Appendix H

PV Glint and Glare Study

Cimitiere Plains Solar Farm

PAGERPOWER
Urban & Renewables

Solar Photovoltaic Glint and Glare Study

Envoca Environmental Consultancy

George Town Solar Farm

September 2023

PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
- Buildings
- Wind
- Airports
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- Mitigation

ADMINISTRATION PAGE

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1	29th August 2023	Initial issue
2	11th September 2023	Administrative amendments

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been retained to assess the possible effects of glint and glare from a proposed solar photovoltaic (PV) development located north-east of George Town, Tasmania, Australia. This glint and glare assessment concerns the potential impact on surrounding road safety and residential amenity. Commentary on the potential impacts at George Town Airport has also been included.

Conclusions

No significant impacts are predicted on surrounding road safety and residential amenity. Mitigation is not recommended.

Guidance and Studies

There is no existing planning guidance for the assessment of solar reflections from solar panels towards roads and nearby dwellings. Pager Power has however produced guidance for glint and glare and solar photovoltaic developments, which was published in early 2017, with the fourth edition published in 2022[1]. The guidance document sets out the methodology for assessing roads and dwellings with respect to solar reflections from solar panels.

Pager Power's approach is to undertake geometric reflection calculations and, where a solar reflection is predicted, consider the screening (existing and/or proposed) between the receptor and the reflecting solar panels. The scenario in which a solar reflection can occur for all receptors is then identified and discussed, and a comparison is made against the available solar panel reflection studies to determine the overall impact.

The available studies have measured the intensity of reflections from solar panels with respect to other naturally occurring and manmade surfaces. The results show that the reflections produced are of intensity similar to or less than those produced from still water and significantly less than reflections from glass and steel[2].

Assessment Results

Roads

The modelling predicts that solar reflections are possible (without consideration of screening) towards a 1.3km section and a 1.1km section of Soldiers Settlement Road.

No significant impacts are predicted on any of the modelled road sections, because there are significant mitigating factors from the following:

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[1] Pager Power Glint and Glare Guidance, Fourth Edition, September 2022.

[2] Source: SunPower, 2009, SunPower Solar Module Glare and Reflectance (appendix to Solargen Energy, 2010).

- Solar reflections are possible from panels **outside** of a road user's primary horizontal field of view (50 degrees either side of the direction of travel);
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal/fleeting views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between road user and closest reflecting panel.

Dwellings

The modelling predicts that solar reflections are possible (without consideration of screening) towards five of the seven assessed dwelling locations.

No significant impacts are predicted on the assessed dwellings, because there are significant mitigating factors from the following:

- Solar reflections are possible for **less** than 60 minutes on any given day and for **less** than 3 months of the year;
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between dwelling observer and closest reflecting panel.

High-Level Aviation

George Town Airport is understood to be an unlicensed airstrip where non-commercial aircraft may operate. It is located approximately 1.5km away from the proposed development at its closest point. The George Town Airport has been contacted in relation to the proposal and no concerns have been raised in relation to glint and glare or other matters.

The Civil Aviation Safety Authority (CASA) were also consulted with regards to the proposed development. CASA confirmed that it is not considered a hazard to aircraft operations at George Town Airport based on the lack of an ATC (Air Traffic Control) Tower, and that they have no objection to the proposed development on that basis.

On the basis of the consultation detailed above, technical modelling is not recommended.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 58 countries internationally.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems.

Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Overview

Pager Power has been retained to assess the possible effects of glint and glare from a proposed solar photovoltaic (PV) development located north-east of George Town, Tasmania, Australia. This glint and glare assessment concerns the potential impact on surrounding road safety and residential amenity. Commentary on the potential impacts at George Town Airport has also been included.

This report contains the following:

- Solar development details.
- Explanation of glint and glare.
- Overview of relevant guidance and studies.
- Overview of Sun movement.
- Assessment methodology.
- Identification of receptors.
- Glint and glare assessment for identified receptors.
- Results discussion.

Following this, a summary of findings and overall conclusions and recommendations from the desk-based analysis is presented.

1.2 Pager Power's Experience

Pager Power has undertaken over 1,100 Glint and Glare assessments in the UK and internationally. The studies have included assessment of civil and military aerodromes, railway infrastructure and other ground-based receptors including roads and dwellings.

1.3 Glint and Glare Definition

The definition of glint and glare is as follows[3]:

- Glint – a momentary flash of bright light typically received by moving receptors or from moving reflectors.
- Glare – a continuous source of bright light typically received by static receptors or from large reflective surfaces.

The term 'solar reflection' is used in this report to refer to both reflection types.

[3] These definitions are aligned with those presented within the UK Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) – published by the Department for Business, Energy & Industrial Strategy in March 2023 and the Federal Aviation Administration in the USA.

2 PROPOSED DEVELOPMENT LOCATION AND DETAILS

2.1 Site Area Layout Plan

The latest solar PV layout for the Proposed Development is shown in Figure 1[4] below. The blue coloured areas represent the areas where solar PV modules will be located.

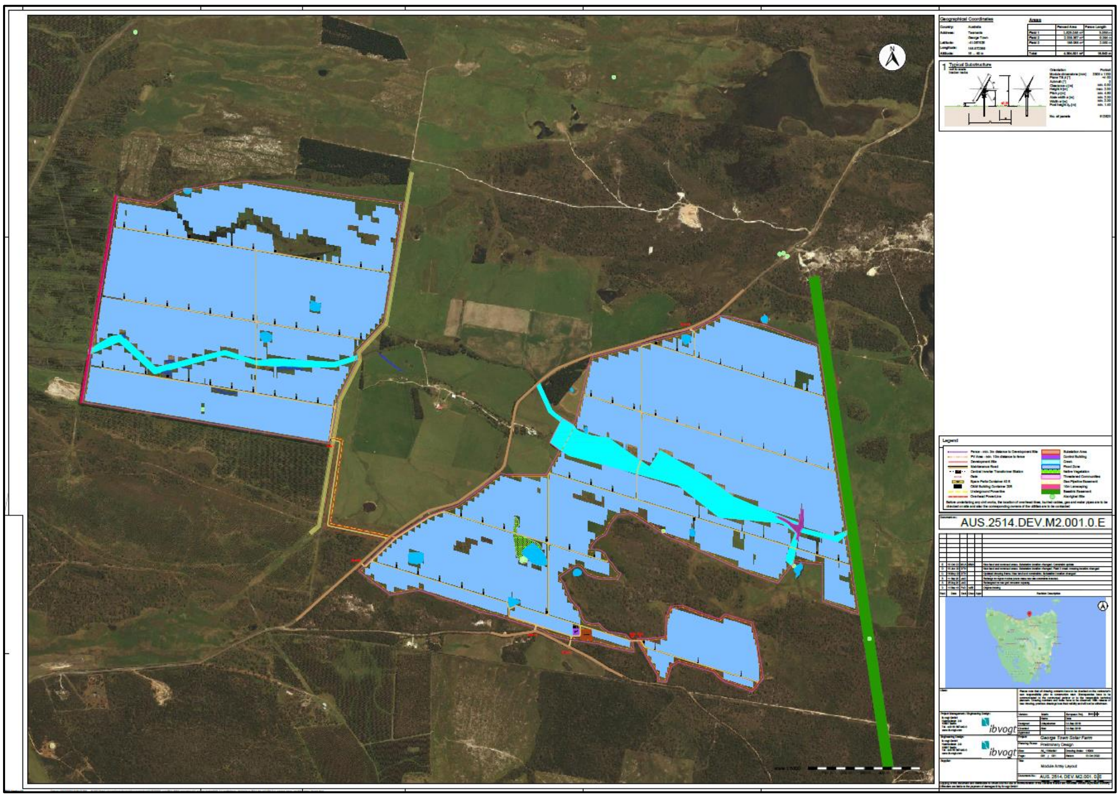

Figure 1 *Site Layout Plan*

[4] Source: AUS.2514.DEV.M2.001.0.E_George_Town_Module_Array_Layout_221014.pdf

2.2 Solar Panel Information

The technical characteristics used for the modelling are presented in Table 1 below.

Solar Panel Technical Information	
Assessed centre-height	1.4m agl (above ground level)
Tracking	Horizontal Single Axis tracks Sun East to West
Tilt of tracking axis (°)	0
Orientation of tracking axis (°)	0
Offset angle of module (°)	0
Tracker Range of Motion (°)	±50
Resting angle (°)	0
Backtracking Method	Instant (for modelling purposes)
Surface material	Smooth glass with ARC (anti-reflective coating)

Table 1 *Solar panel technical information*

2.2.1 Solar Panel Backtracking

Shading considerations dictate the panel tilt. This is affected by:

- The elevation angle of the Sun;
- The vertical tilt of the panels;
- The spacing between the panel rows.

This means that early in the morning and late in the evening, the panels will not be directed exactly towards the Sun, as the loss from shading of the panels (caused by facing the sun directly when the Sun is low in the horizon), would be greater than the loss from lowering the panels to a less direct angle in order to avoid the shading. Figure 2[5] on the following page illustrates this.

[5] Note the graphics in Figure 2 and Figure 3 show two lines illustrating the paths of light from the Sun towards the solar panels. In reality, the lines from the Sun to each panel would be effectively parallel due to the large separation distance. The figure is for illustrative purposes only.

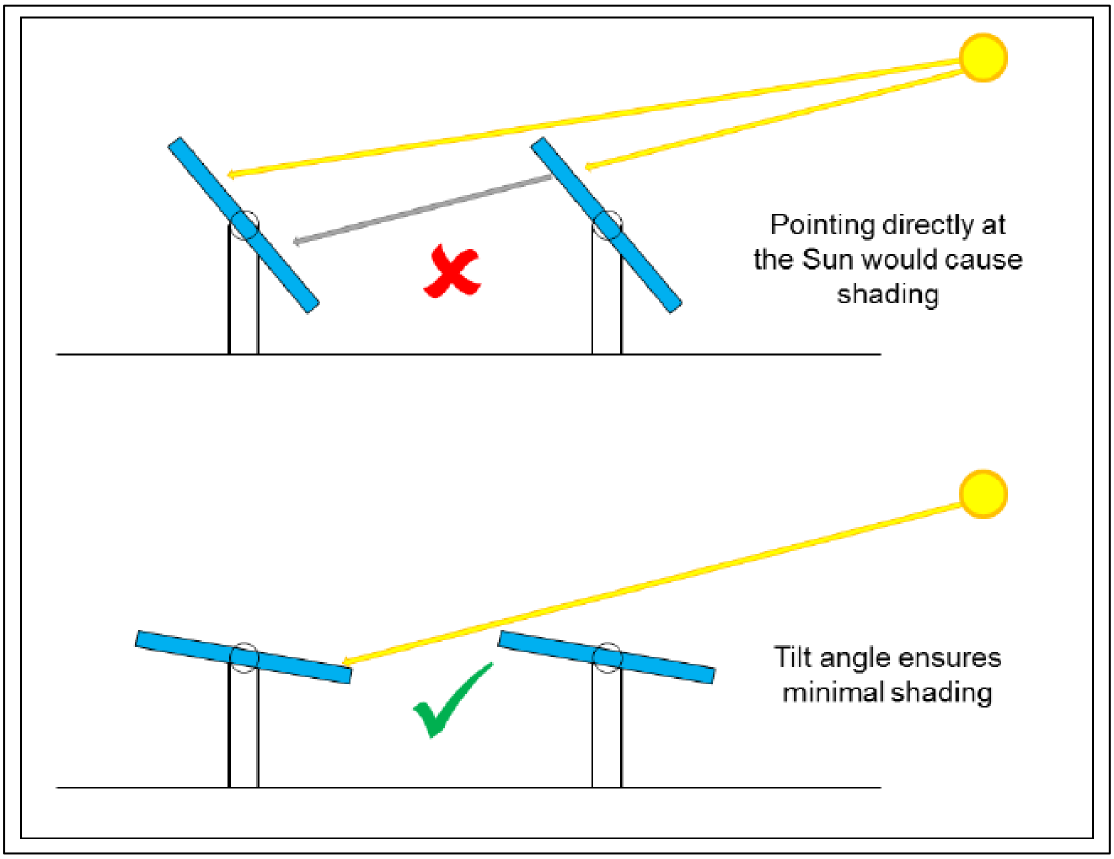

Figure 2 *Shading Considerations*

Later in the day, the panels can be directed towards the Sun without any shading issues. This is illustrated in Figure 3[5] below.

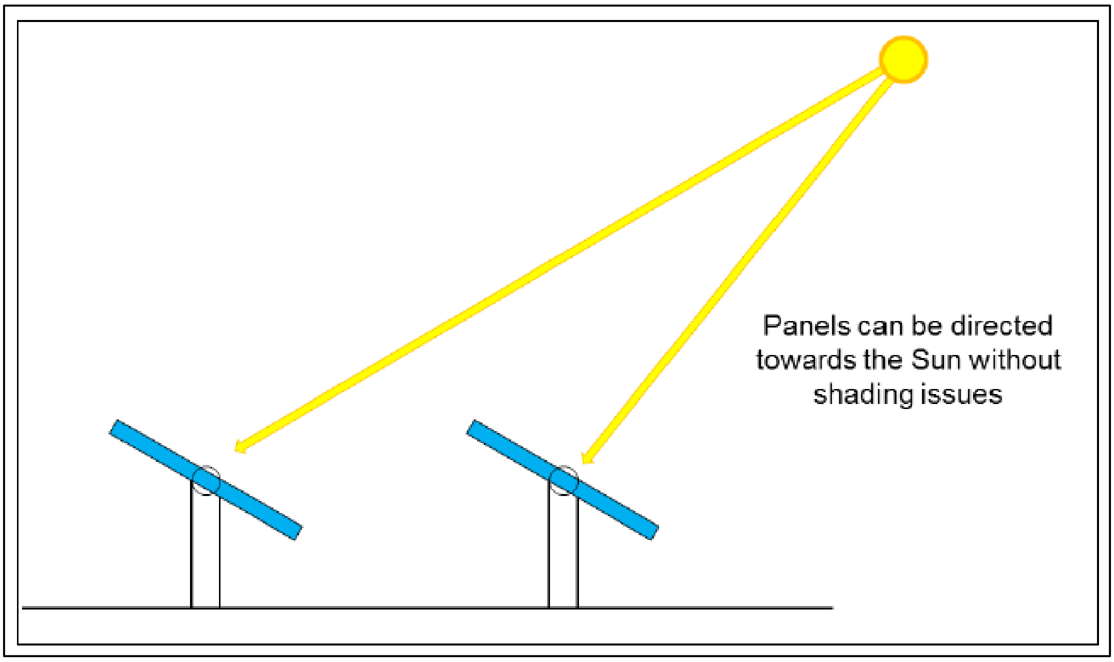

Figure 3 *Panel alignment at high solar angles*

The solar panels backtrack (where the panel angle gradually declines to prevent shading) by reverting to 0 degrees (flat), once the maximum elevation angle of the panels (50 degrees) becomes ineffective due to the low height of the Sun above the horizon and to avoid shading.

3 GLINT AND GLARE ASSESSMENT METHODOLOGY

3.1 Guidance and Studies

Appendices A and B present a review of relevant guidance and independent studies with regard to glint and glare issues from solar panels. The overall conclusions from the available studies are as follows:

- Specular reflections of the Sun from solar panels are possible.
- The measured intensity of a reflection from solar panels can vary from 2% to 30% depending on the angle of incidence.
- Published guidance shows that the intensity of solar reflections from solar panels are equal to or less than those from water. It also shows that reflections from solar panels are significantly less intense than many other reflective surfaces, which are common in an outdoor environment.

3.2 Background

Details of the Sun's movements and solar reflections are presented in Appendix C.

3.3 Methodology

3.3.1 Pager Power's Methodology

The glint and glare assessment methodology has been derived from the information provided to Pager Power through consultation with stakeholders and by reviewing the available guidance and studies. The methodology for a glint and glare assessments is as follows:

- Identify receptors in the area surrounding the solar development.
- Consider direct solar reflections from the solar development towards the identified receptors by undertaking geometric calculations and intensity calculations where required.
- Consider the visibility of the panels from the receptor's location. If the panels are not visible from the receptor then no reflection can occur.
- Based on the results of the geometric calculations, determine whether a reflection can occur, and if so, at what time it will occur.
- Assess the glare intensity if applicable.
- Consider both the solar reflection from the solar development and the location of the direct sunlight with respect to the receptor's position.
- Consider the solar reflection with respect to the published studies and guidance.
- Determine whether a significant detrimental impact is expected in line with the process presented in Appendix D.

Within the Pager Power model, the solar development area is defined, as well as the relevant receptor locations. The result is a chart that states whether a reflection can occur, the duration and the panels that can produce the solar reflection towards the receptor.

3.3.2 Sandia National Laboratories' Methodology

Sandia National Laboratories developed the Solar Glare Hazard Analysis Tool (SGHAT) which is no longer freely available however it is now developed by Forge Solar. Pager Power uses this model where required for aviation receptors. Whilst strictly applicable in the USA and to solar photovoltaic developments only, the methodology is widely used by aviation stakeholders internationally.

Pager Power has undertaken many glint and glare assessments with both models (SGHAT and Pager Power's) producing similar results. In this study the Forge model (based on the SGHAT) was used exclusively.

3.4 Assessment Limitations

Further technical details regarding the methodology of the geometric calculations and limitations are presented in Appendix E and Appendix F.

4 IDENTIFICATION OF RECEPTORS

4.1 Ground-Based Receptors Overview

There is no formal guidance with regard to the maximum distance at which glint and glare should be assessed. From a technical perspective, there is no maximum distance for potential reflections. The significance of a reflection, however, decreases with distance because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes as the separation distance increases. Terrain and shielding by vegetation are also more likely to obstruct an observer's view at longer distances.

The above parameters and extensive experience over a significant number of glint and glare assessments undertaken show that consideration of receptors within 1km of solar PV module areas is appropriate for glint and glare effects on roads and dwellings. Therefore, the study area has been designed accordingly as a 1km boundary from solar PV module areas.

Potential receptors are identified based on mapping and aerial photography of the region. The initial judgement is made based on a high-level consideration of aerial photography and mapping i.e. receptors are excluded if it is clear from the outset that no visibility would be possible. A more detailed assessment is made if the modelling reveals a reflection would be geometrically possible.

Receptor details can be found in Appendix G.

4.2 Road Receptors

4.2.1 Overview

Road types can generally be categorised as:

- Major National – Typically a road with a minimum of two carriageways and fast-moving vehicles with busy traffic.
- National – Typically a road with a one or more carriageways and fast-moving vehicles with moderate to busy traffic density.
- Regional – Typically a single carriageway with a typical traffic density of low to moderate; and
- Local - Typically roads and lanes with the lowest traffic densities. Speed limits vary.

Technical modelling is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the Proposed Development that are experienced by a road user along a local road would be considered low impact in the worst case in accordance with the guidance presented in Appendix D.

The analysis considers any major national, national, and regional roads that:

- are within the one-kilometre study area; and
- have a potential view of the panels.

A height of 1.5 metres above ground level has been taken as a typical eye level for a road user[6]. This height has therefore been added to the ground height at each receptor location. Visibility and direction of travel is considered in the assessment of all receptors.

4.2.2 Identification

A 4.64km section of Soldiers Settlement Road was taken forward for technical modelling. In total, 48 road receptor locations have been identified distanced circa 100m apart. These are shown in Figure 4 on the following page.

[6]This height is chosen for modelling purposes, elevated drivers are considered in the results discussion where appropriate.

Figure 4 *Overview of road receptors*

4.3 Dwelling Receptors

4.3.1 Overview

The analysis has considered dwellings that:

- are within the one-kilometre study area; and
- have a potential view of the panels.

A height of 1.8 metres above ground level has been taken as typical eye level for an observer on the ground floor[7] of the dwelling since this is typically the most occupied floor of a dwelling throughout the day.

4.3.2 Identification

In total, seven dwellings[8] were identified for assessment, as shown in Figure 5 on the following page. These are shown in more detail in Figure 6 to Figure 8 on the following pages.

[7] This fixed height for the dwelling receptors is for modelling purposes. Small changes to the modelling height by a few metres is not expected to significantly change the modelling results. Views above ground floor are considered in the results discussion where necessary.

[8] L1 and L2 are financially involved properties.

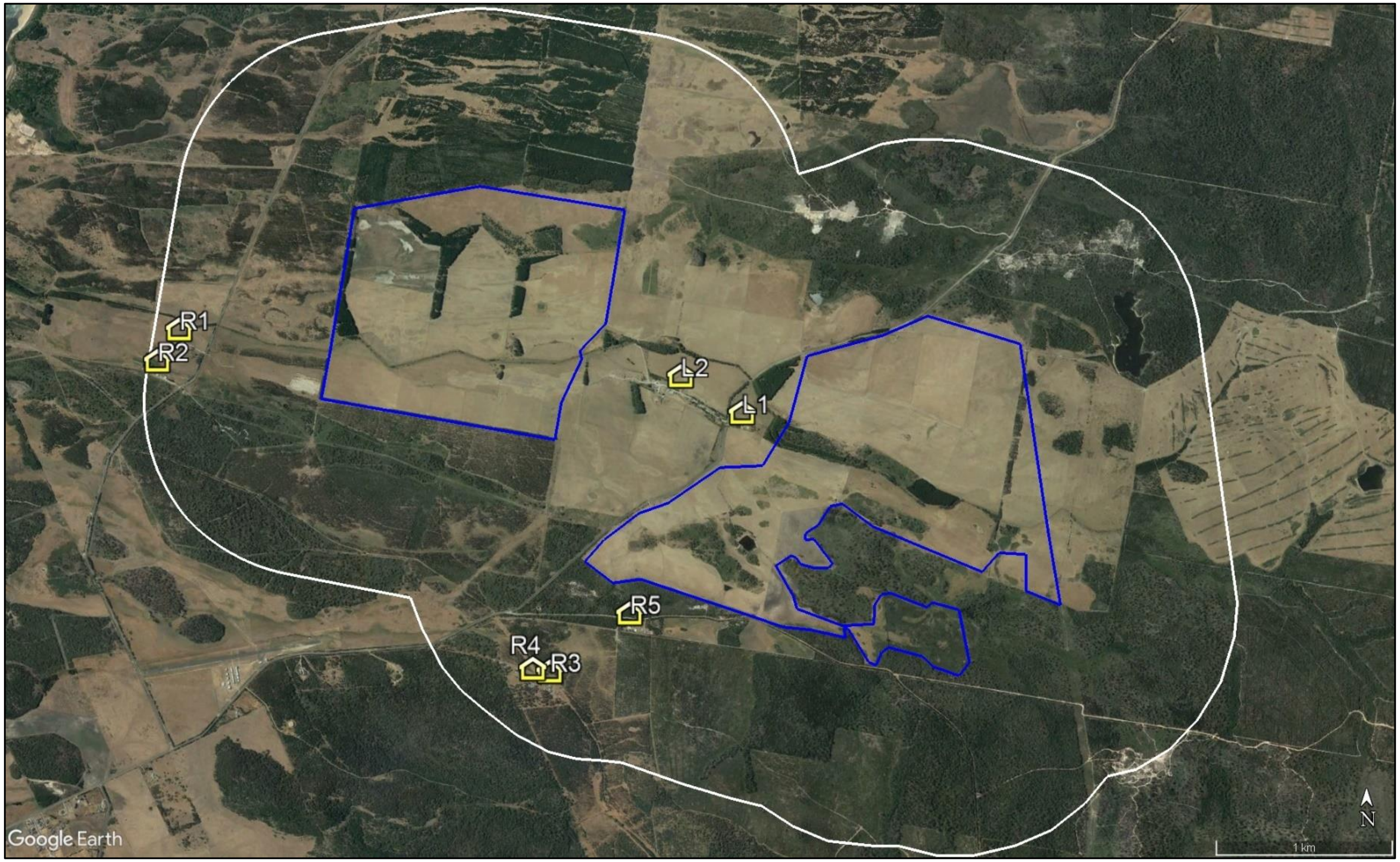

Figure 5 *Overview of dwelling receptors*

Figure 6 *Dwelling receptors R1-R2*

Figure 7 *Dwelling receptors R3-R5*

Figure 8 *Dwelling receptors L1-L2*

5 GEOMETRIC ASSESSMENT RESULTS AND DISCUSSION

5.1 Overview

The following sub-sections present the modelling results as well as the significance of any predicted impact in the context of existing screening, as well as the relevant criteria set out in the next subsection. The criteria are determined by the assessment process for each receptor, which are set out in Appendix D.

When determining the visibility of the reflecting panels for an observer, a conservative review of the available imagery is undertaken, whereby it is assumed views of the panels are possible if it cannot be reliably determined that existing screening will remove effects.

The modelling output showing the precise predicted times and the reflecting panel areas can be provided on request.

5.2 Roads

5.2.1 Impact Significance Methodology

The key considerations for road users along major national, national, and regional roads are:

- Whether a reflection is predicted to be experienced in practice; and
- The location of the reflecting panel relative to a road user's direction of travel.

Where the reflecting panels are predicted to be significantly obstructed from view, no impact is predicted, and mitigation is not required.

Where solar reflections are not experienced as a sustained source of glare, originate from outside of a road user's primary horizontal field of view (50 degrees either side of the direction of travel), or the closest reflecting panel is over 1km from the road user, the impact significance is low, and mitigation is not recommended.

Where sustained solar reflections are predicted to be experienced from inside of a road user's primary field of view, expert assessment of the following factors is required to determine the impact significance and mitigation requirement:

- Whether the solar reflection originates from directly in front of a road user – a solar reflection that is directly in front of a road user is more hazardous than a solar reflection to one side;
- Whether visibility is likely for elevated drivers (applicable to dual carriageways and motorways only) – there is typically a higher density of elevated drivers along dual carriageways and motorways compared to other types of road;
- The separation distance to the panel area – larger separation distances reduce the proportion of an observer's field of view that is affected by glare;
- The position of the Sun – effects that coincide with direct sunlight appear less prominent than those that do not.

If following consideration of the relevant factors, the solar reflections do not remain significant, the impact significance is low, and mitigation is not recommended.

If following consideration of the relevant factors, the solar reflections remain significant, then the impact significance is moderate, and mitigation is recommended.

Where solar reflections originate from directly in front of a road user and there are no mitigating factors, the impact significance is high, and mitigation is required.

5.2.2 Geometric Modelling Results

The modelling has shown that solar reflections are geometrically possible (without consideration of screening) towards a 1.3km section and a 1.1km section of Soldiers Settlement Road that are shown in orange in Figure 9 on the following page.

The modelling results for road receptors are presented in Table 2 on page 27.

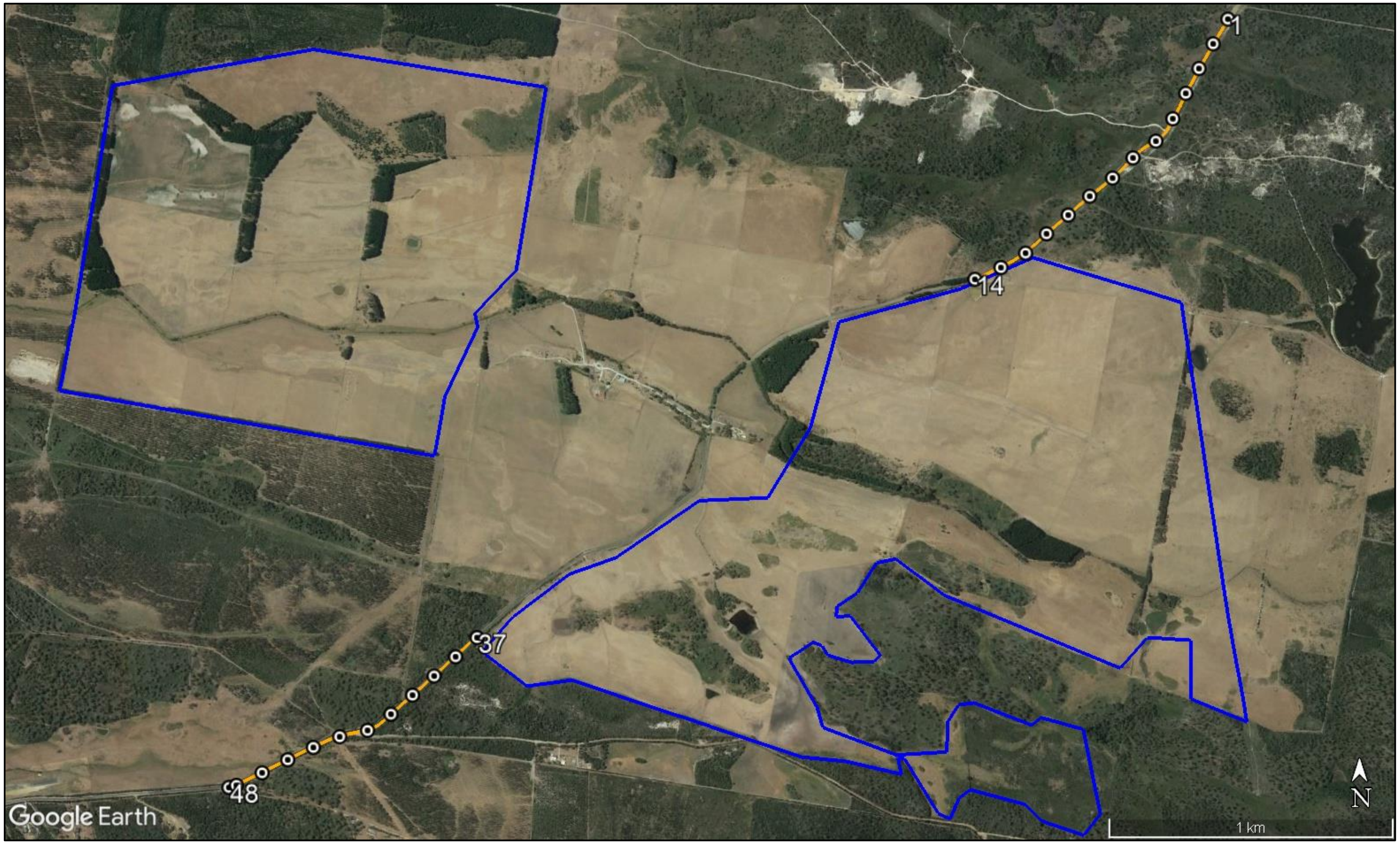

Figure 9 *Sections of road towards which solar reflections are geometrically possible (orange) – aerial image*

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
1 – 3	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from western panel area only)	Reflecting panels are predicted to be screened by intervening terrain and existing vegetation	N/A	None	No
4 – 10	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from both panel areas)	Reflecting panels are predicted to be screened by intervening terrain, existing vegetation, and proposed vegetation planting at 4m high	N/A	None	No

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
11	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from both panel areas)	Reflecting panel areas within field of view are predicted to be screened by intervening terrain, existing vegetation, and proposed vegetation planting at 4m high	Closest reflecting panels are approximately 400m away All reflections are in early morning or late evening when the Sun is low in the sky, and are therefore predicted to coincide with direct sunlight	Low	No

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
12	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from both panel areas)	Reflecting panels within the western panel area predicted to be screened by terrain and existing vegetation Reflecting panels within the eastern panel area are predicted to be screened by proposed planting at 4m high	N/A	None	No
13 – 14	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from eastern panel area only)	Significant existing screening not identified Reflecting panels are predicted to be screened by proposed planting at 4m high	N/A	None	No

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
37	Solar reflections predicted to originate from **outside** of a road user's primary horizontal field of view (from western panel area only)	All reflecting panel areas are predicted to be screened by intervening terrain and existing vegetation	N/A	None	No
38 – 39	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view from eastern panel area, and from **outside** of a road user's primary horizontal field of view from western panel area	Reflecting panel areas within field of view are predicted to be screened by intervening terrain and existing vegetation	N/A	None	No
40 – 48	Solar reflections predicted to originate from **inside** of a road user's primary horizontal field of view (from eastern panel area only)	Reflecting panel areas within field of view are predicted to be screened by intervening terrain and existing vegetation	N/A	None	No

Table 2 *Geometric modelling results, assessment of impact significance, and mitigation recommendation/requirement – road receptors*

5.2.3 Screening Review

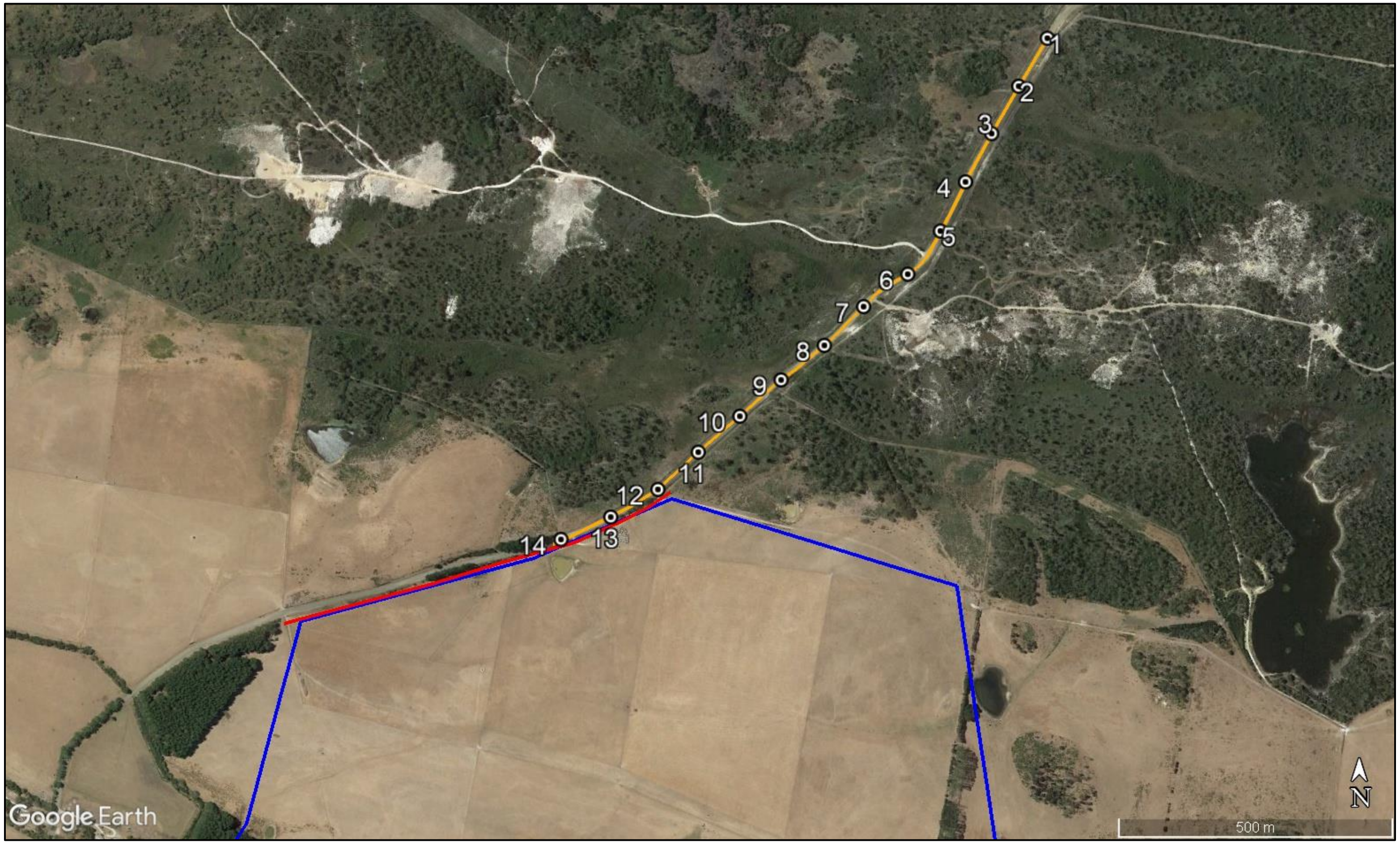

Figure 10 *Proposed screening (red) relative to location of road section 1-14*

Figure 11 *View towards eastern panel area from road receptor 38 (level of screening is representative of receptors 38-48) – streetview image*

5.2.4 Conclusions

No significant impacts are predicted on any of the modelled road sections, because there are significant mitigating factors from the following:

- Solar reflections are possible from panels **outside** of a road user's primary horizontal field of view (50 degrees either side of the direction of travel);
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal/fleeting views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between road user and closest reflecting panel.

5.3 Dwellings

5.3.1 Impact Significance Methodology

The key considerations for residential dwellings are:

- Whether a reflection is predicted to be experienced in practice;
- The duration of the predicted effects, relative to thresholds of:
    - 3 months per year;
    - 60 minutes on any given day.

Where solar reflections are not geometrically possible or the reflecting panels are predicted to be significantly obstructed from view, no impact is predicted, and mitigation is not required.

Where solar reflections are experienced for less than three months per year and less than 60 minutes on any given day, or the closest reflecting panel is over 1km from the dwelling, the impact significance is low, and mitigation is not recommended.

Where reflections are predicted to be experienced for more than three months per year **and/or** for more than 60 minutes on any given day, expert assessment of the following mitigating factors is required to determine the impact significance and mitigation requirement:

- Whether visibility is likely from all storeys – the ground floor is typically considered the main living space and has a greater significance with respect to residential amenity;
- The separation distance to the panel area – larger separation distances reduce the proportion of an observer's field of view that is affected by glare;
- Whether the dwelling appears to have windows facing the reflecting area – factors that restrict potential views of a reflecting area reduce the level of impact;
- The position of the Sun – effects that coincide with direct sunlight appear less prominent than those that do not.

If following consideration of the relevant factors, the solar reflections do not remain significant, the impact significance is low, and mitigation is not recommended. If following consideration of the relevant factors, the solar reflections remain significant, then the impact significance is moderate, and mitigation is recommended.

If effects last for more than three months per year and for more than 60 minutes on any given day, and there are no mitigating factors, the impact significance is high, and mitigation is required.

5.3.2 Geometric Modelling Results

The modelling has shown that solar reflections are geometrically possible (without consideration of screening) towards five (R1 – R5) of the seven assessed dwelling receptors, as shown in Figure 12 on the following page. The modelling results for dwelling receptors are analysed in Table 3 on page 37.

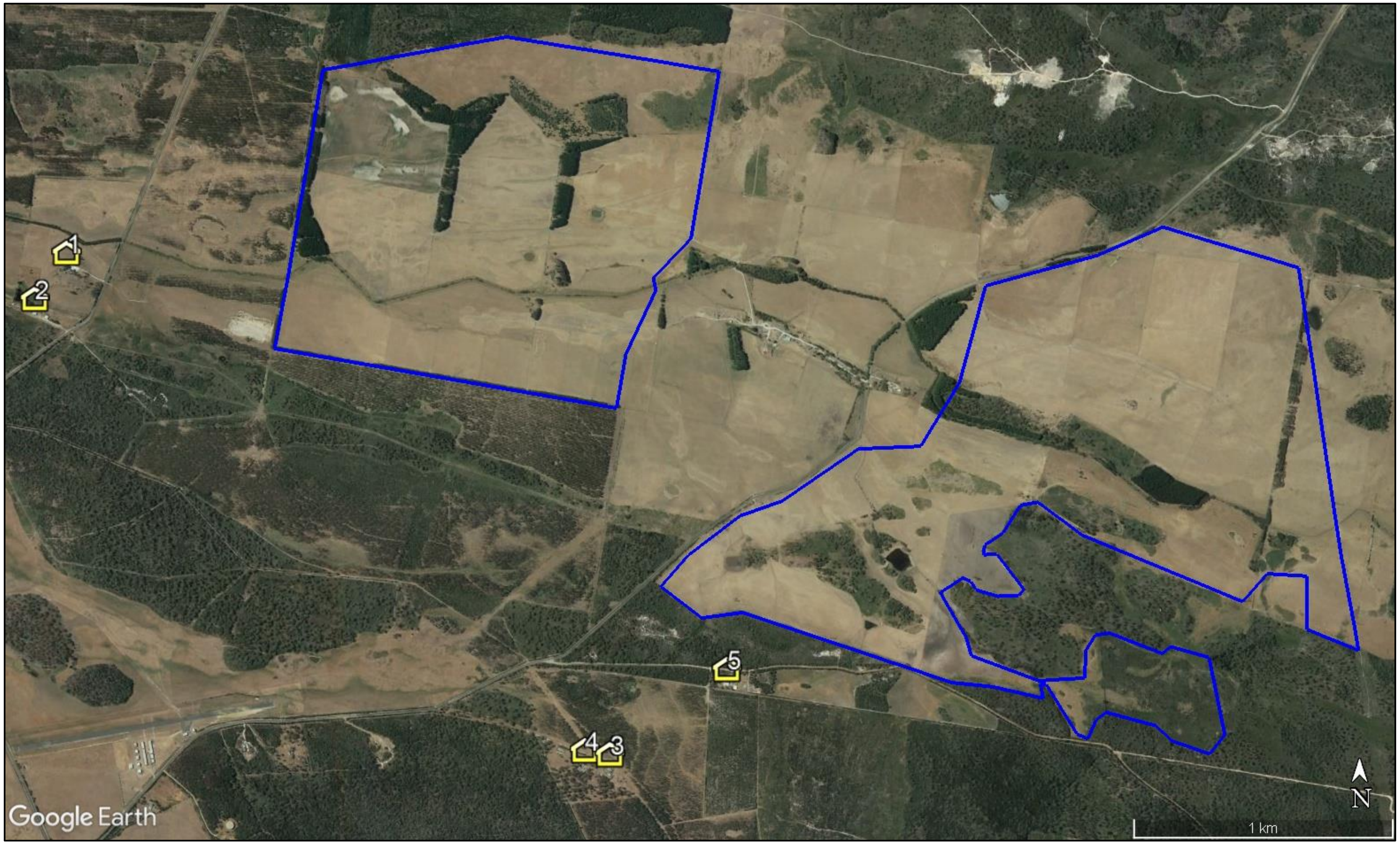

Figure 12 *Dwellings towards which solar reflections are geometrically possible – aerial image*

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
R1	Solar reflections predicted for **less** than 60 minutes on any given day and for **more** than 3 months of the year from both panel areas	Significant existing screening not identified Developer proposing screening at 5-6m high (see Figure 13) Marginal views of reflecting panels may be possible considering the location of the proposed screening	Closest reflecting panels are approximately 840m away, majority of reflecting area is outside of 1km All reflections are in early morning when the Sun is low in the sky and therefore likely to coincide with direct sunlight	Low	No
R2	Solar reflections predicted for **less** than 60 minutes on any given day and for **less** than 3 months of the year from the western panel area only	Some existing screening (terrain, vegetation and buildings) Views of the reflecting panels are predicted	Closest reflecting panels are approximately 950m away, majority of reflecting area is outside of 1km All reflections are in early morning when the Sun is low in the sky and therefore likely to coincide with direct sunlight	Low	No

Receptor	Geometric modelling results (without consideration of screening)	Identified screening and predicted visibility (desk-based review)	Relevant Factors	Predicted Impact Classification	Further Mitigation Recommended/Required?
R3	Solar reflections predicted for **less** than 60 minutes on any given day and for **more** than 3 months of the year from the eastern panel area	All reflecting panels within 1km are expected to be significantly screened by intervening vegetation and terrain (see Figure 14)	N/A	Low	No
R4	Solar reflections predicted for **less** than 60 minutes on any given day and for **more** than 3 months of the year from the eastern panel area	All reflecting panels within 1km are expected to be significantly screened by intervening vegetation and terrain (see Figure 14)	N/A	Low	No
R5	Solar reflections predicted for **less** than 60 minutes on any given day and for **more** than 3 months of the year from both panel areas	All reflecting panels are expected to be significantly screened by intervening vegetation and terrain (see Figure 15)	N/A	None	No

Table 3 *Geometric modelling results, assessment of impact significance, and mitigation recommendation/requirement – dwelling receptors*

5.3.3 Screening Review

Figure 13 *Proposed screening (red) relative to location of R1 (zoomed view outlined in yellow)*

Figure 14 *Photomontage 04 from Landscape and Visual Impact Assessment Appendix C*[9] *(shows view towards the eastern panel area from R3)*

[9] 2249_Appendix C_RevD_20230831_MED.pdf

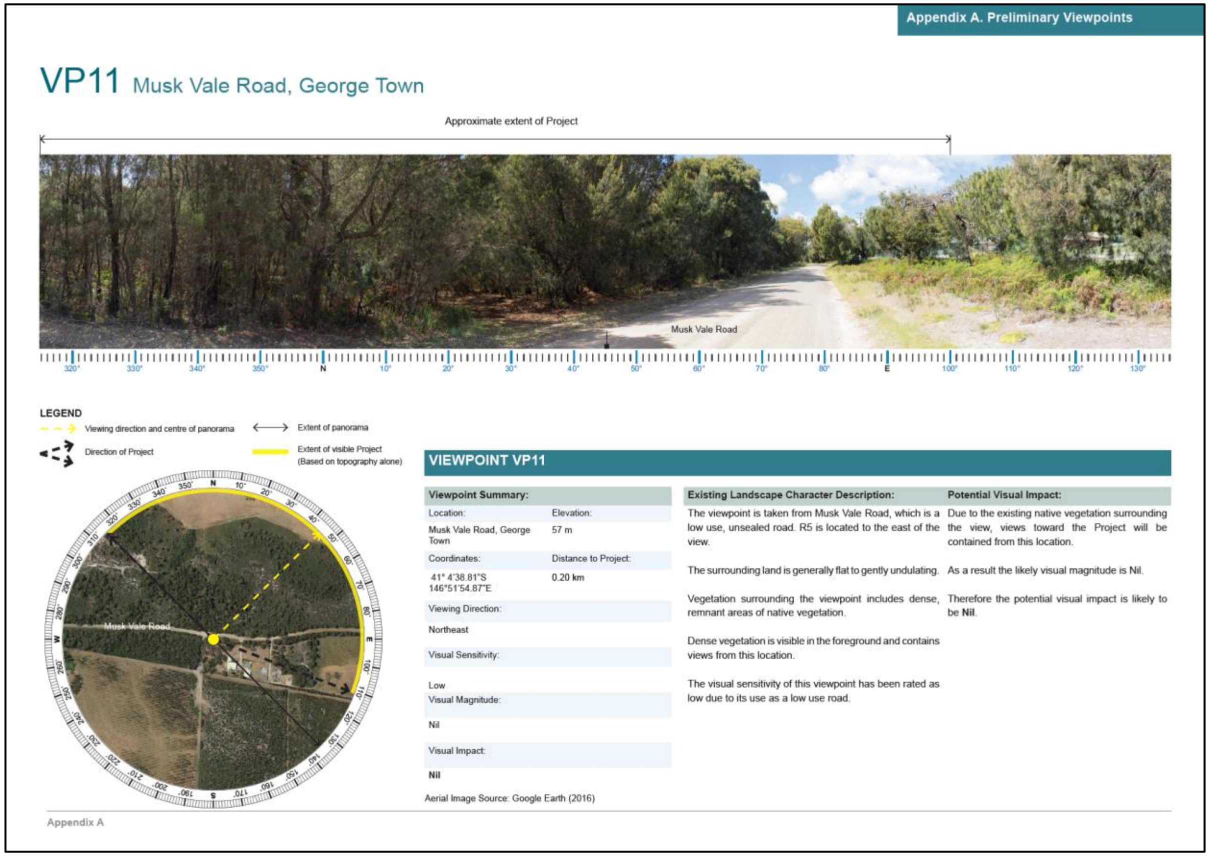

Figure 15 *VP11 Viewpoint analysis from Landscape and Visual Impact Assessment Appendix A*[10] *(shows significant vegetation screening for R5)*

[10] 2249_Appendix A_RevD_20230831_MED.pdf

5.3.4 Conclusions

No significant impacts are predicted on the assessed dwellings, because there are significant mitigating factors from the following:

- Solar reflections are possible for **less** than 60 minutes on any given day and for **less** than 3 months of the year;
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between dwelling observer and closest reflecting panel.

6 HIGH-LEVEL CONSIDERATION OF AVIATION IMPACTS

6.1 Overview

George Town Airport is understood to be an unlicensed airstrip where non-commercial aircraft may operate. It is located approximately 1.5km away from the proposed development at its closest point. The George Town Airport has been contacted in relation to the proposal and no concerns have been raised in relation to glint and glare or other matters.

The Civil Aviation Safety Authority (CASA) were also consulted with regards to the proposed development. Their response was as follows:

"As we currently do not have any guidance material of our own at this point in time, CASA applies the United States FAA guidelines with regard to solar panel installations near or on airports. They recently updated their guidance to state that the glare from solar panels is insufficient to be a hazard to aircraft on approach or departure from an airport. Their primary focus is now on solar installations near airports with Air Traffic Control Towers (ATCT). Glare from solar panels can prevent the air traffic controllers from seeing aircraft in the circuit area at the airport which can result in a hazardous situation. Airservices controlled ATCT are usually limited to the larger airports such as Hobart and Launceston etc.

As Georgetown does not have an Air Traffic Control Tower, CASA does not consider the solar installation near Georgetown Airport, as proposed in your email below to be a hazard to aircraft operations and we have no objection to the proposal as presented."

On the basis of the consultation detailed above, technical modelling is not recommended.

7 CONCLUSIONS

7.1 Roads

The modelling predicts that solar reflections are possible (without consideration of screening) towards a 1.3km section and a 1.1km section of Soldiers Settlement Road.

No significant impacts are predicted on any of the modelled road sections, because there are significant mitigating factors from the following:

- Solar reflections are possible from panels **outside** of a road user's primary horizontal field of view (50 degrees either side of the direction of travel);
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal/fleeting views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between road user and closest reflecting panel.

7.2 Dwellings

The modelling predicts that solar reflections are possible (without consideration of screening) towards five of the seven assessed dwelling locations.

No significant impacts are predicted on the assessed dwellings, because there are significant mitigating factors from the following:

- Solar reflections are possible for **less** than 60 minutes on any given day and for **less** than 3 months of the year;
- There is significant screening such that views of reflecting panels are not expected to be possible in practice;
- There is screening such that reflections will be filtered and only marginal views of reflecting panels are expected to be possible;
- Reflections coinciding with direct sunlight;
- There is a significant clearance distance between dwelling observer and closest reflecting panel.

APPENDIX A – OVERVIEW OF GLINT AND GLARE GUIDANCE

Overview

This section presents details regarding the relevant guidance and studies with respect to the considerations and effects of solar reflections from solar panels, known as 'Glint and Glare'.

This is not a comprehensive review of the data sources, rather it is intended to give an overview of the important parameters and considerations that have informed this assessment.

UK Planning Policy[11]

Renewable and Low Carbon Energy

The National Planning Policy Framework under the planning practice guidance for Renewable and Low Carbon Energy[12] (specifically regarding the consideration of solar farms, paragraph 013) states:

'What are the particular planning considerations that relate to large scale ground-mounted solar photovoltaic Farms?

The deployment of large-scale solar farms can have a negative impact on the rural environment, particularly in undulating landscapes. However, the visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively.

Particular factors a local planning authority will need to consider include:

…

- *the proposal's visual impact, the effect on landscape of glint and glare (see guidance on landscape assessment) and on* ***neighbouring uses and aircraft safety****;*
- *the extent to which there may be additional impacts if solar arrays follow the daily movement of the sun;*

…

The approach to assessing cumulative landscape and visual impact of large scale solar farms is likely to be the same as assessing the impact of wind turbines. However, in the case of ground-mounted solar panels it should be noted that with effective screening and appropriate land topography the area of a zone of visual influence could be zero.'

[11] Although this might not be strictly applicable to the proposed development, it has been used as a reference point for developments internationally.

[12] Renewable and low carbon energy, UK Ministry of Housing, Communities & Local Government, date: 18 June 2015, last updated 14 August 2023, accessed on: 29/08/2023

Draft National Policy Statement for Renewable Energy Infrastructure

The Draft National Policy Statement for Renewable Energy Infrastructure (EN-3)[13] sets out the primary policy for decisions by the Secretary of State for nationally significant renewable energy infrastructure. Sections 3.10.93-97 state:

'3.10.93 Solar panels are specifically designed to absorb, not reflect, irradiation.[14] However, solar panels may reflect the sun's rays at certain angles, causing glint and glare. Glint is defined as a momentary flash of light that may be produced as a direct reflection of the sun in the solar panel. Glare is a continuous source of excessive brightness experienced by a stationary observer located in the path of reflected sunlight from the face of the panel. The effect occurs when the solar panel is stationed between or at an angle of the sun and the receptor.

3.10.94 Applicants should map receptors to qualitatively identify potential glint and glare issues and determine if a glint and glare assessment is necessary as part of the application.

3.10.95 When a quantitative glint and glare assessment is necessary, applicants are expected to consider the geometric possibility of glint and glare affecting nearby receptors and provide an assessment of potential impact and impairment based on the angle and duration of incidence and the intensity of the reflection.

3.10.96 The extent of reflectivity analysis required to assess potential impacts will depend on the specific project site and design. This may need to account for 'tracking' panels if they are proposed as these may cause differential diurnal and/or seasonal impacts.

3.10.97 When a glint and glare assessment is undertaken, the potential for solar PV panels, frames and supports to have a combined reflective quality may need to be assessed, although the glint and glare of the frames and supports is likely to be significantly less than the panels.'

The EN-3 does not state which receptors should be considered as part of a quantitative glint and glare assessment. Based on Pager Power's extensive project experience, typical receptors include residential dwellings, road users, aviation infrastructure, and railway infrastructure.

Sections 3.10.125-127 state:

3.10.125 Applicants should consider using, and in some cases the Secretary of State may require, solar panels to comprise of (or be covered with) anti-glare/anti-reflective coating with a specified angle of maximum reflection attenuation for the lifetime of the permission.

3.10.126 Applicants may consider using screening between potentially affected receptors and the reflecting panels to mitigate the effects.

3.10.127 Applicants may consider adjusting the azimuth alignment of or changing the elevation tilt angle of a solar panel, within the economically viable range, to alter the angle of incidence. In practice

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[13] Draft National Policy Statement for Renewable Energy Infrastructure (EN-3), Department for Energy Security & Net Zero, date: March 2023, accessed on: 05/04/2023.

[14] Most commercially available solar panels are designed with anti-reflective glass or are produced with anti-reflective coating and have a reflective capacity that is generally equal to or less hazardous than other objects typically found in the outdoor environment, such as bodies of water or glass buildings.

this is unlikely to remove the potential impact altogether but in marginal cases may contribute to a mitigation strategy.

The mitigation strategies listed within the EN-3 are relevant strategies that are frequently utilised to eliminate or reduce glint and glare effects towards surrounding observers. The most common form of mitigation is the implementation of screening along the site boundary.

Sections 3.10.149-150 state:

3.10.149 Solar PV panels are designed to absorb, not reflect, irradiation. However, the Secretary of State should assess the potential impact of glint and glare on nearby homes, motorists, public rights of way, and aviation infrastructure (including aircraft departure and arrival flight paths).

3.10.150 Whilst there is some evidence that glint and glare from solar farms can be experienced by pilots and air traffic controllers in certain conditions, there is no evidence that glint and glare from solar farms results in significant impairment on aircraft safety. Therefore, unless a significant impairment can be demonstrated, the Secretary of State is unlikely to give any more than limited weight to claims of aviation interference because of glint and glare from solar farms.

The latest version of the draft EN-3 goes some way in referencing that the issue is more complex than presented in the previous issue; though, this is still unlikely to be welcomed by aviation stakeholders, who will still request a glint and glare assessment on the basis that glare may lead to impact upon aviation safety. It is possible that the final issue of the policy will change in light of further consultation responses from aviation stakeholders.

Finally, the EN-3 relates solely to nationally significant renewable energy infrastructure and therefore does not apply to all planning applications for solar farms.

Assessment Process – Ground-Based Receptors

No process for determining and contextualising the effects of glint and glare has been determined when assessing the impact of solar reflections upon surrounding roads and dwellings. Therefore, the Pager Power approach is to determine whether a reflection from the proposed solar development is geometrically possible and then to compare the results against the relevant guidance/studies to determine whether the reflection is significant.

The Pager Power approach has been informed by the policy presented above, current studies (presented in Appendix B) and stakeholder consultation. Further information can be found in Pager Power's Glint and Glare Guidance document[15] which was produced due to the absence of existing guidance and a specific standardised assessment methodology.

[15] Pager Power Glint and Glare Guidance, Fourth Edition, September 2022.

APPENDIX B – OVERVIEW OF GLINT AND GLARE STUDIES

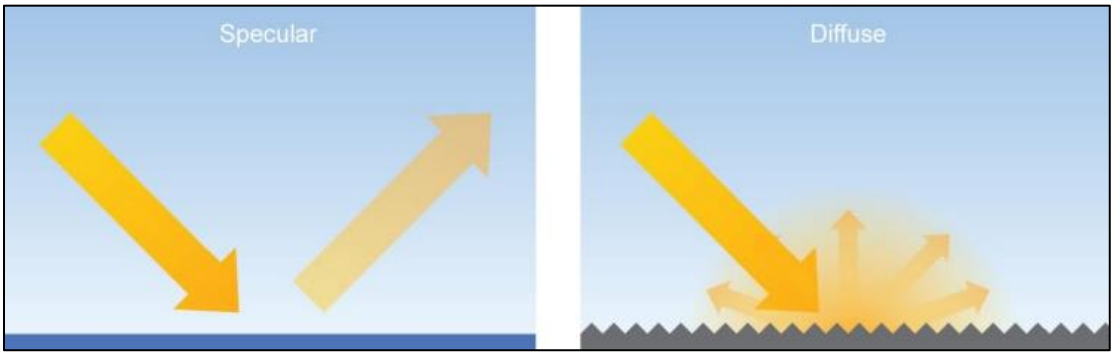
Overview

Studies have been undertaken assessing the type and intensity of solar reflections from various surfaces including solar panels and glass. An overview of these studies is presented below.

The guidelines presented are related to aviation safety. The results are applicable for the purpose of this analysis.

Reflection Type from Solar Panels

Based on the surface conditions reflections from light can be specular and diffuse. A specular reflection has a reflection characteristic similar to that of a mirror; a diffuse will reflect the incoming light and scatter it in many directions. The figure below, taken from the FAA guidance[16], illustrates the difference between the two types of reflections. Because solar panels are flat and have a smooth surface most of the light reflected is specular, which means that incident light from a specific direction is reradiated in a specific direction.



Specular and diffuse reflections

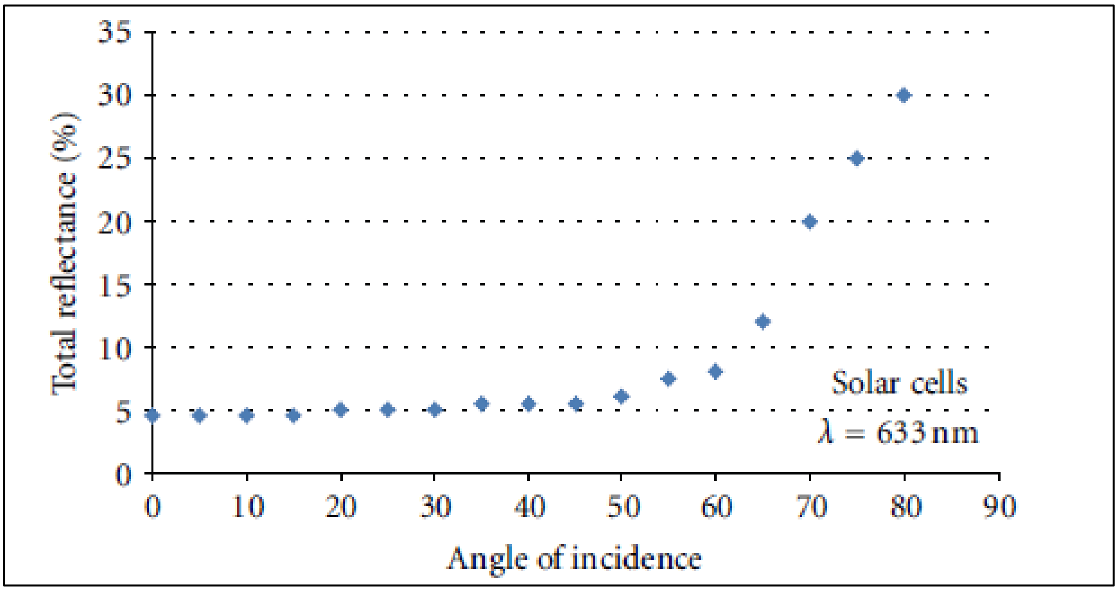
[16] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 08/12/2021.

Solar Reflection Studies

An overview of content from identified solar panel reflectivity studies is presented in the subsections below.

Evan Riley and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems"

Evan Riley and Scott Olson published in 2011 their study titled: *A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems*[17]". They researched the potential glare that a pilot could experience from a 25-degree fixed tilt PV system located outside of Las Vegas, Nevada. The theoretical glare was estimated using published ocular safety metrics which quantify the potential for a postflash glare after-image. This was then compared to the postflash glare after-image caused by smooth water. The study demonstrated that the reflectance of the solar cell varied with angle of incidence, with maximum values occurring at angles close to 90 degrees. The reflectance values varied from approximately 5% to 30%. This is shown on the figure below.



Total reflectance % when compared to angle of incidence

The conclusions of the research study were:

- The potential for hazardous glare from flat-plate PV systems is similar to that of smooth water;
- Portland white cement concrete (which is a common concrete for runways), snow, and structural glass all have a reflectivity greater than water and flat plate PV modules.

[17] Evan Riley and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems," ISRN Renewable Energy, vol. 2011, Article ID 651857, 6 pages, 2011. doi:10.5402/2011/651857

FAA Guidance – "Technical Guidance for Evaluating Selected Solar Technologies on Airports"[18]

The 2018 FAA Guidance included a diagram which illustrates the relative reflectance of solar panels compared to other surfaces. The figure shows the relative reflectance of solar panels compared to other surfaces. Surfaces in this figure produce reflections which are specular and diffuse. A specular reflection (those made by most solar panels) has a reflection characteristic similar to that of a mirror. A diffuse reflection will reflect the incoming light and scatter it in many directions. A table of reflectivity values, sourced from the figure within the FAA guidance, is presented below.

Surface	Approximate Percentage of Light Reflected[19]
Snow	80
White Concrete	77
Bare Aluminium	74
Vegetation	50
Bare Soil	30
Wood Shingle	17
Water	5
Solar Panels	5
Black Asphalt	2

Relative reflectivity of various surfaces

Note that the data above does not appear to consider the reflection type (specular or diffuse).

An important comparison in this table is the reflectivity compared to water which will produce a reflection of very similar intensity when compared to that from a solar panel. The study by Riley and Olsen study (2011) also concludes that still water has a very similar reflectivity to solar panels.

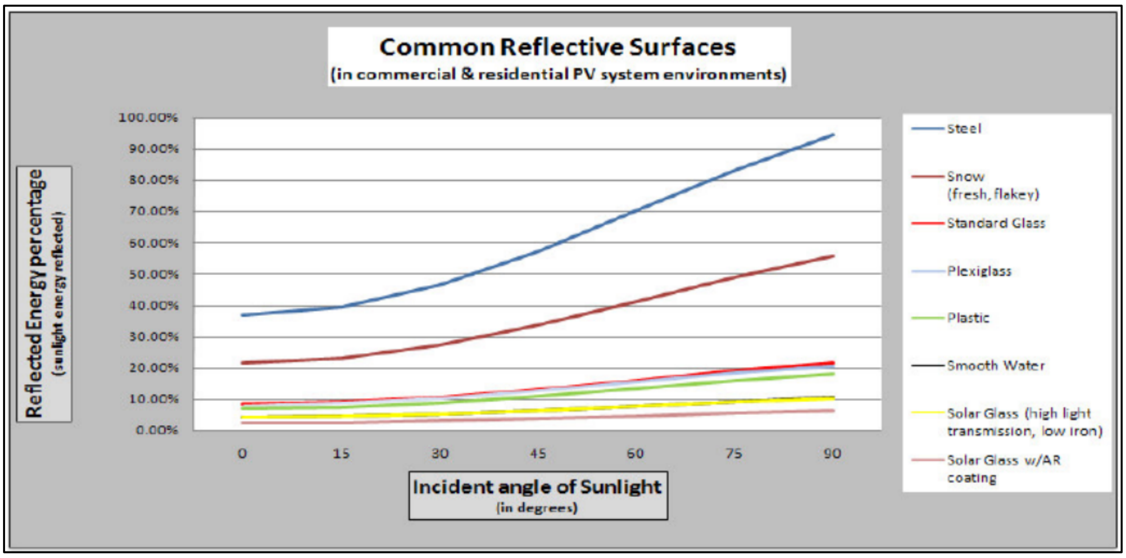
[18] Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration (FAA), date: 04/2018, accessed on: 08/12/2021.

[19] Extrapolated data, baseline of 1,000 W/m^2 for incoming sunlight.

SunPower Technical Notification (2009)

SunPower published a technical notification[20] to '*increase awareness concerning the possible glare and reflectance impact of PV Systems on their surrounding environment*'.

The figure presented below shows the relative reflectivity of solar panels compared to other natural and manmade materials including smooth water, standard glass and steel.



Common reflective surfaces

The results, similarly to those from Riley and Olsen study (2011) and the FAA (2010), show that solar panels produce a reflection that is less intense than those of '*standard glass and other common reflective surfaces*'.

With respect to aviation and solar reflections observed from the air, SunPower has developed several large installations near airports or on Air Force bases. It is stated that these developments have all passed FAA or Air Force standards with all developments considered "No Hazard to Air Navigation". The note suggests that developers discuss any possible concerns with stakeholders near proposed solar farms.

[20] Source: Technical Support, 2009. SunPower Technical Notification – Solar Module Glare and Reflectance.

APPENDIX C – OVERVIEW OF SUN MOVEMENTS AND RELATIVE REFLECTIONS

The Sun's position in the sky can be accurately described by its azimuth and elevation. Azimuth is a direction relative to true north (horizontal angle i.e. from left to right) and elevation describes the Sun's angle relative to the horizon (vertical angle i.e. up and down).

The Sun's position can be accurately calculated for a specific location. The following data being used for the calculation:

- Time.
- Date.
- Latitude.
- Longitude.

The following is true at the location of the solar development:

- The Sun rises highest on 21 December (longest day).
- On 21 June, the maximum elevation reached by the Sun is at its lowest (shortest day).

APPENDIX D – GLINT AND GLARE IMPACT SIGNIFICANCE

Overview

The significance of glint and glare will vary for different receptors. The following section presents a general overview of the significance criteria with respect to experiencing a solar reflection.

Impact Significance Definition

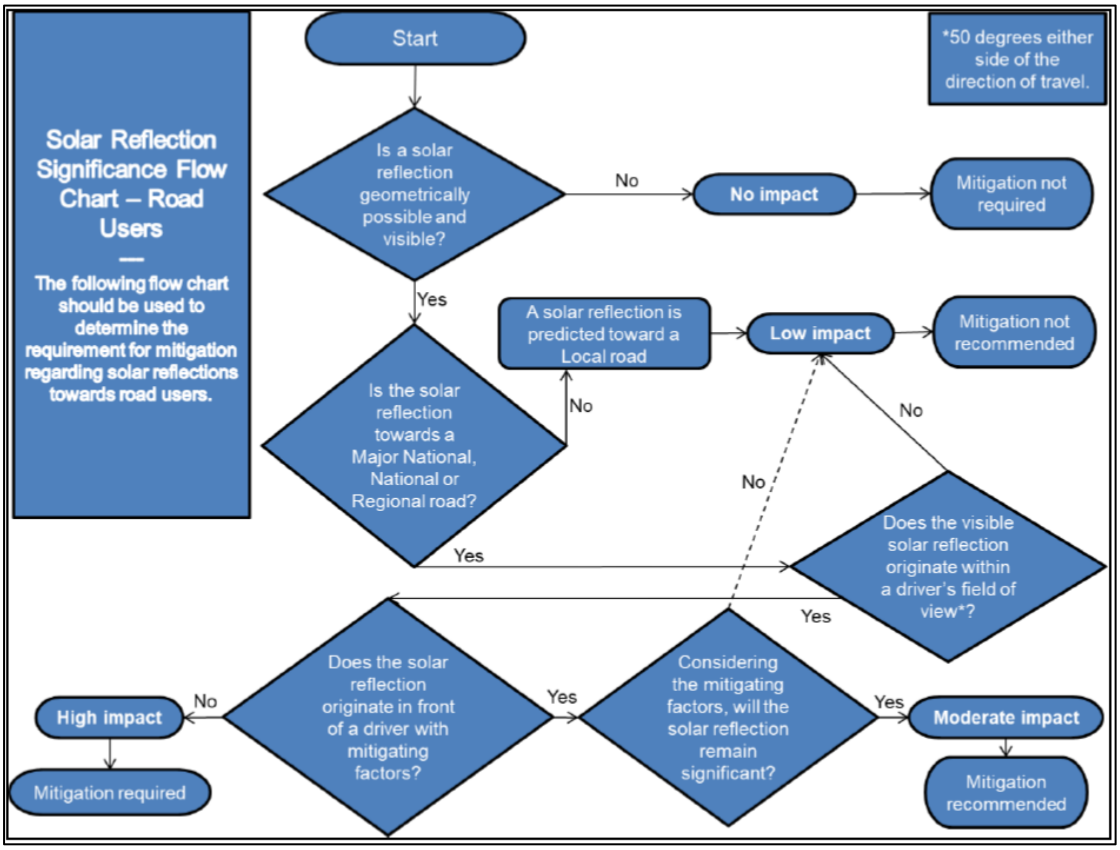
The table below presents the recommended definition of 'impact significance' in glint and glare terms and the requirement for mitigation under each.

Impact Significance	Definition	Mitigation Requirement
No Impact	A solar reflection is not geometrically possible or will not be visible from the assessed receptor.	No mitigation required.
Low	A solar reflection is geometrically possible however any impact is considered to be small such that mitigation is not required e.g. intervening screening will limit the view of the reflecting solar panels.	No mitigation required.
Moderate	A solar reflection is geometrically possible and visible however it occurs under conditions that do not represent a worst-case.	Whilst the impact may be acceptable, consultation and/or further analysis should be undertaken to determine the requirement for mitigation.
Major	A solar reflection is geometrically possible and visible under conditions that will produce a significant impact. Mitigation and consultation is recommended.	Mitigation will be required if the proposed solar development is to proceed.

Impact significance definition

Assessment Process for Road Receptors

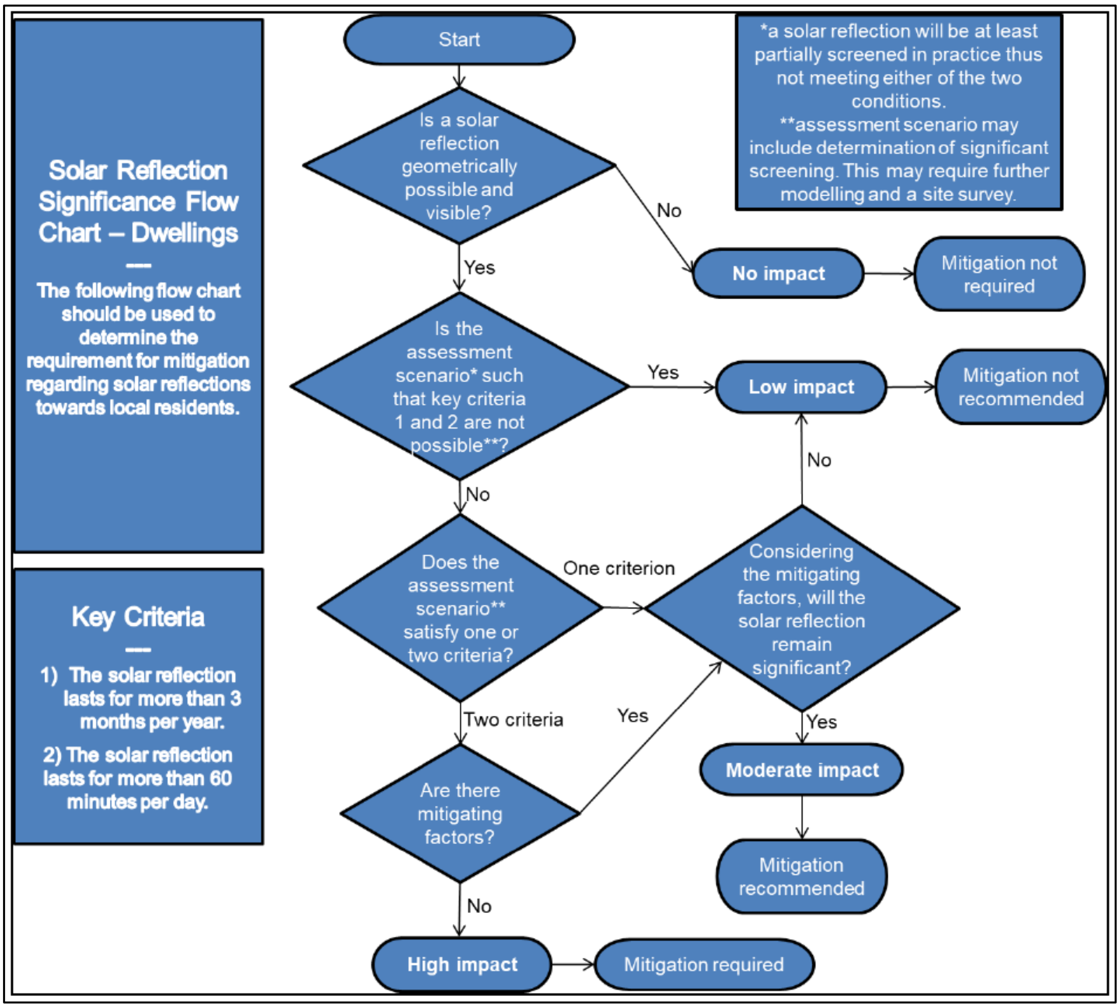
The flow chart presented below has been followed when determining the mitigation requirement for road receptors.



Road receptor mitigation requirement flow chart

Assessment Process for Dwelling Receptors

The flow chart presented below has been followed when determining the mitigation requirement for dwelling receptors.



Dwelling receptor mitigation requirement flow chart

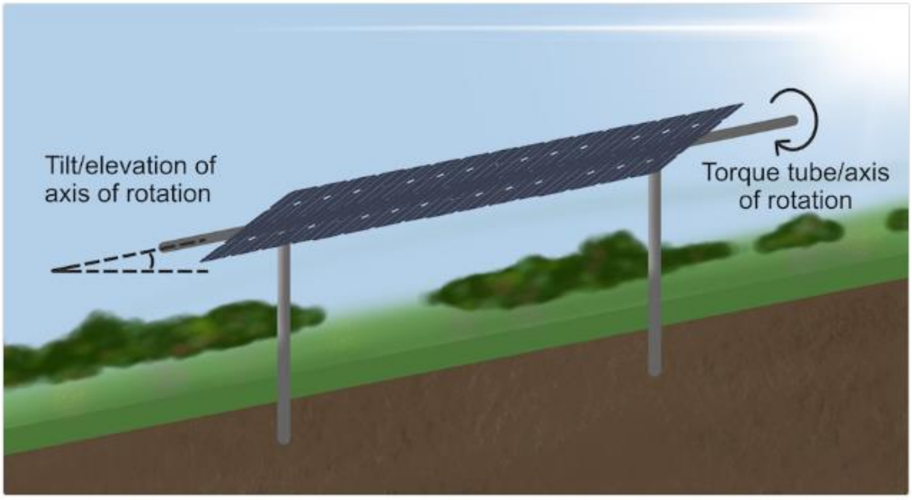
APPENDIX E – REFLECTION CALCULATIONS METHODOLOGY

Forge Reflection Calculations Methodology

Extracts taken from the Forge Solar Model.

Tracking System Parameters

Single-axis module tracking systems are described by a unique set of parameters. These angular inputs model the tracking axis, rotation range and backtracking behavior. Dual-axis module tracking systems are assumed to track the sun at all times.



Single-axis tracking system with torque tube tilted due to geography

Tilt of tracking axis (°)
Tilt above flat ground of axis over which panels rotate (e.g. torque tube). System on flat, level ground would have axis tilt of 0°.

Orientation of tracking axis (°)
Azimuthal angle of axis over which panels rotate. Angle represents the facing of the axis and system. For example, typical tracking system in northern hemisphere has tracking axis oriented north-south with an orientation of 180°, allowing panels to rotate east-west with potential south-facing tilt. Typical tracking system in southern hemisphere runs south-north with axis orientation of 0°, yielding east-west rotation with potential north-facing tilt.

Offset angle of module (°)
Additional tilt angle of PV module elevated above tracking axis/torque tube. Offset angle is measured from the torque tube.

Maximum tracking angle (°)
Maximum angle of rotation of tracking system in one direction. For example, a typical system with a 120° range of rotation has a *max tracking angle* of 60° (east/west).

Resting angle (°)
Angle of rotation of panels when sun is outside tracking range. Used to model backtracking. Panels will revert to the position described by this rotation angle at all times when the sun is outside the rotation range. Setting this equal to the *maximum tracking angle* implies the panels do not backtrack.

ForgeSolar utilizes a simplified model of backtracking which assumes panels instantaneously revert to the *resting angle* whenever the sun is outside the rotation range. For example, panels with *max tracking angle* of 60° and *resting angle* of 0° would lie flat from sunrise until the sun enters the rotation range, and immediately after the sun leaves the rotation range until sunset daily.

Tracking System Parameters

APPENDIX F – ASSESSMENT LIMITATIONS AND ASSUMPTIONS

Forge's Sandia National Laboratories' (SGHAT) Model[21]

Summary of assumptions and abstractions required by the SGHAT/ForgeSolar analysis methodology

1. Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
2. Result data files and plots are now retained for two years after analysis completion. Files should be downloaded and saved if additional persistence is required.
3. 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.
4. Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects analyses of path receptors.
5. 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.
6. 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.)
7. The algorithm assumes that the PV array is aligned with a plane defined by the total heights of the coordinates outlined in the Google map. For more accuracy, the user should perform runs using minimum and maximum values for the vertex heights to bound the height of the plane containing the solar array. Doing so will expand the range of observed solar glare when compared to results using a single height value.
8. The algorithm does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
9. 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.
10. 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.
11. 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.
12. 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.
13. Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
14. Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
15. PV array tracking assumes the modules move instantly when tracking the sun, and when reverting to the rest position.

[21] https://www.forgesolar.com/help/#assumptions

APPENDIX G – RECEPTOR AND REFLECTOR AREA DETAILS

Terrain Height

Terrain Height is calculated from SRTM data, based on the coordinates of the point of interest.

Road Receptor Data

The table below presents the coordinates and altitudes for the assessed road receptors.

Location	Latitude (°)	Longitude (°)	Assessed Altitude (m) (amsl)
1	-41.054629	146.894148	49.91
2	-41.055403	146.893539	49.04
3	-41.056183	146.892945	49.28
4	-41.056974	146.892375	52.69
5	-41.057775	146.891833	52.89
6	-41.058479	146.891127	52.65
7	-41.059008	146.890171	52.22
8	-41.05964	146.889323	51.27
9	-41.060202	146.888393	44.72
10	-41.060796	146.887497	43.95
11	-41.061384	146.886594	41.69
12	-41.061995	146.885717	41.38
13	-41.062449	146.88469	40.22
14	-41.062819	146.883604	37.59
15	-41.063064	146.882457	36.79
16	-41.063279	146.881298	35.48
17	-41.063537	146.880155	34.17
18	-41.063787	146.879009	31.36
19	-41.063989	146.877846	29.99

Location	Latitude (°)	Longitude (°)	Assessed Altitude (m) (amsl)
20	-41.064285	146.876721	28.26
21	-41.064613	146.875609	27.84
22	-41.065135	146.874642	27.85
23	-41.065694	146.873707	26.67
24	-41.066293	146.872817	26.27
25	-41.067163	146.872557	27.15
26	-41.068049	146.872354	27.21
27	-41.068936	146.872151	29.15
28	-41.069689	146.871588	28.99
29	-41.070243	146.870648	28.57
30	-41.070785	146.869695	29.06
31	-41.071237	146.868673	28.79
32	-41.071478	146.867523	30.64
33	-41.071891	146.866474	33.28
34	-41.072408	146.865497	36.29
35	-41.072933	146.864529	39.41
36	-41.073532	146.863638	41.89
37	-41.074131	146.862747	46.21
38	-41.074731	146.861856	48.41
39	-41.07533	146.860965	51.76
40	-41.075928	146.860073	55.4
41	-41.076523	146.859178	56.97
42	-41.077026	146.858207	59.34
43	-41.077228	146.857043	59.23

Location	Latitude (°)	Longitude (°)	Assessed Altitude (m) (amsl)
44	-41.077566	146.855941	58.8
45	-41.077958	146.854867	56.81
46	-41.078364	146.853801	56.35
47	-41.078758	146.852729	54.31
48	-41.078824	146.852416	53.74

Road Receptor Data

Dwelling Receptor Data

The table below presents the coordinates for the assessed dwelling receptors.

Location	Latitude (°)	Longitude (°)	Assessed Altitude (m) (amsl)
1	-41.063563	146.835564	36.13
2	-41.065132	146.834076	30.18
3	-41.080847	146.860583	74.99
4	-41.080686	146.859464	73.6
5	-41.077933	146.865932	61.17
6	-41.067768	146.873492	30.2
7	-41.065907	146.869351	26.86

Dwelling Receptor Data

Modelled Western Panel Area

The boundary coordinates of the modelled western panel area are presented in the table below.

No.	Latitude (°)	Longitude (°)	No.	Latitude (°)	Longitude (°)
1	-41.066331	146.844909	6	-41.062383	146.86435
2	-41.068337	146.86096	7	-41.05672	146.865637
3	-41.066331	146.861389	8	-41.055523	146.855338
4	-41.06439	146.862547	9	-41.05672	146.847227
5	-41.063807	146.862333			

Modelled Western Panel Area

Modelled Eastern Panel Area

The boundary coordinates of the modelled eastern panel area are presented in the table below.

No.	Latitude (°)	Longitude (°)	No.	Latitude (°)	Longitude (°)
1	-41.074463	146.862655	26	-41.074333	146.876474
2	-41.07566	146.864843	27	-41.074851	146.877718
3	-41.075401	146.866474	28	-41.075045	146.879521
4	-41.077795	146.875916	29	-41.074721	146.879821
5	-41.078215	146.878877	30	-41.073168	146.877804
6	-41.078409	146.880508	31	-41.072715	146.878619
7	-41.077956	146.880164	32	-41.071551	146.879778
8	-41.077892	146.880465	33	-41.072715	146.882053
9	-41.079768	146.881752	34	-41.074463	146.88673
10	-41.0798	146.882353	35	-41.075207	146.889477
11	-41.078927	146.882353	36	-41.074171	146.890764
12	-41.078895	146.883211	37	-41.074074	146.89261
13	-41.079477	146.885529	38	-41.076177	146.892738
14	-41.080124	146.886344	39	-41.076662	146.894841
15	-41.080415	146.888318	40	-41.06343	146.891966
16	-41.079445	146.889477	41	-41.062168	146.885915
17	-41.077148	146.888104	42	-41.063106	146.883383
18	-41.076598	146.886215	43	-41.064141	146.877461
19	-41.076857	146.8857	44	-41.067701	146.876645
20	-41.076112	146.882911	45	-41.069771	146.874843
21	-41.076598	146.882181	46	-41.069739	146.871753
22	-41.077924	146.882181	47	-41.071486	146.868706
23	-41.077633	146.880121	48	-41.071874	146.86686

No.	Latitude (°)	Longitude (°)	No.	Latitude (°)	Longitude (°)
24	-41.076662	146.877074	49	-41.073233	146.864286
25	-41.074592	146.876001			

Modelled Eastern Panel Area

APPENDIX H – MODELLING RESULTS

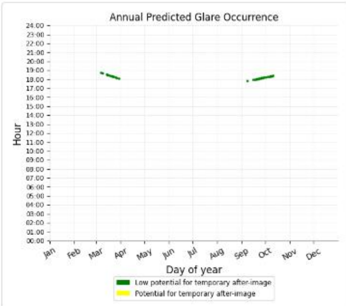
Full modelling results are available on request.

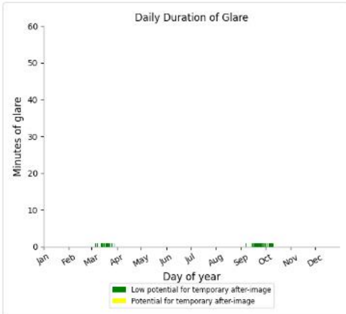
Roads

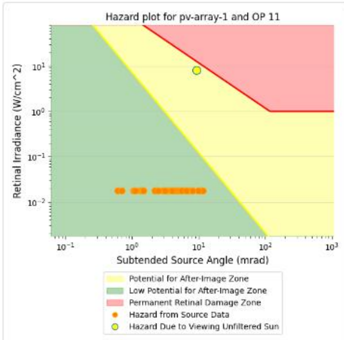
PV array 1: OP 11

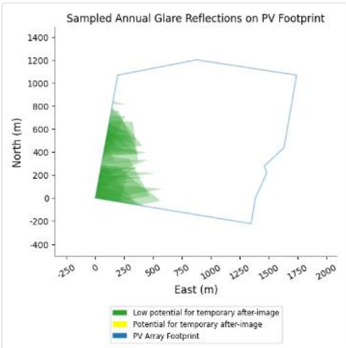
PV array is expected to produce the following glare for this receptor:

- 35 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.





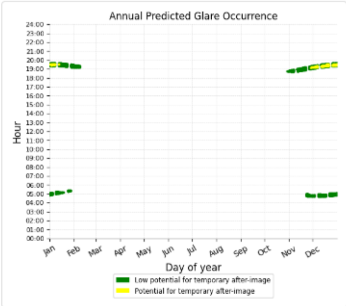


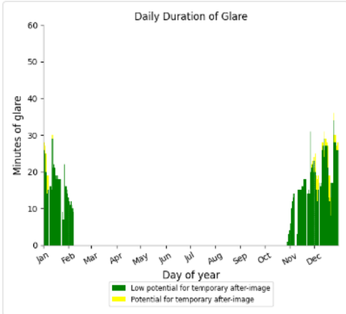


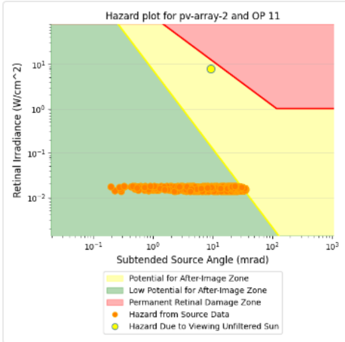
PV array 2: OP 11

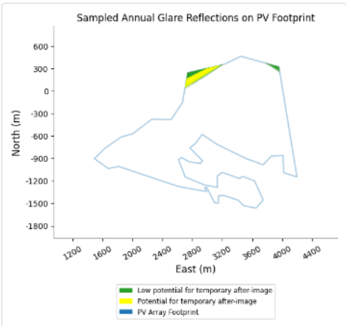
PV array is expected to produce the following glare for this receptor:

- 1,641 minutes of "green" glare with low potential to cause temporary after-image.
- 98 minutes of "yellow" glare with potential to cause temporary after-image.







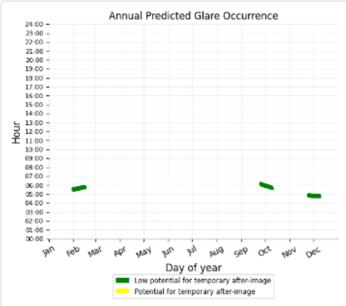


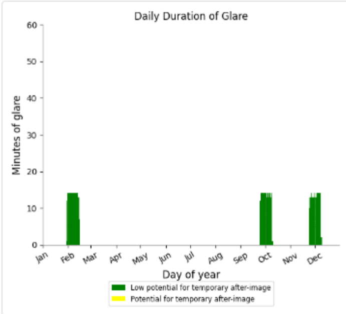
Dwellings

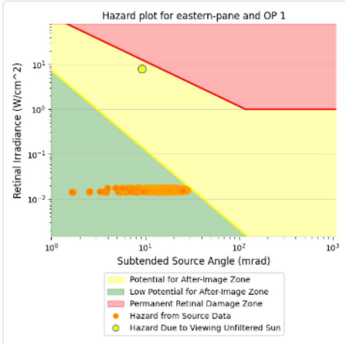
Eastern panel area: OP 1

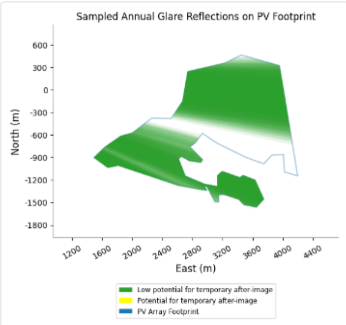
PV array is expected to produce the following glare for this receptor:

- 623 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.





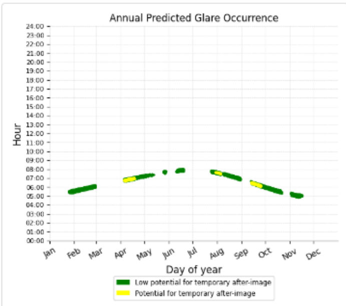


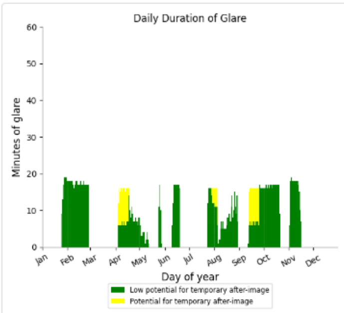


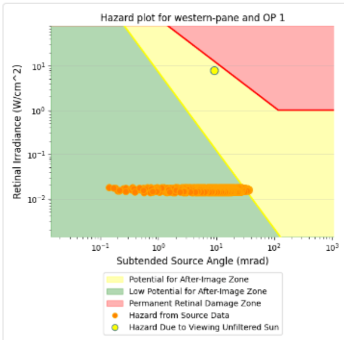
Western panel area: OP 1

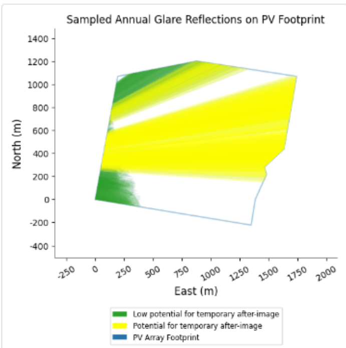
PV array is expected to produce the following glare for this receptor:

- 2,111 minutes of "green" glare with low potential to cause temporary after-image.
- 276 minutes of "yellow" glare with potential to cause temporary after-image.





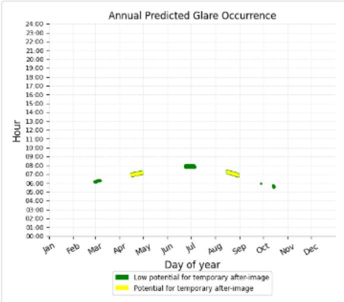


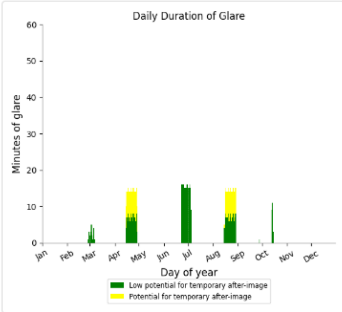


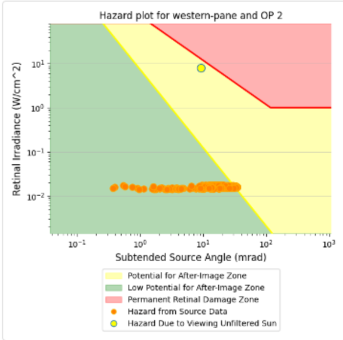
Western panel area: OP 2

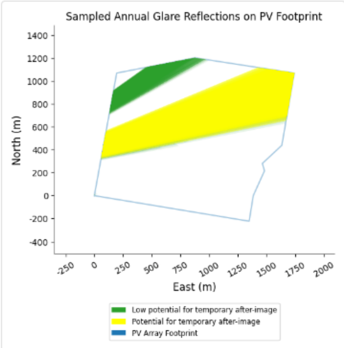
PV array is expected to produce the following glare for this receptor:

- 443 minutes of "green" glare with low potential to cause temporary after-image.
- 210 minutes of "yellow" glare with potential to cause temporary after-image.





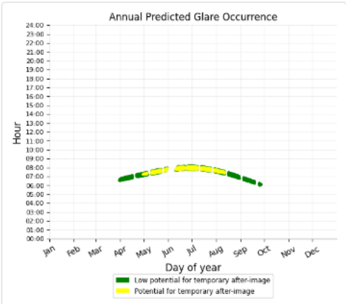


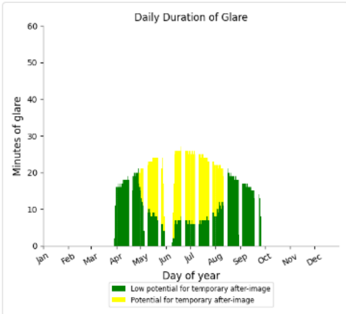


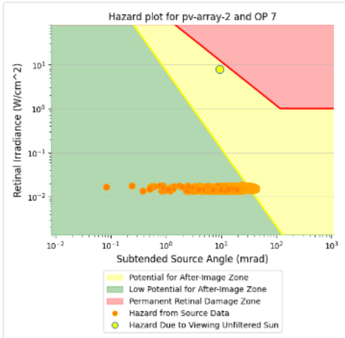
Eastern panel area: OP 3

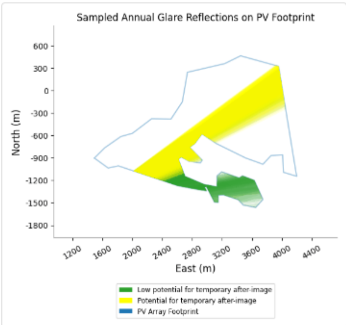
PV array is expected to produce the following glare for this receptor:

- 1,613 minutes of "green" glare with low potential to cause temporary after-image.
- 1,125 minutes of "yellow" glare with potential to cause temporary after-image.





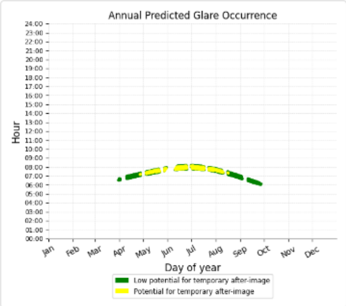


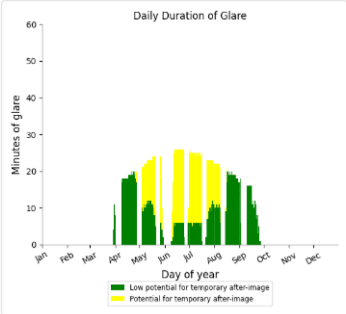


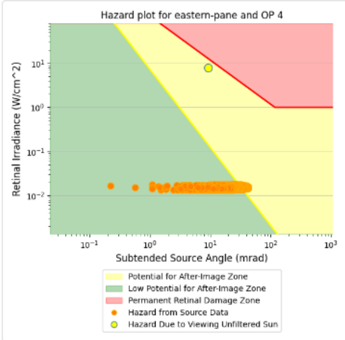
Eastern panel area: OP 4

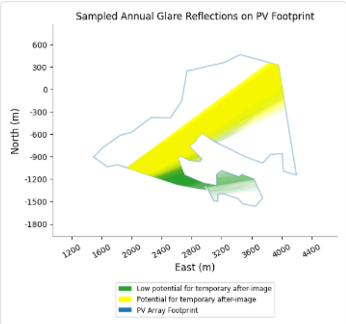
PV array is expected to produce the following glare for this receptor:

- 1,479 minutes of "green" glare with low potential to cause temporary after-image.
- 1,064 minutes of "yellow" glare with potential to cause temporary after-image.





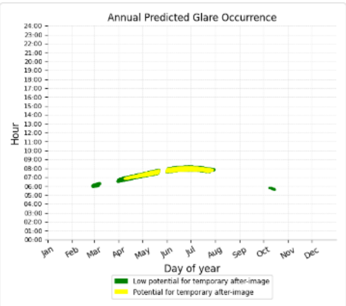


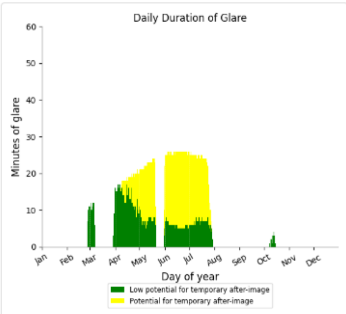


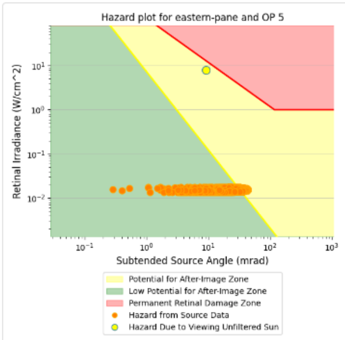
Eastern panel area: OP 5

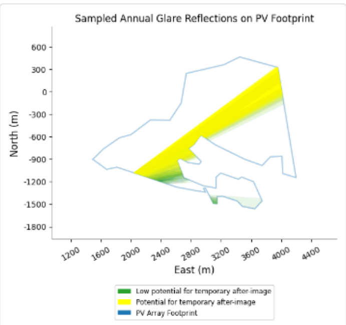
PV array is expected to produce the following glare for this receptor:

- 1,062 minutes of "green" glare with low potential to cause temporary after-image.
- 1,491 minutes of "yellow" glare with potential to cause temporary after-image.





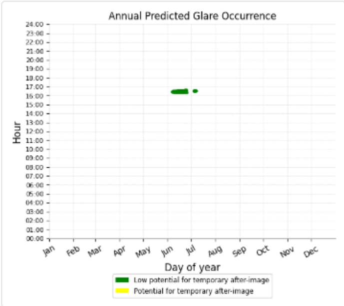


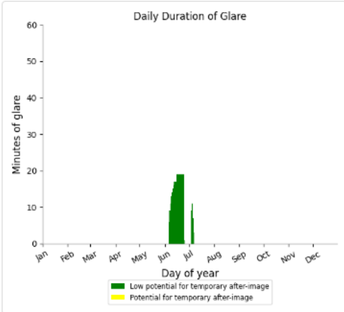


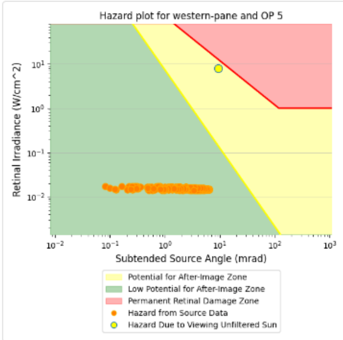
Western panel area: OP 5

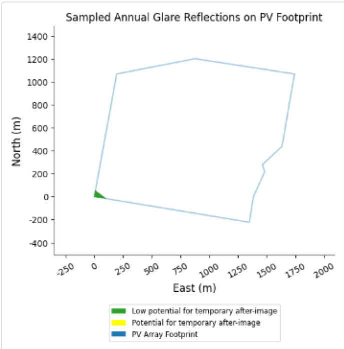
PV array is expected to produce the following glare for this receptor:

- 337 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









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