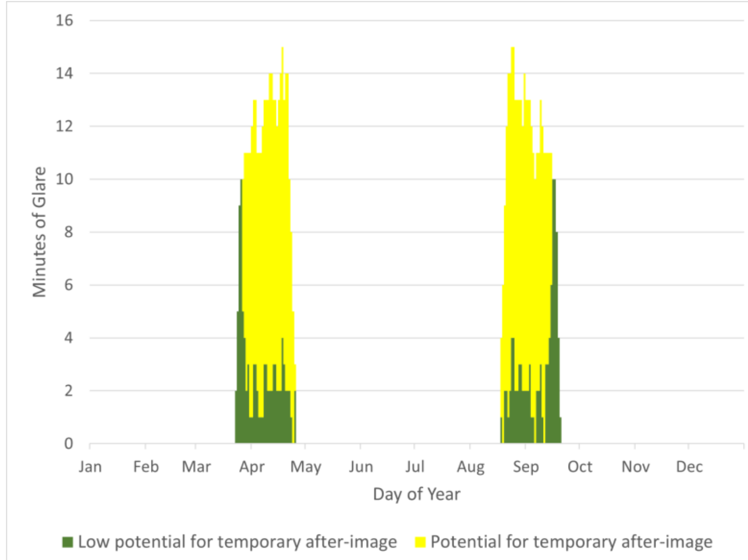

Figure 6-2 – Daily Duration of Glare for Township Road 124 (Commercial, ±15° FOV, 0° Resting Angle)

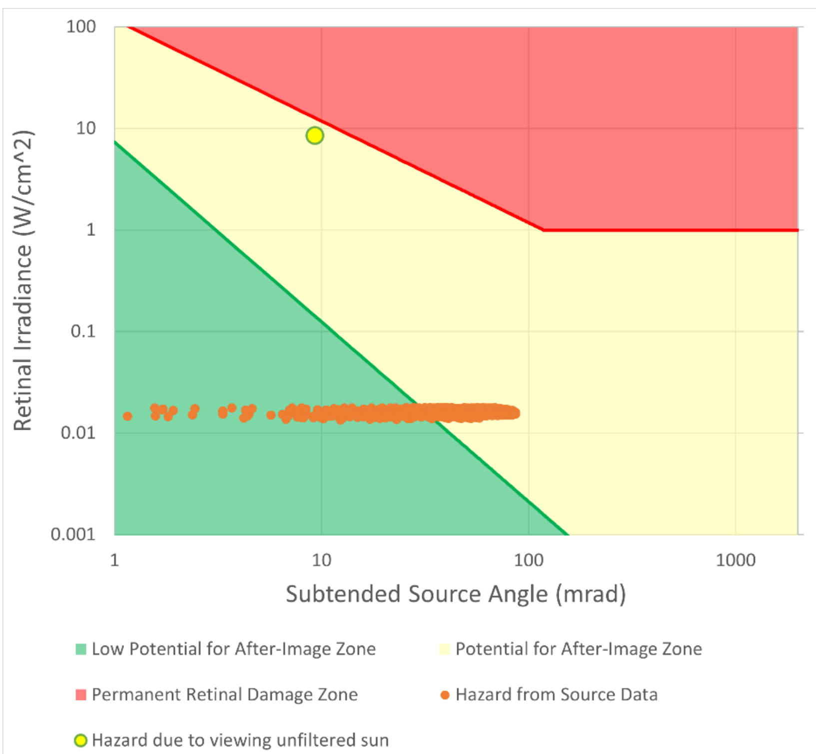

Figure 6-3 – Hazard Plot for Township Road 124 (Commercial, ±15° FOV, 0° Resting Angle)

6.2 Dwelling Results

Five observation points were plotted to represent dwellings near the Project. Dwellings were modelled at 4.5m above ground to conservatively represent two-storey buildings. GCR followed the guidelines provided in AUC Rule 007 to identify dwellings within 800m of the Project. R1 is the only dwelling within 800m, R2-R5 are outside the required assessment zone but were included in the analysis to be consistent with the previous SGHAR. Impacts on dwellings outside of the 800m assessment zone are not expected to be significant because the solar glare forms a lesser part of the resident's view at that distance.

A resting angle of 0° had the greatest glare impact on the dwellings, therefore the results from that model are shown below. **Table 6-3** provides the glare results for the dwellings assessed.

Table 6-3 – Annual Glare Levels for Dwellings near the Project (0° Resting Angle)

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
R1	946	5	0	15
R2	1,131	0	0	15
R3	932	0	0	13
R4	2,094	8	0	15
R5	0	0	0	0

Dwellings R1 and R4 are predicted to observe moderate annual durations of green glare from the Project and minimal yellow glare from the Project. R2 and R3 are predicted to observe moderate annual durations of green glare from the Project and no yellow glare. R5 is predicted to have no glare impact at the dwelling. Glare was not predicted for any of the evaluated dwellings in the models using a resting/minimum backtracking angle of 8° or steeper. The results for R4 are described in further detail below.

In the worst-case models using 0° resting angle, R4 is the dwelling predicted to observe the most glare from the Project. Observers are predicted to see yellow glare for a maximum of 8 minutes/year. The yellow glare is predicted between 04:24 and 04:31 MST for up to 1 minute per morning in late April and mid-August. The green glare is predicted at sunrise between 03:38 and 07:31 MST for up to 15 minutes per morning from November to January, as well as late February to mid-October. The glare is expected to originate from the same general direction as the sun for these periods, so glare impacts may be eclipsed by the direct effects of the sun if both can be seen simultaneously by the observer. This is an effect called "sun-masking".

R4 is approximately 900m west of the Project area with minimal obstructions between the dwelling and the site, as determined from satellite imagery. The glare was modelled from a second-storey window to be conservative. A site visit can confirm the type of structure. A ground level receptor is likely to observe less glare than a second-storey receptor. The results of the assessment are the "worst-case" scenario, and the actual observed glare may be less.

The following figures represent the predicted glare for R4. **Figure 6-4** shows the daily time periods during which glare is predicted, and **Figure 6-5** shows the daily duration of predicted glare.

Figure 6-6 presents the glare hazard plot for glare predicted to be seen at R4. The hazard plot shows that the glare seen from R4 will be approximately four times the subtended angle of the sun, but it will be around 472 times dimmer.

The glare is also around two orders of magnitude below the threshold for glare that has the potential to cause permanent eye damage at the same subtended angle. Glare at this level is not expected to create a hazardous situation or affect a resident's use of their home, so mitigation is not expected to be required.

If glare is determined to be an issue during the Project's operation, mitigation measures may be designed to reduce or eliminate its impact on an observer, and specific mitigation measures may be developed in consultation with affected stakeholders. Potential mitigation measures may include installing blinds over windows, modified backtracking behaviour, planting vegetation like trees or hedges, or installing fencing or other visual barriers. Due to the predicted duration and level of glare, mitigation is not expected to be required.

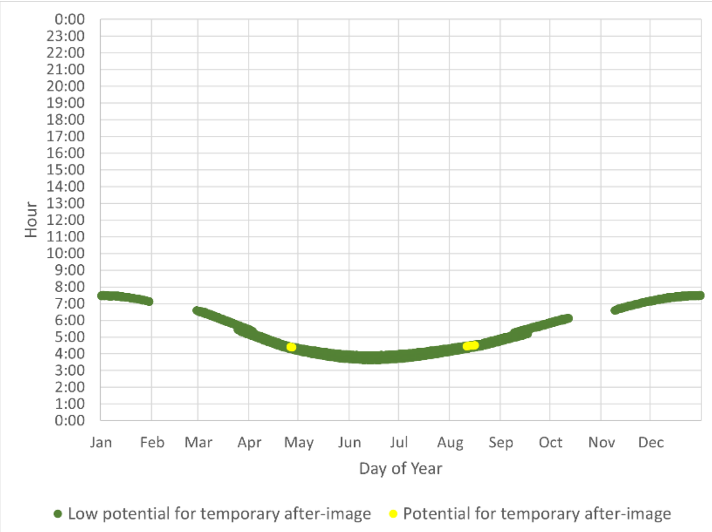

Figure 6-4 – Annual Predicted Glare occurrence for R4 (0° Resting Angle)

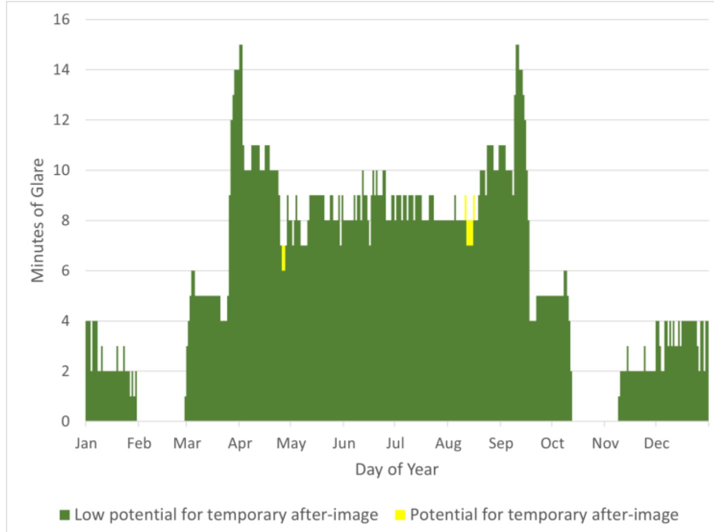

Figure 6-5 – Daily Duration of Glare for R4 (0° Resting Angle)

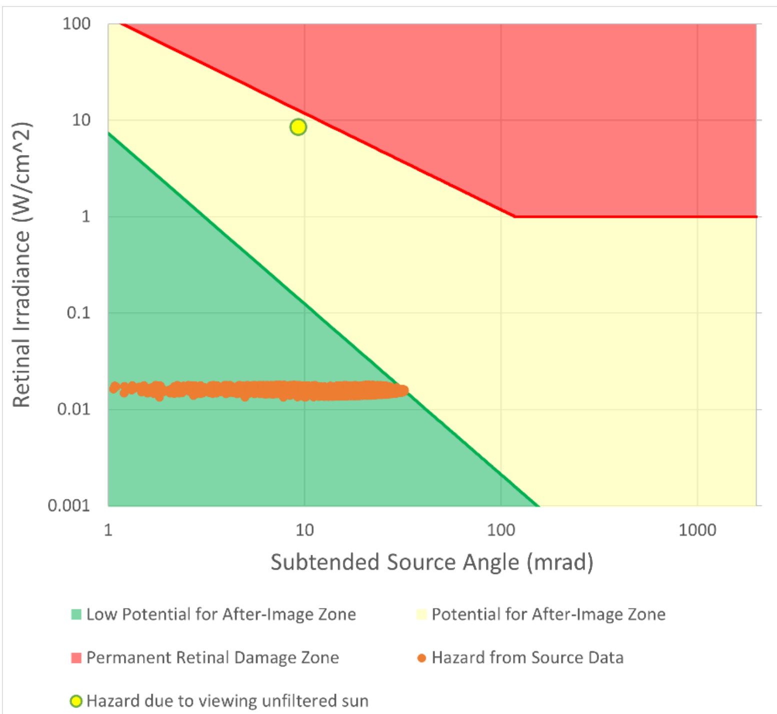

Figure 6-6 – Hazard Plot for R4 (0° Resting Angle)

6.3 Flight Path Results

The tables below present the glare results for the flight paths assessed from the array centroid height. **Table 6-4** shows the results for the flight paths evaluated with a conservative ±50° horizontal FOV to capture potential glare a pilot may see while landing an airplane. **Table 6-5** shows the results for the flight paths modelled with a ±25° FOV to assess glare within a pilot's critical visual range. Equivalent levels of glare within ±25° will have a greater impact on the observer than glare outside that range.

Table 6-4 – Annual Glare Levels for Flight Paths from Unregistered Aerodrome (±50° FOV, 0° Resting Angle)

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
FP1 (north bound)	382	0	0	14
FP2 (south bound)	1,088	0	0	28

Table 6-5 – Annual Glare Levels for Flight Paths from Unregistered Aerodrome (±25° FOV, 0° Resting Angle)

Receptor	Green Glare (min/year)	Yellow Glare (min/year)	Red Glare (min/year)	Max Daily Glare (min/day)
FP1 (north bound)	0	0	0	0
FP2 (south bound)	0	0	0	0

Both flight paths, FP1 and FP2, are only predicted to observe short annual and daily durations of green glare within the extended ±50° FOV. No glare is predicted on either flight path within the more critical ±25° FOV. FP1 and FP2 are not predicted to experience yellow glare within the ±50° FOV or ±25° FOV.

FP2 approaches the unregistered aerodrome while heading south with the Project to the southeast of the flight path, and it is the flight path predicted to observe the most glare from the Project. Along this flight path, pilots are only predicted to see green glare in the ±50° FOV for a maximum of 1,088 minutes/year. Green glare is not generally considered to be a hazard. The glare is predicted around sunrise from mid-November to mid-January. Glare may be seen along this route between 07:33 and 08:08 MST for up to 28 minutes per morning.[34] The glare is expected to originate from the same general direction as the sun for these periods, so glare impacts may be eclipsed by the direct effects of the sun if both can be seen simultaneously by the observer. This is an effect called "sun-masking". The glare and sun during these periods will be nearly perpendicular to the pilot's direction of travel, therefore the direct effects of the sun and glare from the solar farm will not be in the pilot's main vision. In addition, the actual impact is expected to be less because pilots will be travelling past the affected portion of the flight path, not standing still while looking at the solar PV arrays.

The following figures represent the predicted glare for FP2. **Figure 6-7** shows the daily time periods during which glare is predicted, and **Figure 6-8** shows the daily duration of predicted glare.

[34] These results apply to a portion of the route, not just a single point along the route. The results describe a time period during which a pilot may see glare from the Project, but it is highly unlikely that an observer will be affected by the glare for the full duration.

Figure 6-9 presents the glare hazard plot for glare predicted to affect FP2. The hazard plot shows that the glare seen from FP2 will have approximately two times the subtended angle as the sun, but it will be around 500 times dimmer. The glare is also around three orders of magnitude below the threshold for glare that has the potential to cause permanent eye damage at the same subtended angle. The predicted glare is completely within the green level, which is not generally considered a hazard. The green glare is only predicted within a viewing range outside the critical ±25° FOV, which will not necessarily have an adverse impact on a pilot's vision or ability to safely operate their airplane. Glare at this level has a low potential to temporarily affect an operator's vision, but it is not expected to create a hazardous situation.

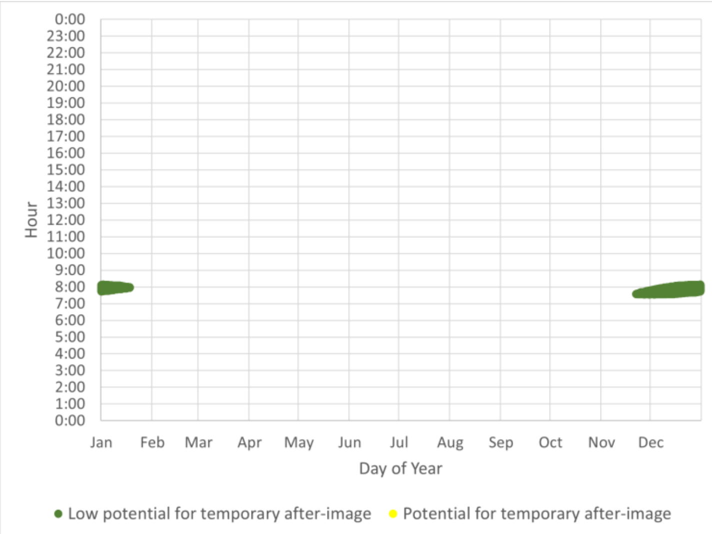

Figure 6-7 – Annual Predicted Glare occurrence for FP2 (±50° FOV, 0° Resting Angle)

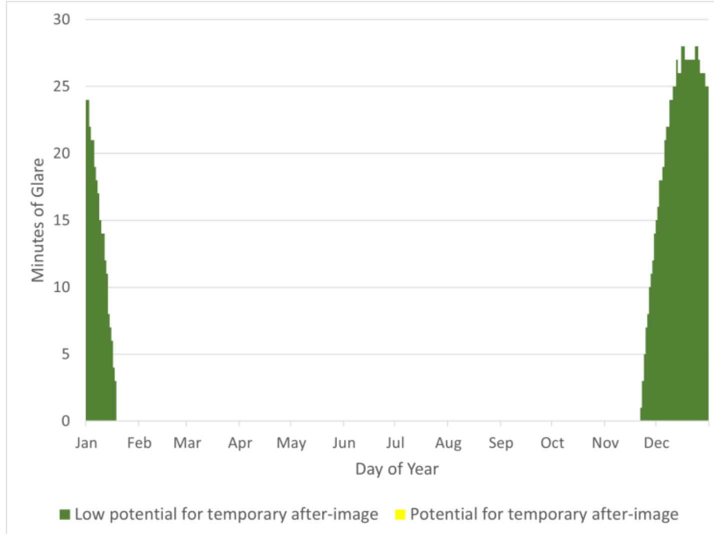

Figure 6-8 – Daily Duration of Glare for FP2 (±50° FOV, 0° Resting Angle)

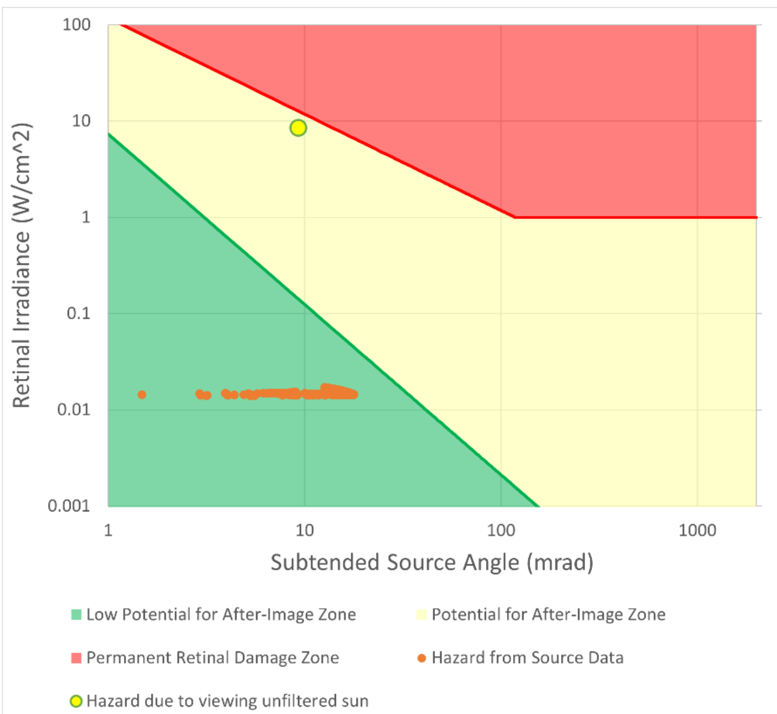

Figure 6-9 – Hazard Plot for FP2 (±50° FOV, 0° Resting Angle)

6.4 Comparison to Past Results

Comparing the new SGHAR results with the previously submitted SGHAR[35] shows an overall decrease in glare on ground-based route receptors and dwellings, even when comparing the worst-case models specified with a 0° minimum backtracking angle. The main reason for the difference in predicted glare between the two SGHARs is due to the change from fixed tilt racking to single axis tracking, as well as significant differences in assessment methodology, e.g., software version, receptor selection, input parameters, etc. Not all receptors modeled in the two reports match due to differences in assessment methodology, so only the receptors assessed in both reports will be compared for predicted glare.

Table 6-6 compares the maximum annual predicted yellow glare for ground-based routes, dwellings, and flight paths that were modeled in the previous report and this current report.

Table 6-6 – Comparison of Annual Yellow Glare Levels for Dwellings near the Project

Receptor	Updated Report Yellow Glare (min/year)	Previous Report Yellow Glare (min/year)
Highway 41 (±15° FOV)	0	0
Highway 41 (±25° FOV)	0	0
Township Road 124 (±15° FOV)	562	1,707
Township Road 124 (±25° FOV)	1,140	1,712
R1	5	2,573
R2	0	416
R3	0	386
R4	8	1,607
R5	0	265
FP1 (north bound) (±50° FOV)	0	0
FP2 (south bound) (±50° FOV)	0	0
FP1 (north bound) (±25° FOV)	0	0
FP2 (south bound) (±25° FOV)	0	0

For ground-based route receptors, both Highway 41 and Township Road 124 were assessed in the two reports. Both reports concluded Highway 41 is not predicted to experience glare from the Project. On Township Road 124, the previous report predicted a maximum of 1,707 minutes per year of yellow glare within a driver's critical ±15° FOV, while the updated model only predicted a maximum of 562 minutes per year of yellow glare within a driver's critical ±15° FOV.

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The same five receptors were used to represent dwellings around the Project for both SGHARs. All five residences are now predicted to be far less impacted by the Project compared with the previous report. The previous report predicted 2,573 minutes per year of yellow glare for R1, while the new results predict 5 minutes per year of yellow glare. R2 is now predicted to experience no yellow glare and was previously predicted to see 515 minutes per year of yellow glare. R3 is now predicted to experience no yellow glare and was previously predicted to see 699 minutes per year of yellow glare. The previous report predicted 1,607 minutes per year of yellow glare for R4, the new results predict 8 minutes per year of yellow glare. R5 is no longer predicted to experience glare, while it was previously predicted to see 265 minutes of yellow glare per year.

The two flight paths from the unregistered aerodrome were modeled in both SGHARs. The flight paths were previously predicted not to experience glare from the Project. The switch from fixed tilt racking to single axis tracking indicates that green glare may be experienced on the two flight paths in the extended ±50° FOV, but not within the ±25° FOV. Green glare is not generally considered a hazard, and the ±50° FOV represents a conservative region where a pilot will not necessarily be adversely impacted by glare.

7 Summary

Solar modules are specifically designed to absorb light rather than reflect it. Moreover, most modules are now manufactured with anti-reflective coatings that help further mitigate the intensity of reflections, as is the case with the modules selected for the Project.

The assessment of the Dunmore Solar Power Plant was undertaken using GlareGauge software. The results are based on the assumptions and limitations set out in previous sections of this report. The SAT systems were modelled at their centroid heights with a maximum tracking angle of 55°. The assessment included models using resting/minimum backtracking angles of 0°-10°. Glare was only predicted by the models using resting angles between 0° and 8°, with the 0° resting angle model resulting in the most potential glare.

The ground-based route paths assessed for glare impacts included both directions of travel on sections of Highway 41, Range Road 42, Township Road 130, Township Road 124, and Route 1 at passenger, truck, and commercial vehicle heights. The routes were evaluated with a horizontal viewing angle of ±15° to capture potential glare within a vehicle operator's critical visual range, as well as ±25° to identify routes that may observe peripheral glare. Drivers travelling along the evaluated sections of Highway 41, Range Road 42, and Route 1 are not predicted to observe glare at any level from the Project, while Township Road 130 and 124 are predicted to observed minimal green and yellow glare from the Project. None of the route receptors are predicted to observe glare at any level from the Project in the models that used a resting angle of 4° or steeper.

In the worst case (0° resting angle), the assessed portion of Township Road 124 is the ground route predicted to observe the most glare from the Project. The results indicate that taller vehicles may see more glare than shorter vehicles. Along this route, observers are predicted to see yellow glare in the more critical ±15° FOV for a maximum of 562 minutes/year. The glare is predicted around sunrise and sunset between late March and late April, as well as mid-August and mid-September. The actual impact is expected to be less because vehicle operators will be travelling past the affected areas, not standing still while looking at the solar PV arrays. Satellite imagery shows that this is a remote road that is likely to experience minimal traffic, which further reduces the likelihood that there will be observers to see glare from the Project.

On Township Road 124 the previous report predicted a maximum of 1,797 minutes per year of yellow glare within a driver's critical ±15° FOV, while the updated model only predicted a maximum of 562 minutes per year of yellow glare within a driver's critical ±15° FOV. Both reports concluded Highway 41 is not predicted to experience glare from the Project. Range Road 42, Township Road 130, and Route 1 were not previously assessed.

Five dwellings were evaluated in this assessment. Only one is within the 800m required for Rule 007, the other four were included for consistency with the previous assessment. Dwellings were modelled at 4.5m above ground to conservatively represent two-storey buildings. Dwellings R1 and R4 are predicted to observe moderate annual durations of green glare from the Project and minimal yellow glare from the Project. R2 and R3 are predicted to observe moderate annual durations of green glare from the Project and no yellow glare. R5 is predicted to have no glare impact at the dwelling. In the worst-case models using 0° resting angle, R4 is the dwelling predicted to observe the most glare from the Project. Observers are predicted to see yellow glare for a maximum of 8 minutes/year. The yellow glare is predicted between 04:24 and 04:31 MST for up to 1 minute per morning in mid-April and mid-August. The glare is expected to originate from the same general direction as the sun for these periods, so glare impacts may be eclipsed by the direct effects of the sun if both can be seen simultaneously by the observer. This is an effect called "sun-masking". The updated results show a decrease in maximum annual yellow glare at all five dwellings.

Two flight paths approaching a private, unregistered aerodrome 3,900m northwest of the Project were included in this glare assessment. The flight paths were evaluated with a horizontal viewing angle of ±25° to capture potential glare within a pilot's critical visual range, as well as ±50° to identify routes that may observe peripheral glare. Both flight paths, FP1 and FP2, are only predicted to observe short annual and daily durations of green glare within the extended ±50° FOV and outside the ±25° FOV, but green glare is not generally considered a hazard. No glare is predicted on either flight path within the more critical ±25° FOV, so the predicted green glare has less potential to adversely affect a pilot's vision. FP1 and FP2 are not predicted to experience yellow glare within the ±50° FOV or ±25° FOV. FP2 approaches the unregistered aerodrome while heading south and it is the flight path predicted to observe the most glare from the Project. Along this flight path, pilots are only predicted to see green glare around sunrise from mid-November to mid-January for up to 28 minutes per morning. Pilots will only see a fraction of the predicted glare since they will be travelling past the affected portion of the flight path, not standing still while looking at the solar PV arrays, and sun-masking may also reduce potential glare impacts. The predicted glare is not expected to create hazardous conditions.

In the previous report, the flight paths were not predicted to experience glare from the Project. The switch from fixed tilt racking to single axis tracking indicates that green glare may be experienced on the two flight paths in the extended ±50° FOV. Green glare is not generally considered a hazard, and the ±50° FOV represents a conservative region where a pilot will not necessarily be adversely impacted by glare.

8 Conclusion

In conclusion, the Dunmore Solar Power Plant is not likely to have the potential to create hazardous glare conditions for the dwellings, roads, or flight paths that were assessed. The maximum annual yellow glare for route receptors and dwellings within 800m of the Project is predicted to be lower compared to the results from the previous SGHAR. The switch from fixed tilt racking to single axis tracking indicates that green glare may be experienced on the two flight paths in the extended ±50° FOV, while no glare was predicted in the previous SGHAR. Green glare is not generally considered a hazard, and the ±50° FOV represents a conservative region where a pilot will not necessarily be adversely impacted by glare.

The actual glare impacts that will be experienced in the field along transportation routes are anticipated to be only a fraction of the results presented in this report. The actual impact is expected to be less because vehicle operators will be travelling past the affected areas, not standing still while looking at the solar PV arrays. The impact of the glare on affected receptors is expected to be reduced by sun-masking as the glare occurs around sunrise/sunset when the sun aligns with the glare spot and observer, and the sunlight glances across the arrays at a shallow angle.

Based on the assessment results, glare from the Dunmore Solar Power Plant is not expected to present a hazard to drivers along nearby roads, or pilots landing at the unregistered aerodrome. Glare is not expected to have an adverse effect on a resident's use of their home either.

9 Glare Practitioners' Information

Table 9-1 summarizes the information of the author and technical reviewer of the solar glare hazard analysis.

Table 9-1 – Summary of Practitioners' Information

Name	Laura Essak	Jason Mah	Cameron Sutherland
Title	Renewable Energy EIT	Senior Renewable Energy Engineer	Technical Director
Role	Glare Analyst, Author	Technical Reviewer	Technical Reviewer and Approver
Experience	• MSc Renewables Energy Engineering	• Analyst on 40+ glare assessments in Alberta, BC, Nunavut, the USA, and the UK • Technical support for AUC information requests and hearings • Expert witness experience in technical solar development for the Sollair Solar Energy Project • BSc Chemical Engineering • P.Eng. (APEGA)	• Expert witness experience in technical solar development in Canada for Brooks II Solar Project, East Strathmore Solar Project, and Fox Coulee Solar Project • Technical oversight, technical review, or authorship of 40+ glare assessments for 20+ proceedings in Alberta • MSci Physics • MSc Renewable Energy Systems Technology

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