Green Hill Solar Farm

EN010170

Environmental Statement

Appendix 15.2: Green Hill B Ground-Based Receptor Results

Prepared by: Arthian

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Appendix 15.2: Green Hill Solar Farm - Green Hill B Ground-Based Receptor Results

For: Green Hill Solar Farm

Site: Green Hill B

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1. Introduction

1.1 Background

Green Hill Solar Farm Ltd (the Applicant) are involved in the development of a Nationally Significant Infrastructure Project (NSIP) solar scheme on land to the north of Northampton. The Scheme is made up of a disparate number of sites, incorporating ground mounted solar panels.

A Glint and Glare Assessment has been undertaken to evaluate the potential light-sensitive receptors which may be impacted by glint and glare from Green Hill Solar Farm (hereafter referred to as the 'Scheme').

This report presents the findings of the Glint and Glare Assessment for Green Hill B for ground-based receptors.

1.2 Glint & Glare

Reflectivity refers to light that is reflected off surfaces (e.g. glazed surfaces or areas of metal cladding). The potential effects of reflectivity are glint and glare. The Federal Aviation Administration's (FAA) *'Technical Guidance for Evaluating Selected Solar Technologies on Airports'* provides the following glint and glare definitions:

- *Glint – "a momentary flash of bright light"*
- *Glare – "a continuous source of bright light"*

These present an ocular hazard to light sensitive receptors such as road users, train drivers, occupants of nearby dwellings, pilots, and air-traffic control personnel, as they can cause a brief, temporary or permanent eye damage (ocular impact categories and significance further discussed in Section 4.3).

In general, solar photovoltaic (PV) systems are constructed of dark, light absorbing material designed to maximise light adsorption and minimise reflection. However, the glass surfaces of solar PV systems also reflect sunlight to varying degrees throughout the day and year, based on the incidence angle of the sun relative to ground-based receptors. Lower incidence angles amount to increased reflection.

As such, the amount of light reflected off a solar PV panel surface or an array of solar panels depends on a variety of factors to include:

- The amount of sunlight hitting the surface;
- Its surface reflectivity;
- Its geographic location;
- Time of the year;
- Cloud coverage; and
- Surface orientation.

1.3 Scope of Work

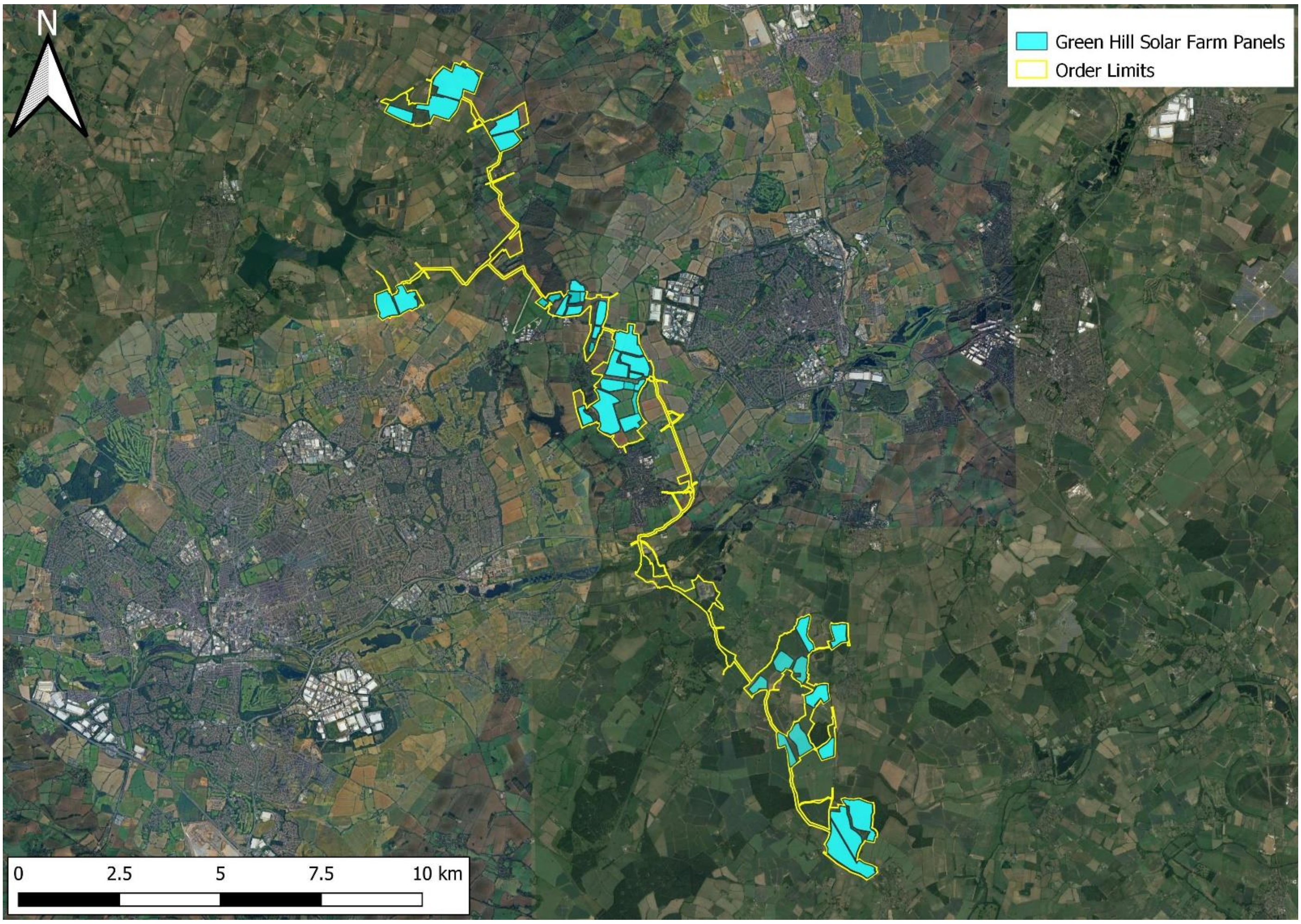
Based on definitions and factors described in Section 1.2 and in combination with available guidance and good practice recommendations, a desk-based evaluation was undertaken to evaluate the potential to experience the effects of glint and glare towards aviation

2. Development Characteristics

2.1 Site Description

The site is situated on land north of Northampton and is made up of a disparate number of sites, as can be seen below in Figure 2.1 below.

Figure 2.1: Site Location



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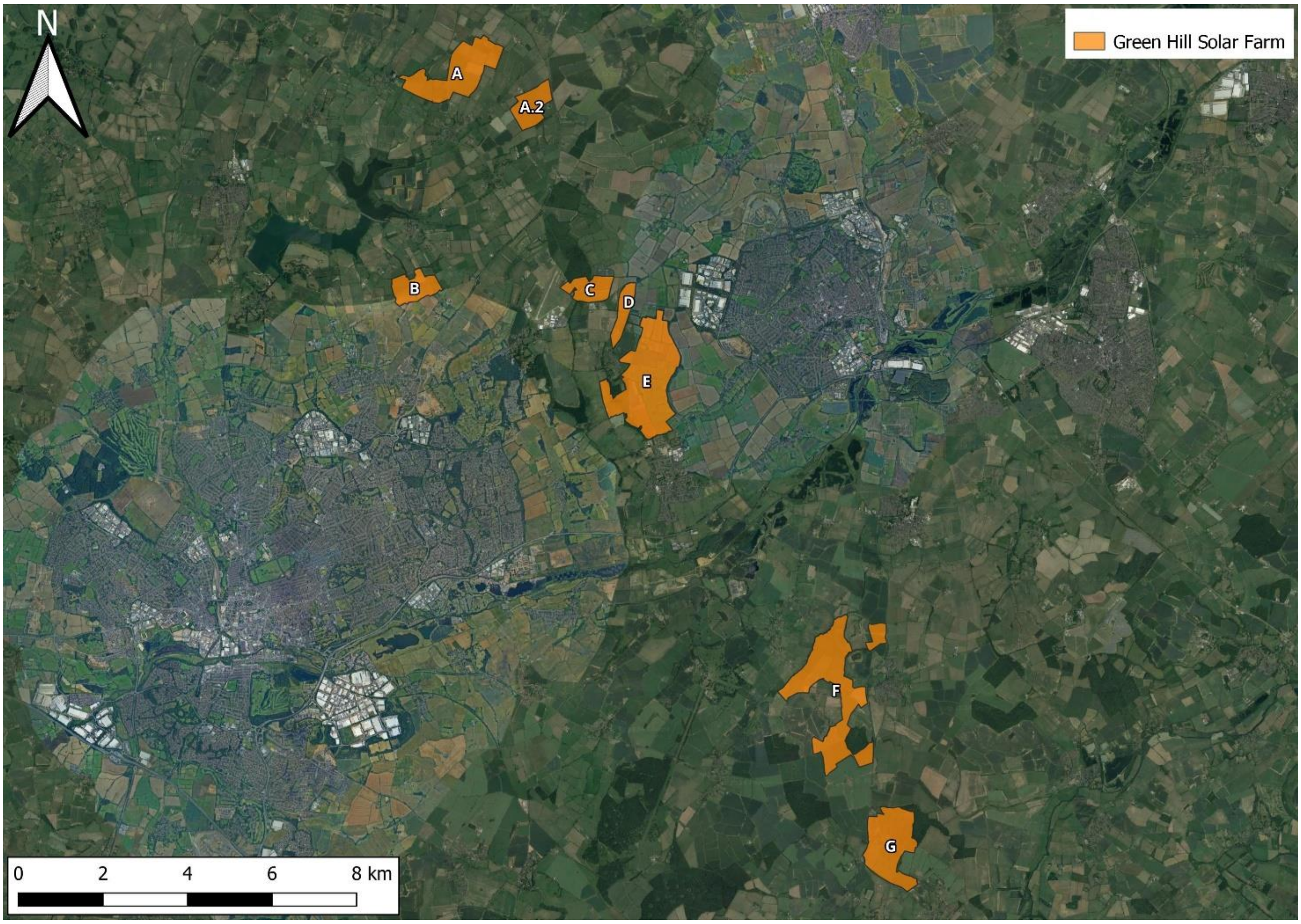
The Scheme will accommodate panels and Battery Energy Storage System (BESS). Green Hill BESS is allocated for a Battery Energy Storage System (BESS) and will not include the installation of any solar arrays. Therefore, this area will not be relevant for a glint and glare assessment. Flexibility has been sought to have BESS also on Green Hill C. An aerial view of the remaining areas (that will include solar panels) is shown below in Figure 2.2.

This report focuses on Green Hill B of Green Hill Solar Farm.

Figure 2.2: Green Hill Solar Farm



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2.2 Proposed Development

The Proposed Development comprises of the installation of ground mounted solar PV arrays across eight areas of agricultural land. At this stage it is understood that two options are being considered for the Proposed Development: fixed tilt and single axis tracker.

The modelled PV module orientations and inclinations, as well as the modelled panel height, are summarised in the below tables. It is noted that since the assessment, the PV footprint at Green Hill B has been reduced. However, as the worst case scenario has been modelled, the model has not been updated.

For the fixed tilt option, a range of tilts are being considered from 10-35°. As such, a tilt of 22.5° has been modelled to represent the average tilt proposed. The average height[1] of the solar panels will be 1.95m above

[1] The heights of the panels (minimum = 0.40m and maximum = 3.5m) have been provided. A centre height of 1.95m (0.4+((3.5-0.4)/2) has been used for the assessment.

ground. It is noted that a small variation in average panel height will not change the conclusions of the report because the modelling results are unlikely to be meaningfully affected.

The proposed PV module orientation and inclination, as well as PV panel height above ground, is summarised in in Table 2.1[2].

Table 2.1: Proposed Fixed Panel Details

PV Array	Orientation (Azimuth)[3]	Panel Tilt	Height Above Ground (m)[4]
Green Hill B			
Arrays 1-2	180°	22.5°	1.95

For the single axis track option, the tracking range will be between +/- 60°, where 0° refers to the solar panel laying horizontal. The average height[5] of the solar panels will be 2.45m above ground. The proposed PV module orientation and inclination, as well as PV panel height above ground, is summarised in Table 2.2[2].

Table 2.2: Proposed Tracking Panel Details

PV Array	Backtracking Method	Tracking Axis Orientation (Azimuth)[3]	Tracking Axis Tilt	Maximum Tracking Angle	Height Above Ground (m)[4]
Green Hill B					
Arrays 1-2	None	180°	0°	60°	2.45

For the purpose of this assessment, 'Smooth glass with Anti-Reflective Coating (ARC)' modules have been used to model the surface material of the arrays.

For modelling purposes, the array layouts have been simplified, as shown below in Figure 2.3.

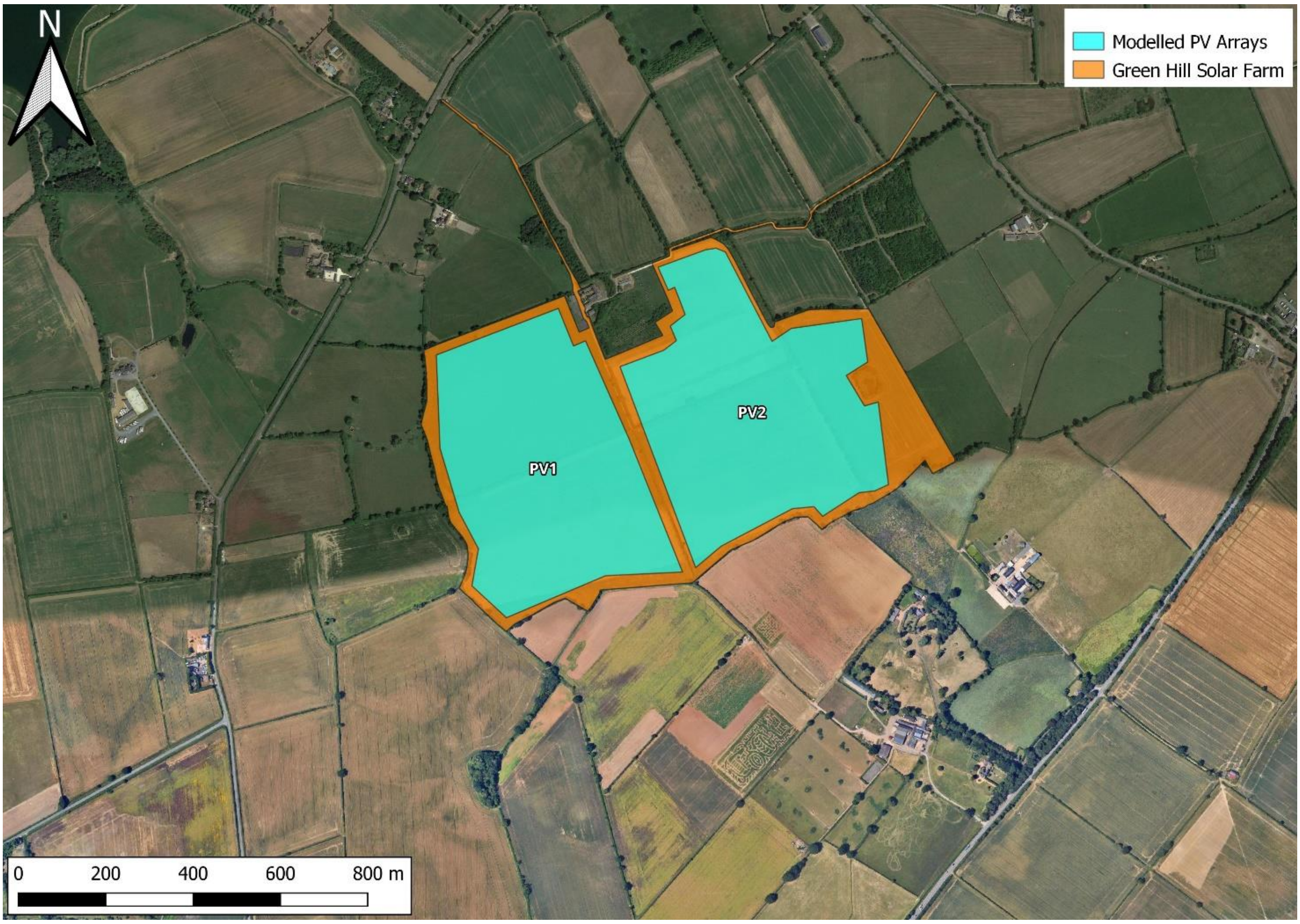
[2] Based on information provided by Green Hill Solar Farm Ltd

[3] North referenced at 0°

[4] The middle of the solar panel has been used as the assessed height in metres above ground level, which has been chosen as it represents the smallest possible variation in height from the bottom and top of the solar panels. The small variation in panel height will not change the conclusions of the report because the modelling results are unlikely to be meaningfully affected. When the visibility of the solar panels for ground-based receptors is discussed, the maximum height of the panel is considered since it will be the most visible part of the panel.

[5] The heights of the panels (minimum = 0.40m and maximum = 4.5m) have been provided. A centre height of 2.45m (0.4+((4.5-0.4)/2) has been used for the assessment.

Figure 2.3: Modelled PV Panels



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3. Legislation & Guidance

3.1 National Planning Policy

3.1.1 National Policy Statement for Energy

The National Policy Statement for energy (EN-1)[6] sets out the overarching policy for decisions by the Secretary of State for nationally significant energy infrastructure. It is noted that Glint and Glare is not specifically mentioned within EN-1.

Section 5.5 of EN-1 sets out the primary policy for the relationship between aviation and new energy:

> "5.5.1 All aerodromes, covering civil and military activities, as well as aviation technical sites, meteorological radars and other types of defence interests (both onshore and offshore) can be affected by new energy development.
>
> 5.5.2 Collaboration and co-existence between aviation, defence and energy industry stakeholders should be strived for to ensure scenarios such that neither is unduly compromised.
>
> ...
>
> 5.5.5 UK airspace is important for both civilian and military aviation interests. It is essential that new energy infrastructure is developed collaboratively alongside aerodromes, aircraft, air systems and airspace so that safety, operations and capabilities are not adversely affected by new energy infrastructure. Likewise, it is essential that aerodromes, aircraft, air systems and airspace operators work collaboratively with energy infrastructure developers essential for net zero. Aerodromes can have important economic and social benefits, particularly at the regional and local level, but their needs must be balanced with the urgent need for new energy developments, which bring about a wide range of social, economic and environmental benefits.
>
> ...
>
> 5.5.7 The approaches and flight patterns to aerodromes can be irregular owing to a variety of factors including the performance characteristics of the aircraft concerned and the prevailing meteorological conditions. It may be possible to adapt flight patterns to work alongside new energy infrastructure without impacting on aviation safety.
>
> ...
>
> 5.5.55 Lighting must also be designed in such a way as to ensure that there is no glare or dazzle to pilots and/or ATC, aerodrome ground lighting is not obscured and that any lighting does not diminish the effectiveness of aeronautical ground lighting and cannot be confused with aeronautical lighting. Lighting may also need to be compatible with night vision devices for military low flying purposes."

[6] https://assets.publishing.service.gov.uk/media/65bbfbdc709fe1000f637052/overarching-nps-for-energy-en1.pdf

3.1.2 National Policy Statement for Renewable Energy Infrastructure

The National Policy Statement for Renewable Energy Infrastructure (EN-3)[7] sets out the primary policy for decisions by the Secretary of State for nationally significant renewable energy infrastructure.

The above policy is applicable to significant renewable energy infrastructure (i.e. solar photovoltaic >50 MW in England, where MW is measured as alternating current). However, the principles should be extended to infrastructure <50MW.

Sections 2.10.27 and 2.10.102-2.10.106 outlines the potential impact of glint and glare that the applicants may consider:

> *"2.10.27 Utility-scale solar farms are large sites that may have a significant zone of visual influence. The two main impact issues that determine distances to sensitive receptors are therefore likely to be visual amenity and glint and glare. These are considered in Landscape, Visual and Residential Amenity (paragraphs 3.10.84-3.10.92) and Glint and Glare (paragraphs 3.10.93 – 3.10.97) impact sections below."*
>
> …
>
> *2.10.102 Solar panels are specifically designed to absorb, not reflect, irradiation[8]. 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.*
>
> *2.10.103 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.*
>
> *2.10.104 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.*
>
> *2.10.105 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.*
>
> *2.10.106 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."*

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf
[8] 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.

Sections 2.10.134-2.10.136 outlines the potential mitigations for glint and glare impacts that the applicants may consider:

"2.10.134 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.

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

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

Sections 2.10.158-2.10.159 outlines further detail on the potential glint and glare impacts that the Secretary of State may consider as part of their decision making:

"2.10.158 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).

2.10.159 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."

3.2 Local Planning Policy

3.2.1 West Northampton Joint Core Strategy Local Plan

15.3.8 The West Northampton Joint Core Strategy Local Plan[9] sets out the long-term vision and objectives for the whole area covered by the former Daventry District, Northampton Borough, and South Northamptonshire Councils for the plan period up to 2029, including strategic policies for steering and shaping development. The West Northamptonshire Joint Core Strategy Local Plan (Part 1) states in paragraph 4.44:

"Development that aims to secure sustainable communities is designed to minimise its impact on the environment and so combat climate change. A realistic and serious response to meeting climate change objectives must be made through the JCS direction on policies. Larger scale developments, including Sustainable Urban Extensions (SUEs), provide the opportunity to secure exemplary standards of design, renewable or low carbon energy generation and through the location of development reduce the need to travel. All development proposals will need to fully consider climate change adaption to meet the vision of sustainable development."

[9] https://www.westnorthants.gov.uk/west-northamptonshire-joint-core-strategy/west-northamptonshire-joint-core-strategy-local-plan-part

In relation to Glint and Glare, Policy S10 – Sustainable Development Principles describes how visual intrusion from renewable energy developments should be limited:

> *"When considering planning applications for low carbon and renewable energy, an assessment will need to take account of impacts on landscape, townscape, natural, historical and cultural features and areas and nature conservation interests. Proposals should also use high quality design to minimise impacts on the amenity of the area, in respect of visual intrusion, noise, dust, and odour and traffic generation."*

3.2.2 North Northamptonshire Joint Core Strategy

The North Northamptonshire Joint Core Strategy [10] provides the strategic planning policies for the future development of the area from 2016 to 2031.

Policy 26: Renewable and Low Carbon Energy states that renewable and low carbon energy generation will be supported where the proposal meets the following criteria relevant to glint and glare:

> *"The siting of development does not significantly adversely affect the amenity of existing, or proposed, residential dwellings and/or businesses, either in isolation or cumulatively, by reason of noise, odour intrusion, dust, traffic generation, visual impact or shadow flicker;"*

3.2.3 Wind and Solar Energy Supplementary Planning Document

The Wind and Solar Energy Supplementary Planning Document[11] provides guidance on the information to be submitted with a planning application and sets out the key issues that will be taken into consideration by the Council.

Section 16 of the Wind and Solar Energy Supplementary Planning Documents states the following on Glint and Glare:

> *"The effect of glint and glare on landscape, neighbouring uses and aircraft safety is identified in the NPPG as an important factor to consider when assessing proposals for large scale solar PV farms. The guidance further indications that there may be additional impacts if solar arrays track the daily movement of the sun.*
>
> *Solar panels are designed to absorb as much light as possible rather than reflect it. Nevertheless, there is the potential for glint and glare effects. 'Glint' refers to a momentary flash of light produced as direct reflection of the sun whilst 'glare' is a more continuous source of brightness relative to the ambient lighting. These effects can have a visual impact on the landscape and can act as a potential hazard or distraction for motorists, pilots, pedestrians and occupiers' of nearby properties. Specifically in respect to aviation, the Civil Aviation Authority has issued interim guidance on solar photovoltaic systems. There is also potential for glint and glare to have an affect on nearby heritage assets.*
>
> *The potential for glint and glare to occur should therefore be assessed. This should address the additional impacts of 'tracking' panels, which follow the movement of the sun across the sky to maximise solar gain,*

[10] https://www.northnorthants.gov.uk/planning-strategies-and-plans/north-northamptonshire-local-plan
[11] https://www.northnorthants.gov.uk/planning-strategies-and-plans/supplementary-planning-documents-spd

where proposed. Modelling tools are available to evaluate solar farm projects. Undertaking an assessment at an early stage will enable variables such as the orientation and tilt angles of arrays to be changed, where necessary, to minimise any adverse impacts."

3.2.4 MK:Plan (2016-2031)

The MK:Plan (2016-2031)[12] sets out the vision and framework for the future development of the area from 2015 to 2031.

Policy SC3: Low Carbon and Renewable Energy Generation states the following regarding glint and glare:

"A. The Council will encourage proposals for low carbon and renewable energy generation developments that are led by, or meet the needs of local communities.

B. Planning permission will be granted for proposals to develop low carbon and renewable energy sources (including community energy networks) unless there would be:

1. Significant harm to the amenity of residential area, due to noise, traffic, pollution or odour;

2. Significant harm to wildlife species or habitat;

3. Unacceptable landscape and visual impact on the landscape, including cumulative impacts;

4. Unacceptable harm to the significance of heritage assets; and

5. Unacceptable impact on air safety.

C. In addition to the above criteria, wind turbines should avoid unacceptable shadow flicker and electro-magnetic interference and be sited an appropriate distance away from occupied properties, consistent with the size and type of the turbine. Proposals to develop solar PV farms should avoid unacceptable visual impact from the effect of glint and glare on the landscape, on neighbouring uses and aircraft safety. Proposals for large scale renewable energy in the open countryside should be informed by a satisfactory landscape and visual impact assessment."

3.3 Emerging Local Planning Policy

3.3.1 MK City Plan 2050

The MK City Plan 2050[13] sets out the strategy for growth through to 2050 related to the need for homes, creating jobs and supporting businesses, transport around the city, climate change, the natural and built environment, design of streets, and the places which support everyday living (i.e. schools and shops).

Policy CEA6: Low and Zero Carbon Energy Provision states the following regarding low carbon and renewable energy developments:

[12] https://www.milton-keynes.gov.uk/sites/default/files/2022-05/PlanMK%20Adoption%20Version%20%28March%202019%29.pdf
[13] https://www.milton-keynes.gov.uk/planning-and-building/planning-policy/mk-city-plan-2050

"2. Proposals to development low carbon and renewable energy sources (including community energy networks) and infrastructure needed to facilitate the green energy transition (e.g. grid and sub-station upgrades) will be supported, unless there would be

a. Conflict with other policies within the development plan.

b. Unacceptable harm on air safety, in terms of the risk of incidents on approaches/departures from local airfields/airports, as well as radar interference."

3.4 Guidance

3.4.1 National Planning Practice Guidance

In the absence of specific guidance on solar development, the National Planning Practice Guidance for 'Renewable and Low Carbon Energy'[14] dictates the following with respect to large-scale solar PV developments and glint and glare:

> *"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 potential to mitigate landscape and visual impacts through, for example, screening with native hedges;...*
>
> *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."*

3.4.2 BRE Planning guidance for the development of large-scale ground mounted solar PV panels

[14] https://www.gov.uk/guidance/renewable-and-low-carbon-energy

The BRE Planning guidance for the development of large-scale ground mounted solar PV panels[15] sets out guidance relating to different planning application considerations. In relation to Glint and Glare, the guidance states:

> *"Glint may be produced as a direct reflection of the sun in the surface of the solar PV panel. It may be the source of the visual issues regarding viewer distraction. Glare is a continuous source of brightness, relative to diffused lighting. This is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Glare is significantly less intense than glint.*
>
> *Solar PV panels are designed to absorb, not reflect, irradiation. However the sensitivities associated with glint and glare, and the landscape/ visual impact and the potential impact on aircraft safety, should be a consideration. In some instances it may be necessary to seek a glint and glare assessment as part of a planning application. This may be particularly important if 'tracking' panels are proposed as these may cause differential diurnal and/or seasonal impacts.*
>
> *The potential for solar PV panels, frames and supports to have a combined reflective quality should be assessed. This assessment needs to consider the likely reflective capacity of all of the materials used in the construction of the solar PV farm."*

3.5 UK Highway Code

The UK Highway Code states that a road user should be aware of particular hazards such as glare from the sun and should adjust their driving style appropriately. Solar PV panels reflect sunlight producing solar glare under specific conditions, which may pose hazard towards road users.

3.6 Network Rail Guidance

Rail Industry Standard (RIS) RIS-0737-CCS on 'Signal Sighting Assessment Requirements' highlights that:

> *"a planned change external to the railway could affect signal sighting, for example changes that affect the built environment (for example, a new structure causing obscuration, a solar farm causing reflection)."*

It should be noted that Network Rail guidance does not provide a specific glare assessment methodology for rail receptors, beyond the above information.

15 [redacted]

4. Methodology

4.1 Glare Assessment Model

The Glint and Glare evaluation will be undertaken using ForgeSolar software. ForgeSolar succeeds the Solar Glare Hazard Analysis Tool (SGHAT), whose use was required by the FAA to demonstrate compliance with the standards for measuring ocular impact for any proposed solar energy systems at airports. ForgeSolar is the software specialist for modelling glare impacts and the software is used extensively across the UK for assessing impacts toward airports, transportation and residential dwellings.

4.2 Receptor Identification

In general, light-sensitive receptors with view of a solar PV development have potential to experience solar reflection. While no technical distance limits/thresholds are reported within which solar reflections are possible for such receptors, the potential or significance of a reflection decreases with distance due to an observer's decreasing field of vision capability with increasing distance, as well as possible obstructions such as shielding caused by terrain and vegetation. For the purpose of this assessment, the following good practice considerations will be applied, incorporating relevant guidance as laid out in Section 3.0.

Table 4.1: Receptor Identification Criterium

Dwellings	There is not a defined screening distance for consideration of the potential glare impact of rooftop solar panels on residential dwellings. For residential dwellings very close to a proposed rooftop solar development, there will be instances where the resident does not have geometric line of sight of the proposed roof. In addition, there may be obstructions to the line of sight such as other buildings or vegetation screening. Line of sight for this assessment is reviewed using Google Satellite Images and Google Street View. Where there is potential line of sight, glare modelling is undertaken. Professional judgement is used to determine a representative number of dwelling points to be modelled. Industry guidance recommends glare modelling for ground floor residential receptors because it is typically the most occupied part of the dwelling during daylight hours. A height of 1.8 m above ground level will be considered to account for observer's eye level on ground floor (main habitable rooms are generally on the ground floor), unless otherwise stated.
Road Users	Major national, national and regional roads are predicted to have higher level of traffic compared to local roads and have higher sensitivity. Therefore, these roads that are within 1 km from the solar PV development boundary with a visual line of sight to the panels will be considered for the technical modelling. An additional height of 1.5 m above ground level will be considered to represent the typical road user viewing height. A driver field-of-view (FOV) of 100° will be applied (50° either side of direction of travel). Glare that appears beyond this FOV is mitigated.

Railways	Railways in the immediate surrounding area to around 100 m from the solar PV development boundary with a visual line of sight to the panels will be considered. Length of railway line will be assessed via individual static receptor locations no more than 200 m apart up to 500 m from the Proposed Development boundaries. An additional height of 2.75 m above ground level will be considered to represent typical train driver viewing height. A train driver field-of-view (FOV) of 60° will be applied (30° either side of direction of travel). Glare that appears beyond this FOV is mitigated. Where signals are located immediately adjacent to or above a railway line, their lens is in line of sight of the Proposed Development, and are used to direct trains on the lines, these will also be assessed as individual static receptors.

4.3 Magnitude of Impact

4.3.1 Ocular Impact

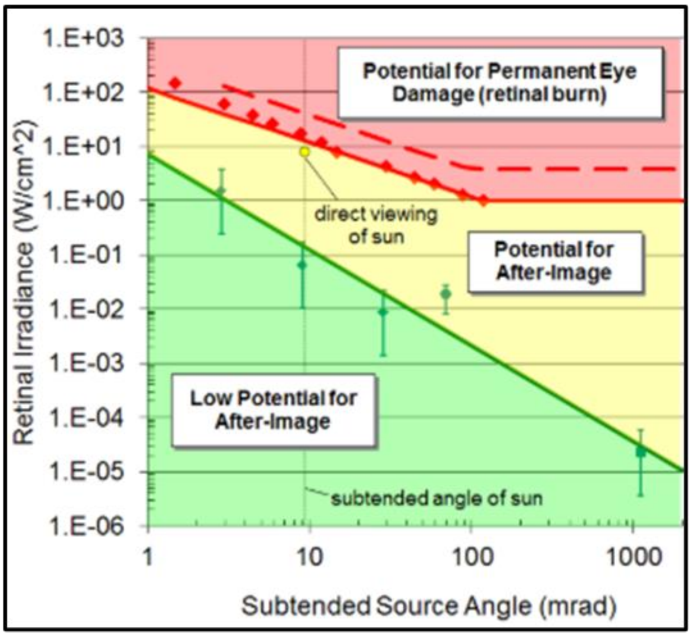
Ocular impact significance depends on the line of sight between the reflector (solar PV panels) and the receptor, the location of the receptor relative to the reflector and thus the solar reflection, the time of the day, they path between the Sun and the reflective surface, and the reflection exposure period (e.g. momentary exposure is less significant that prolonged exposure).

As such, ocular impact can be classified into three levels based on the retinal irradiance and subtended source angle: low potential for after-image (**green**), potential for after-image (**yellow**), and potential for permanent eye damage (**red**). These categories are illustrated in the Ocular Hazard plot[16] shown in Figure 4.1 (NOTE: this is a universal Ocular Hazard plot and does not represent potential glare conditions that may be experienced at the Proposed Development.).

The subtended source angle represents the size of glare observed by receptor, while the retinal irradiance is the quantity of energy impacting the retina of the observer. As it can be seen from Figure 4.1, wide subtended source angles can cause retinal irritation/damage even at low retinal irradiance.

[16] Sliney, D.H. and B.C. Freasier, 1973, Evaluation of Optical Radiation Hazards, Applied Optics, 12(1), p. 1-24.

Figure 4.1: Ocular Hazard Plot



4.3.2 Glint & Glare Impact Significance

4.3.2.1 Dwellings

Table 4.2: Dwellings Impact Significance Guidance

No Impact	Solar reflection is not geometrically possible or will not be visible from the assessed receptor.
Low	Predicted glare of any intensity (green or yellow) occurs for less than 60 minutes per day and for less than three months per year. Predicted glare of any intensity (green or yellow) occurs for longer than 60 minutes and for more than 3 months per year. However, application of professional judgement renders the residual potential glare to be not significant. Mitigation is not required.
Moderate	Predicted glare of any intensity (green or yellow) occurs for longer than 60 minutes or for more than 3 months per year. Application of professional judgement does not sufficiently decrease the significance of the potential glare. Predicted glare of any intensity (green or yellow) occurs for longer than 60 minutes and for more than 3 months per year. Application of professional judgement does not sufficiently decrease the significance of the potential glare. Mitigation may be required at planner's discretion.
High	Predicted glare of any intensity (green or yellow) occurs for longer than 60 minutes per day and for more than 3 months of the year. Application of professional judgement does not sufficiently decrease the significance of the potential glare. Mitigation will be required if the proposed development is to proceed.

4.3.2.2 Road Users

Table 4.3: Road User Impact Significance Guidance

<table>
<tr>
<td rowspan="7">Road Users</td>
<td colspan="2">While there is no specific guidance on glint and glare impact significance evaluation or limits, the following approach will be adapted in line with best available practice guidance/recommendations:</td>
</tr>
<tr>
<td>No or Insignificant Impact</td>
<td>Solar reflection is not geometrically possible or will not be visible from the assessed receptor.</td>
</tr>
<tr>
<td>Low</td>
<td>Solar reflection is not geometrically possible or will not be visible from the assessed receptor.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Potential glare of any intensity (yellow or green) predicted towards a local road.

Potential glare of any intensity (e.g. yellow or green) predicted towards a major national, national or regional road, and does not originate in front of driver (e.g. not in centre of FOV).

Potential glare of any intensity (e.g. yellow or green) predicted towards a major national, national or regional road and originates in front of driver (e.g. in centre of FOV). However, application of professional judgement renders the residual potential glare to be not significant.

Mitigation is not considered necessary.</td>
</tr>
<tr>
<td>High</td>
<td>Potential glare of any intensity (e.g. yellow or green) predicted towards a major national, national or regional road and originates in front of driver (e.g. not in centre of FOV). Application of professional judgement does not sufficiently decrease the significance of the potential glare.

Mitigation may be required at regulator’s discretion.</td>
</tr>
<tr>
<td colspan="2">Based on industry guidance, it is recommended that any predicted solar reflection is assessed pragmatically. Therefore, professional judgement will be applied and the following factors will also be considered when determining whether a solar reflection is significant:
1. The relative position and visibility of the reflecting panels relative to road vehicle drivers and whether the glare is within the field of view of drivers;
2. Additional screening and obstructions to the line of sight;
3. The separation distance between the reflecting panels and the vehicle driver;
4. The extent to which impacts coincide with effects of direct sunlight;
5. The length of road affected;
6. The intensity of the solar reflection.</td>
</tr>
</table>

4.3.2.3 Railways

Table 4.4: Railway Impact Significance Guidance

<table>
<tr><td rowspan="6">Train Drivers</td><td colspan="2">While there is no specific guidance on glint and glare impact significance evaluation or limits, the following approach will be adapted in line with best available practice guidance/recommendations:</td></tr>
<tr><td>No or Insignificant Impact</td><td>Solar reflection is not geometrically possible or will not be visible from the assessed receptor.</td></tr>
<tr><td>Low</td><td>Glare predicted which does <u>not</u> originate in front of the train driver (30° field of view either side of the direction of travel).
Glare originates in front of the train driver (30° field of view either side of the direction of travel). However, application of professional judgement renders the residual potential glare to be not significant.
Mitigation is not considered necessary.</td></tr>
<tr><td>Moderate</td><td>Glare originates in front of the train driver (30° field of view either side of the direction of travel). Application of professional judgement does not sufficiently decrease the significance of the potential glare.
Mitigation not required but could be considered necessary.</td></tr>
<tr><td>High</td><td>Glare originates in front of the train driver (30° field of view either side of the direction of travel). Application of professional judgement does not sufficiently decrease the significance of the potential glare.
Mitigation required if the Proposed Development is to proceed.</td></tr>
<tr><td colspan="2">Based on industry guidance, it is recommended that any predicted solar reflection is assessed pragmatically. Therefore, professional judgement will be applied and the following factors will also be considered when determining whether a solar reflection is significant:
1. The relative position and visibility of the reflecting panels relative to train drivers and whether the glare is within the field of view of drivers;
2. The separation distance between the reflecting panels and the train driver;
3. The extent to which impacts coincide with effects of direct sunlight;
4. Presence of other infrastructure (e.g. signals, crossings).
5. The length of railway line affected;
6. The intensity of the solar reflection.</td></tr>
</table>

4.4 Time Zone / Datum

The UK uses British Summer Time (BST, UTC +01:00) in the summer and Greenwich Mean Time (GMT, UTC +0) in the winter. For the purpose of this report all time references are in GMT. All locations are given in Eastings and Northings using the UK National Grid Reference system, unless otherwise specified.

4.5 Assumptions, Limitations & Fixed Model Variables

Provided in Appendix A is a list of assumptions, limitations and fixed variables of the model and assessment methodology.

4.6 Elevation Data

Elevation data for the modelled arrays and road and residential receptors were obtained using Defra Survey[17] LiDAR data database. Digital Terrain Model data was downloaded from the most recent survey. ForgeSolar employs an interactive Google map such that latitude, longitude, and ground elevation of PV geometry and receptors are automatically queried from Google, providing necessary information for sun position and vector calculations.

[17] https://environment.data.gov.uk/survey

5. Receptor Screening & Model Considerations

5.1 Residential Dwellings

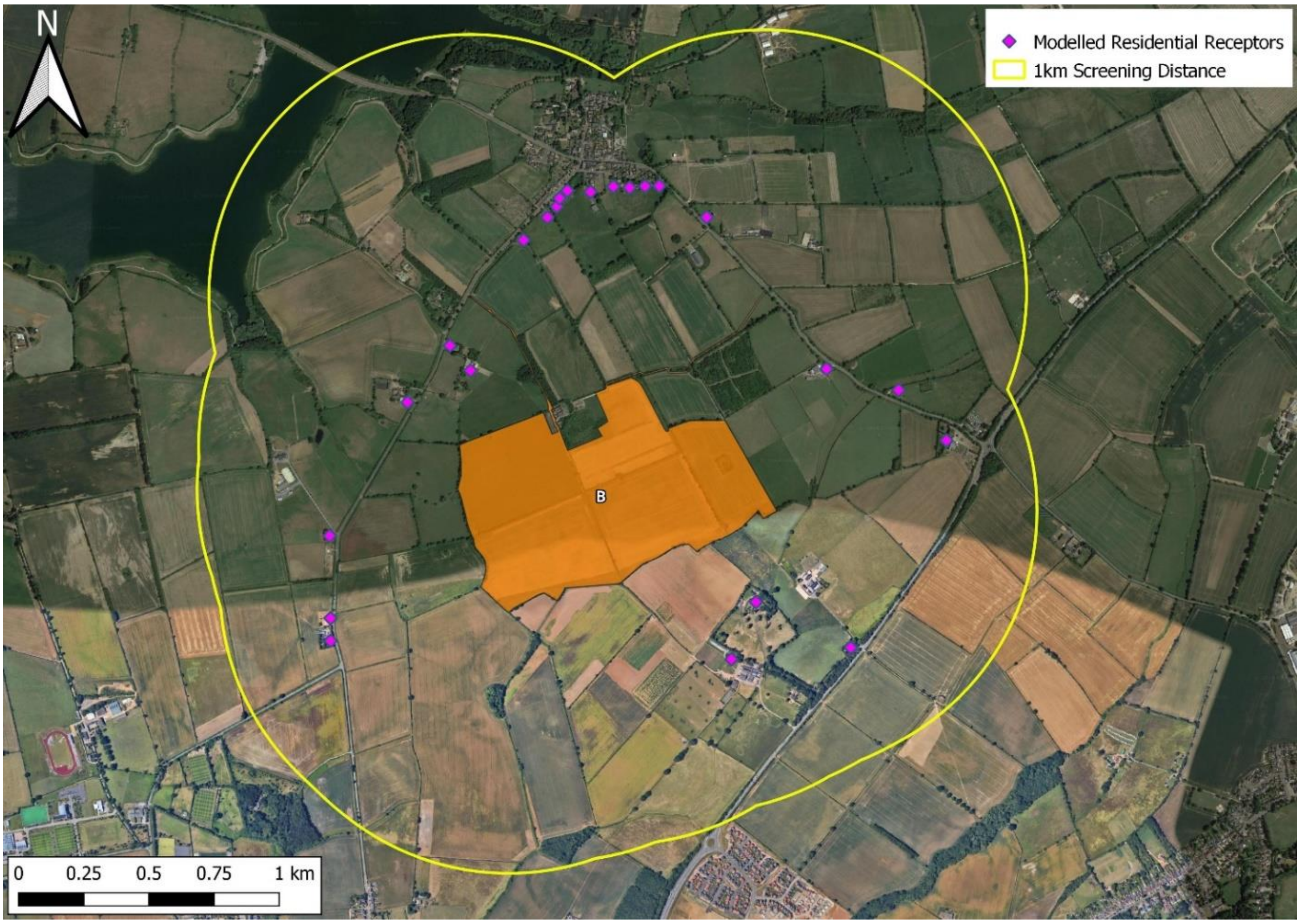
While no technical distance limits/thresholds are reported within which solar reflections are possible for such receptors, the potential for significance of a reflection decreases with distance due to an observer's decreasing field of vision capability with increasing distance, as well as possible obstructions such as shielding caused by terrain and vegetation. Industry guidance advises that dwelling receptors at up to 1 km from solar panels may be considered in terms of potential glare impact.

A number of residential dwellings exist within 1 km of the Order Limits. Only the receptor points closest to the Scheme with a potential line of sight towards the PV panels were considered, as other dwellings are expected to be screened by these receptors, as well as vegetation and/or other infrastructure found in between them. The high-level review was undertaken using mapping and aerial photography.

The residential dwellings will be modelled at an additional height of 1.8m above ground level as this is considered to represent typical viewing height on ground floor, which is typically occupied during daylight hours.

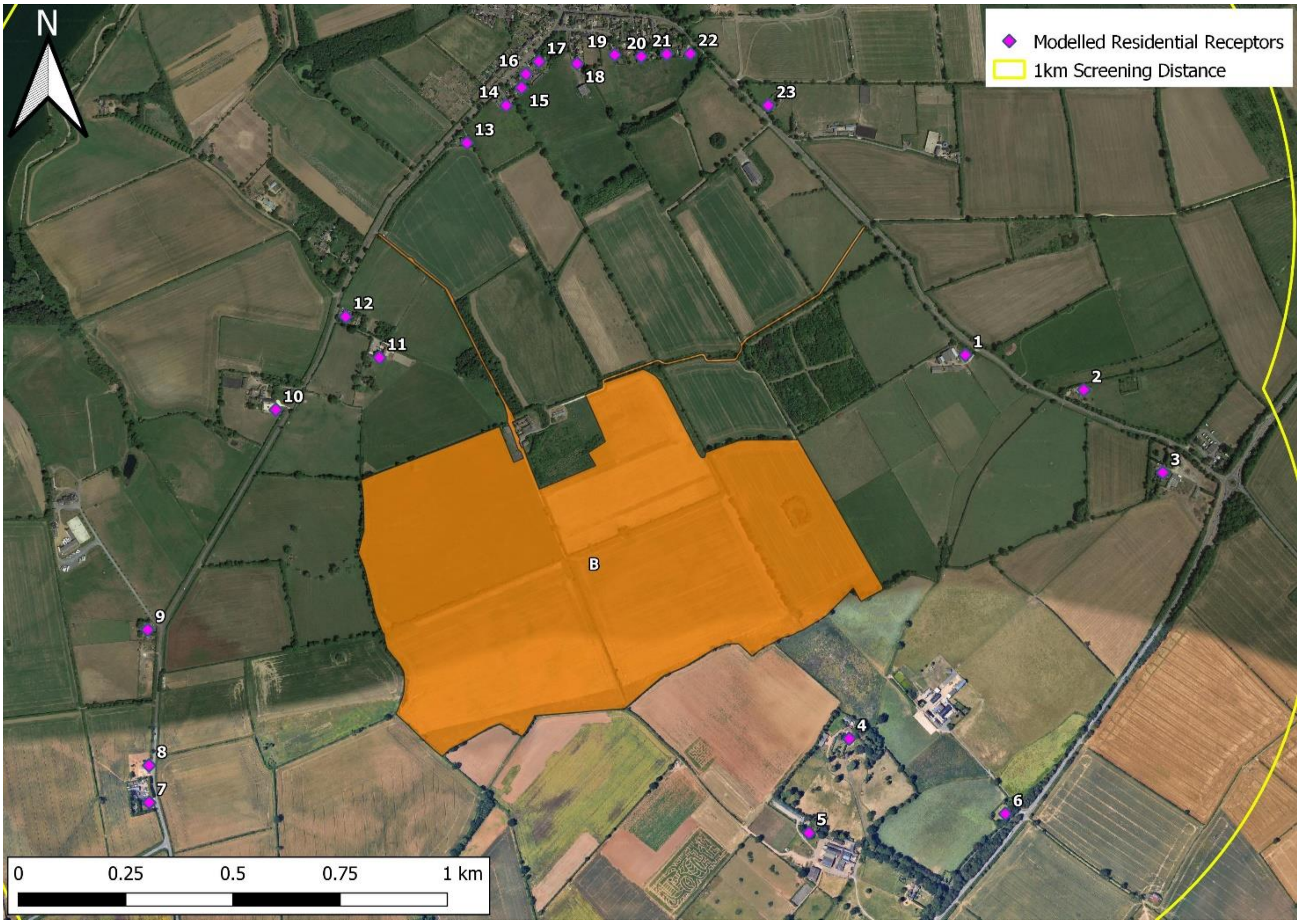
In total, 23 residential dwellings have been identified within this area. These receptors have been modelled as observation points (R1, R2,...). Receptor points closest to the Scheme with a potential line of sight towards the PV panels can be seen below in Figure 5.1 and Figure 5.2.

Figure 5.1: Nearby Residential Dwellings to Green Hill B



Imagery © 2025 Google Satellite

Figure 5.2: Modelled Residential Dwellings Green Hill B



Imagery © 2025 Google Satellite

The list of dwelling receptors is presented in Appendix B.

5.2 Road Infrastructure

Based on industry guidance, road receptors within 1km of the Green Hill Boundary of the Scheme may be considered.

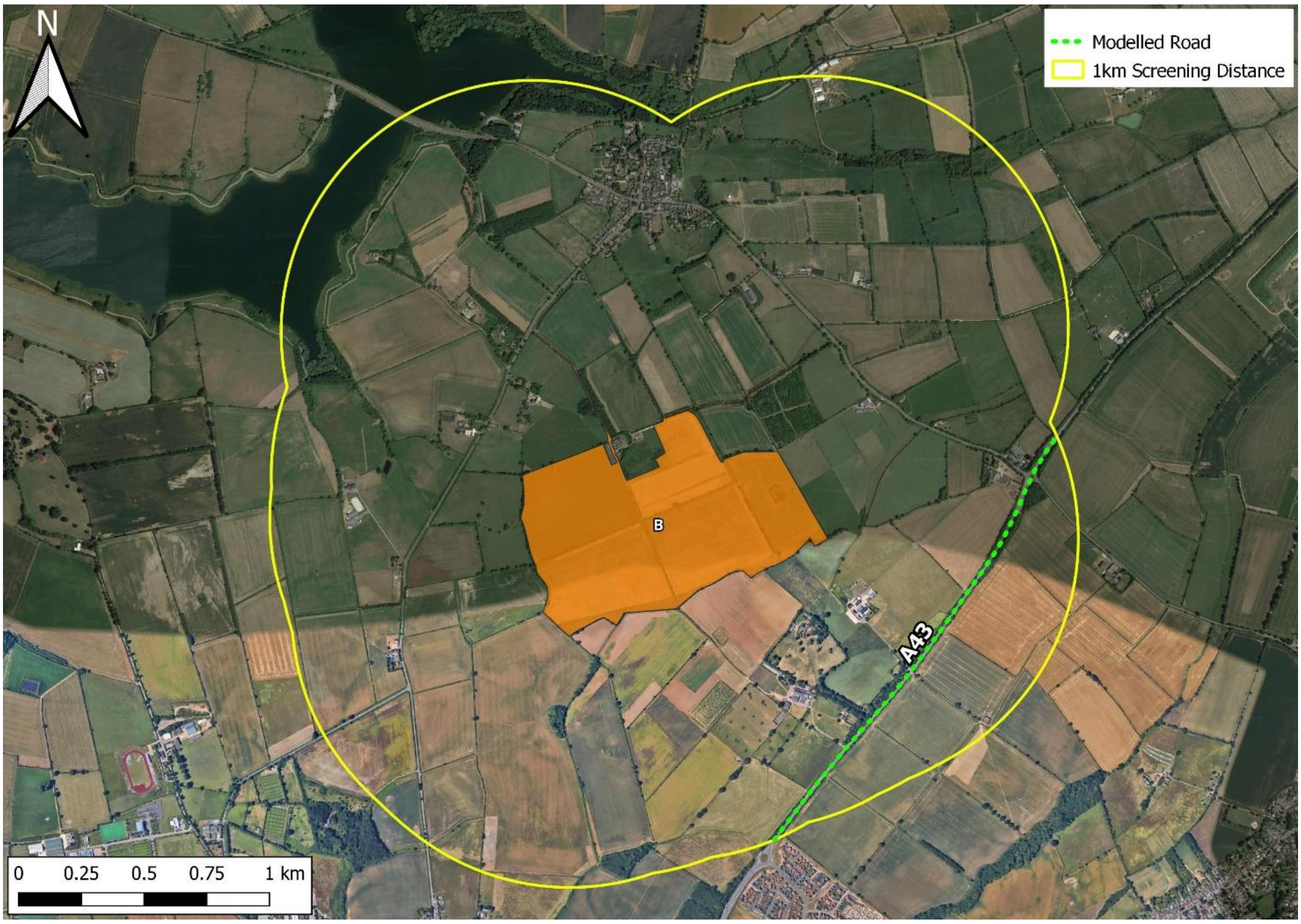
Major National, National and Regional roads are predicted to have higher level of traffic compared to local roads and have higher sensitivity. Therefore, these roads that are within 1 km from the solar PV development boundary with a visual line of sight to the panels will be considered for the technical modelling.

Based on industry guidance, technical modelling is not recommended for local roads, where traffic densities are likely to be relatively low. Any solar reflections from the Scheme that are experienced by a road user along a local road would be considered 'Low / Minor' impact magnitude.

A high-level review indicates that the A43 is within the screening distance of Green Hill B, however line of sight is obstructed between the road users and reflecting panels by vegetation and terrain. The A43 is shown below in Figure 5.3. Google Street View imagery taken from December (when vegetation is most sparse) has been utilised to review the line of sight from the A43 and Green Hill B, shown below in Figure 5.4 to Figure 5.12.

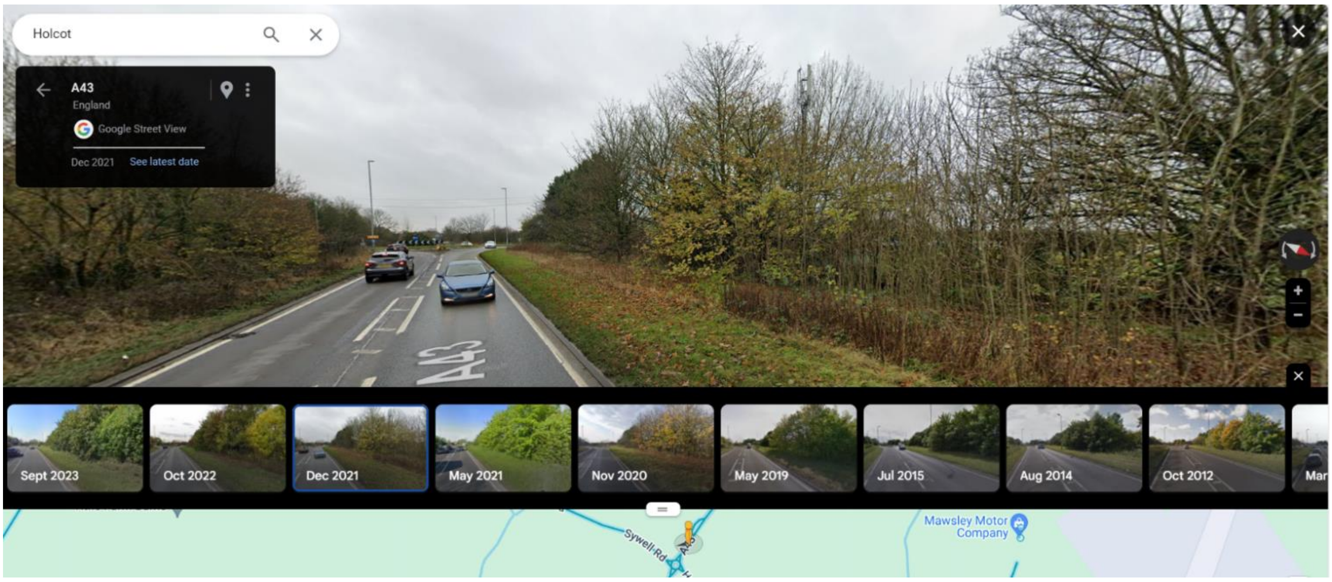
As shown in each image, the surrounding vegetation and terrain will obstruct line of sight to the proposed panels, such that they would not be visible for vehicles travelling on the A43. As such, potential impacts on road users along the A43 are not considered further.

Figure 5.3: Modelled Road Infrastructure Green Hill B



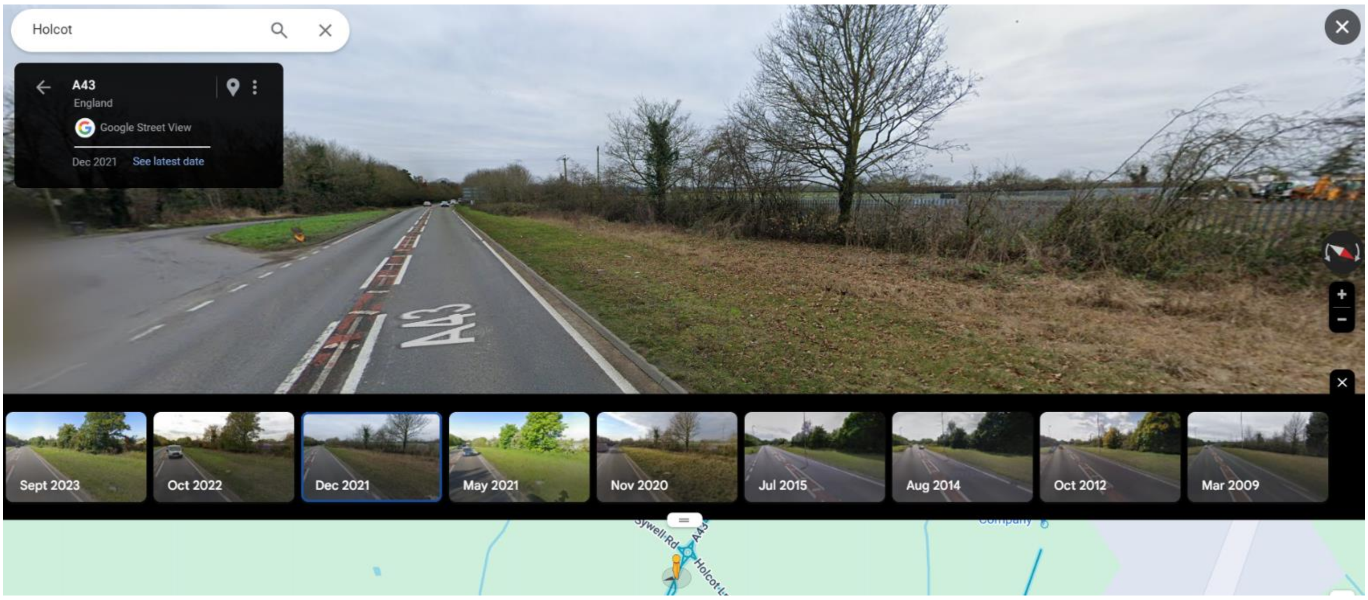
Imagery © 2024 Google Satellite

Figure 5.4: Line of Sight from the A43 towards Green Hill B



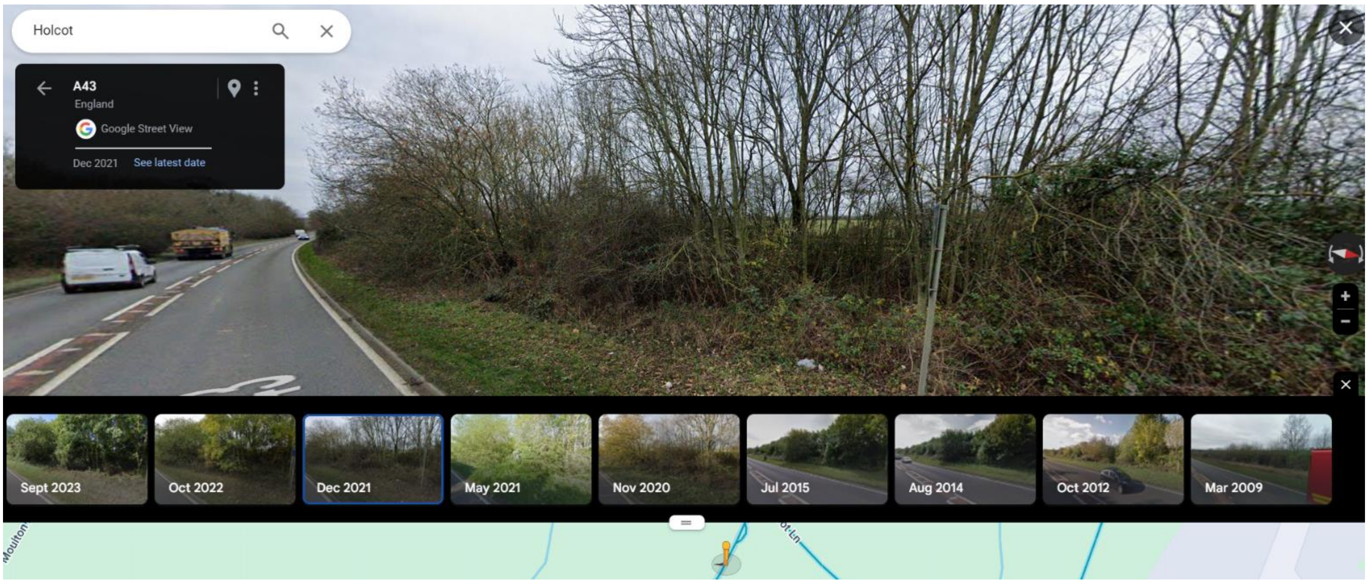
Imagery © 2024 Google Street View

Figure 5.5: Line of Sight from the A43 towards Green Hill B



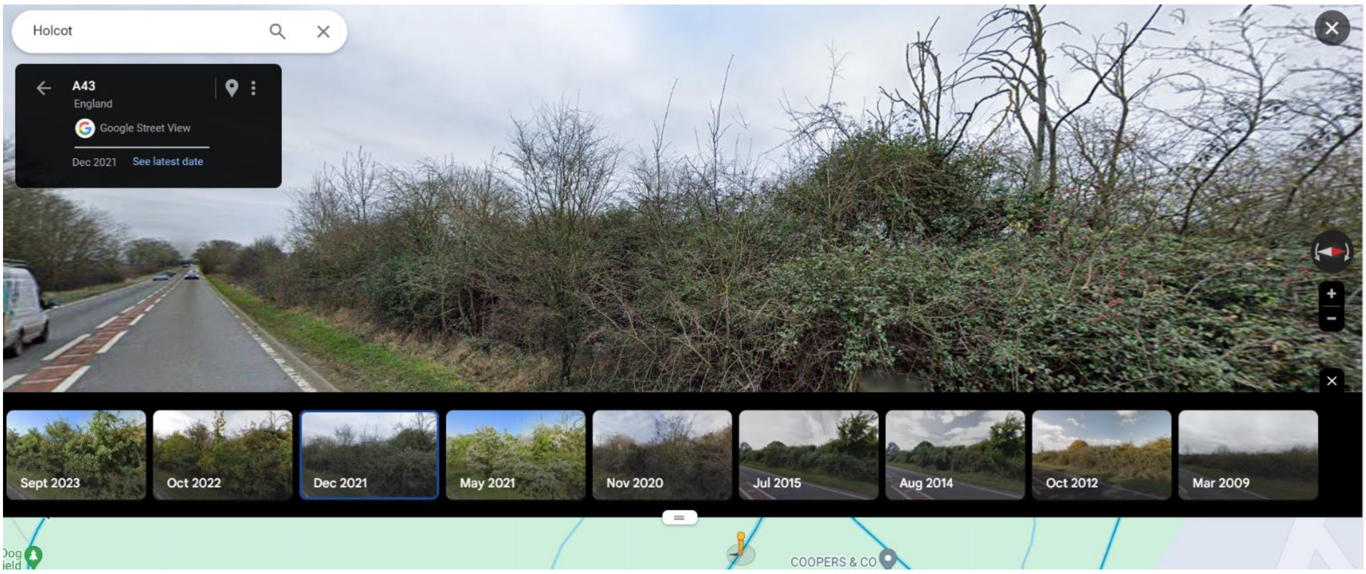
Imagery © 2024 Google Street View

Figure 5.6: Line of Sight from the A43 towards Green Hill B



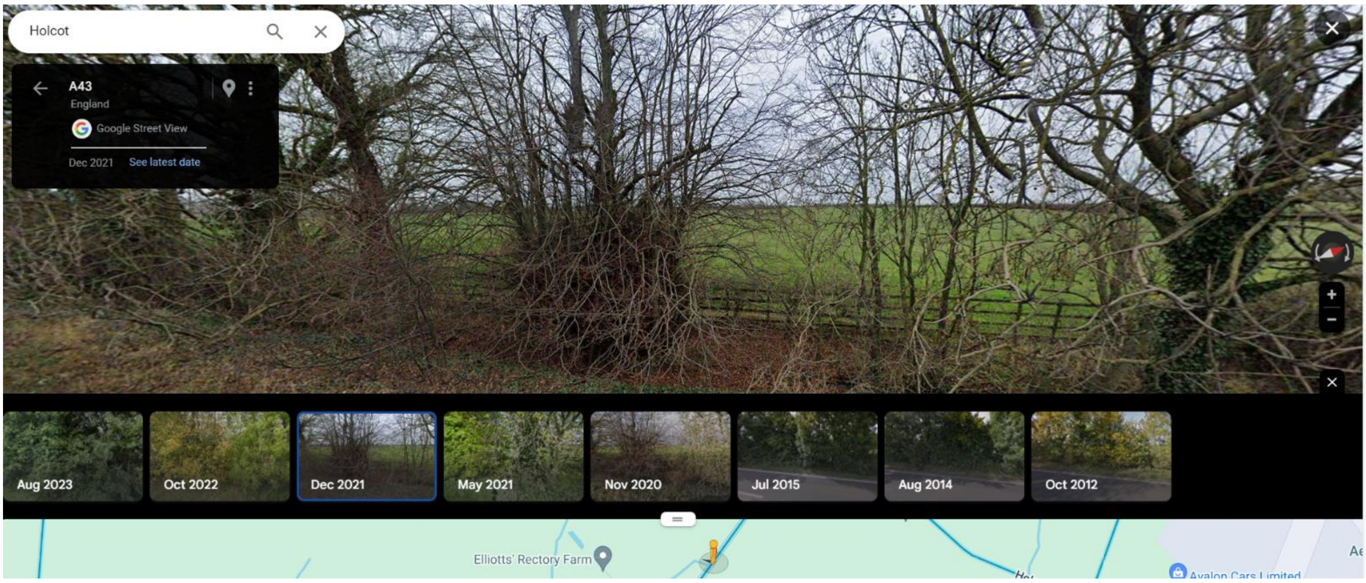
Imagery © 2024 Google Street View

Figure 5.7: Line of Sight from the A43 towards Green Hill B



Imagery © 2024 Google Street View

Figure 5.8: Line of Sight from the A43 towards Green Hill B



Imagery © 2024 Google Street View

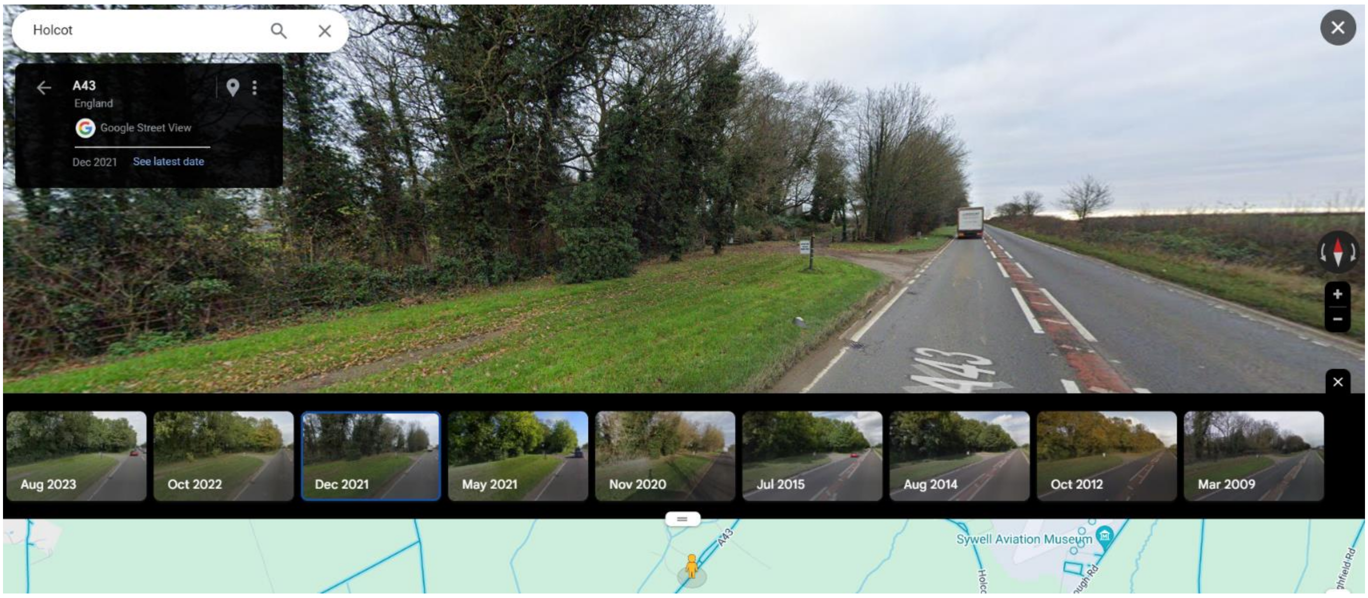
Figure 5.9: Line of Sight from the A43 towards Green Hill B

Imagery © 2024 Google Street View

Figure 5.10: Line of Sight from the A43 towards Green Hill B

Imagery © 2024 Google Street View

Figure 5.11: Line of Sight from the A43 towards Green Hill B

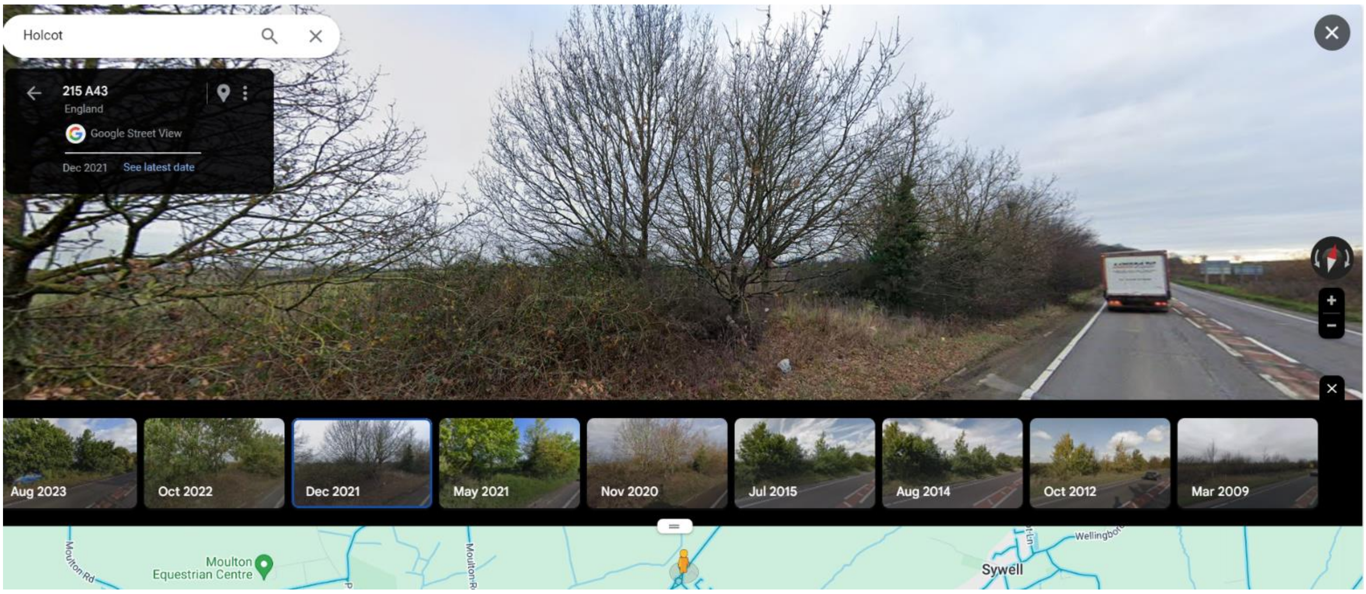


Imagery © 2024 Google Street View

Figure 5.12: Line of Sight from the A43 towards Green Hill B

Imagery © 2024 Google Street View

Figure 5.13: Line of Sight from the A43 towards Green Hill B



Imagery © 2024 Google Street View

5.3 Rail Infrastructure

Based on industry guidance, rail operators may raise an objection to solar developments that are within 500m of their infrastructure due to safety implications caused by glare on train drivers, level crossings and railway light signals. A high-level receptor review indicates no railway infrastructure within this screening distance. Therefore, no rail receptors will be considered within the modelling assessment.

6. Modelled Results and Interpretation

6.1 Residential Results

6.1.1 Fixed Panel Results

Receptor	Results
R1	***No glare is predicted towards R1.***
R2	Glare is predicted from PV2 from Green Hill B. Glare is predicted from PV2 Green Hill B from mid-March to early April and from early to late September between 17:30-18:30 for a maximum of 10 minutes per day. Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R3	Glare is predicted from PV1 and PV2 from Green Hill B. R3 is located outside the 1km screening distance of PV1 Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV1 Green Hill B. Glare is predicted from PV2 Green Hill B from mid-March to late April and from mid-August to late September between 17:30-18:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R4	Glare is predicted from PV1 and PV2 from Green Hill B. Glare is predicted from Green Hill B from mid-March to late September between 17:30-19:00 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R5	Glare is predicted from PV1 from Green Hill B. Glare is predicted from PV1 Green Hill B from late April to late August between 17:30-18:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R6	Glare is predicted from PV1 and PV2 from Green Hill B.

Receptor	Results
	Glare is predicted from Green Hill B from early April to early September between 17:30-18:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R7	Glare is predicted from PV1 and PV2 from Green Hill B. R7 is located outside the 1km screening distance of PV2 Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV2 Green Hill B. Glare is predicted from PV1 Green Hill B from early April to late August between 06:30-07:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R8	Glare is predicted from PV1 and PV2 from Green Hill B. R8 is located outside the 1km screening distance of PV2 Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV2 Green Hill B. Glare is predicted from PV1 Green Hill B from late March to mid-September between 06:30-07:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R9	Glare is predicted from PV1 and PV2 from Green Hill B. Glare is predicted from Green Hill B from late March to late September between 05:30-07:30 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R10	Glare is predicted from PV2 from Green Hill B. Glare is predicted from PV2 Green Hill B from late March to early April and from early to mid-September between 05:30-06:30 for a maximum of 10 minutes per day.

Receptor	Results
	Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R11-R23	***No glare is predicted towards R11-R23.***

Detailed results can be provided upon request.

With reference to impact significance guidance (Section 4.3.2.1), a 'no impact' significance may be classified where glare will not be visible from the assessed receptor. As such, no impacts are predicted to occur at R1, and R11-R23.

With reference to impact significance guidance (Section 4.3.2.1), a 'low impact' may be classified where glare of any intensity occurs for less than 60 minutes per day and for less than 3 months per year. As such, low impacts are predicted to occur at R2 and R10.

With reference to impact significance guidance (Section 4.3.2.1), a 'moderate impact' may be classified where unmitigated glare of any intensity occurs for longer than 60 minutes per day, or for more than 3 months of the year. Residential dwellings R3-R9 are predicted to receive glare for less than 60 minutes daily, however the incidence of glare is predicted to exceed 3 months. Based on industry guidance, professional judgement is applied and further review of factors not included within the model are considered in Section 6.1.3.

6.1.2 Tracking Panel Results

Receptor	Results
R1	Glare is predicted from PV1 and PV2 from Green Hill B. R1 is located outside the 1km screening distance of PV1 of Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV1 of Green Hill B. Glare is predicted from PV2 Green Hill B from early October to early March between 15:00-18:00 for a maximum of 20 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R2	Glare is predicted from PV1 and PV2 from Green Hill B. R2 is located outside the 1km screening distance of PV1 of Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV1 from Green Hill B. Glare is predicted from PV2 Green Hill B for days in late September, late October, early to late November, early December, early to mid-January, late January to mid-February, early March and late March between 15:00-18:30 for a maximum of 20 minutes per day.

Receptor	Results
	Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R3	Glare is predicted from PV1 and PV2 from Green Hill B. R2 is located outside the 1km screening distance of PV1 of Green Hill B. As such, a maximum impact magnitude of 'low impact' is assigned to glare predicted from PV1 from Green Hill B. Glare is predicted from PV2 Green Hill B from mid-February to mid-April and early September to late October between 16:00-19:00 for a maximum of 25 minutes per day. As such, glare is predicted for less than 60 minutes per day but for more than three months of the year. Professional judgement and a review of additional considerations has been undertaken in Section 6.1.3.
R4	Glare is predicted from PV1 from Green Hill B. Glare is predicted from PV1 Green Hill B from early to mid-July and early to mid-September between 17:30-18:30 and 19:30-20:30 for a maximum of 20 minutes per day. Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R5	Glare is predicted from PV1 from Green Hill B. Glare is predicted from PV1 Green Hill B from early to mid-July between 19:30-20:30 for a maximum of 25 minutes per day. Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R6	Glare is predicted from PV1 and PV2 from Green Hill B. Glare is predicted from Green Hill B from early to mid-July and early September between 17:30-18:30 and 19:30-20:30 for a maximum of 25 minutes per day. Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R7-R8	***No glare is predicted towards R7-R8.***
R9	Glare is predicted from PV1 from Green Hill B. Glare is predicted from PV1 Green Hill B from early to mid-March and late September to late October between 06:00-07:30 for a maximum of 5 minutes per day.

Receptor	Results
	Based on industry guidance, glare predicted for less than 60 minutes per day and for less than 3 months of the year may be classified as 'low impact', and no further mitigation is recommended.
R11-R23	***No glare is predicted towards R11-R23.***

Detailed results can be provided upon request.

With reference to impact significance guidance (Section 4.3.2.1), a 'no impact' significance may be classified where glare will not be visible from the assessed receptor. As such, no impacts are predicted to occur at R7-R8 and R11-R23.

With reference to impact significance guidance (Section 4.3.2.1), a 'low impact' may be classified where glare of any intensity occurs for less than 60 minutes per day and for less than 3 months per year. As such, low impacts are predicted to occur at R2, R4-R6 and R9.

With reference to impact significance guidance (Section 4.3.2.1), a 'moderate impact' may be classified where unmitigated glare of any intensity occurs for longer than 60 minutes per day, or for more than 3 months of the year. Residential dwellings R1 and R3 are predicted to receive glare for less than 60 minutes daily, however the incidence of glare is predicted to exceed 3 months. Based on industry guidance, professional judgement is applied and further review of factors not included within the model are considered in Section 6.1.3.

6.1.3 Results Discussion

Additional factors have been considered to determine the residual impact significance at receptors R1 and R3-R9. These include:

- Additional screening/obstructions; and
- The extent to which cloud cover and glare impacts coincide.

6.1.3.1 Additional Screening/Obstructions

R1

Line of sight is obstructed between R1 and Green Hill B is obstructed by nearby farm buildings and dense vegetation to the east of Green Hill B PV2. As such, a maximum impact magnitude of 'low impact' may be classified towards R1.

Figure 6.1: Farm Buildings and Dense Vegetation between R1 and Green Hill B

© Google Street View

R3

Line of sight is obstructed between R3 and Green Hill B by intervening topography and vegetation. As such, a maximum impact of 'low impact' may be classified towards R3 from Green Hill B.

Figure 6.2: Line of sight from R3 towards Green Hill B (R3 to the left of screenshot, Green Hill B to the right)

© Google Street View

R4

Line of sight is obstructed between R4 and Green Hill B by intervening vegetation and farm buildings to the north and west of R4. As such, a maximum impact of 'low impact' may be classified towards R4 from Green Hill B.

Figure 6.3: Line of sight from R4 towards Green Hill B

© Google Street View

R5

Line of sight is obstructed between R5 and Green Hill B by intervening topography and vegetation. As such, a maximum impact of 'low impact' may be classified towards R5 from Green Hill B.

Figure 6.4: Line of sight from R5 towards Green Hill B

© Google Satellite

R6

Line of sight is obstructed between R6 and Green Hill B is obstructed by dense vegetation and farm buildings to the northwest of R6. As such, a maximum impact magnitude of 'low impact' may be classified towards R6.

Figure 6.5: Dense vegetation and farm buildings between R6 and Green Hill B

© Google Satellite

R7

Line of sight is obstructed between R7 and Green Hill B is obstructed by dense vegetation aligning the Moulton Road. As such, a maximum impact magnitude of 'low impact' may be classified towards R7.

Figure 6.6: Dense vegetation between R7 and Green Hill B

© Google Street View

R8

Line of sight is obstructed between R8 and Green Hill B is obstructed by dense vegetation to the west of Green Hill B. As such, a maximum impact magnitude of 'low impact' may be classified towards R8.

Figure 6.7: Dense vegetation between R8 and Green Hill B

© Google Street View

R9

Line of sight is obstructed between R9 and Green Hill B is obstructed by dense vegetation aligning the Moulton Road and beyond. As such, a maximum impact magnitude of 'low impact' may be classified towards R9.

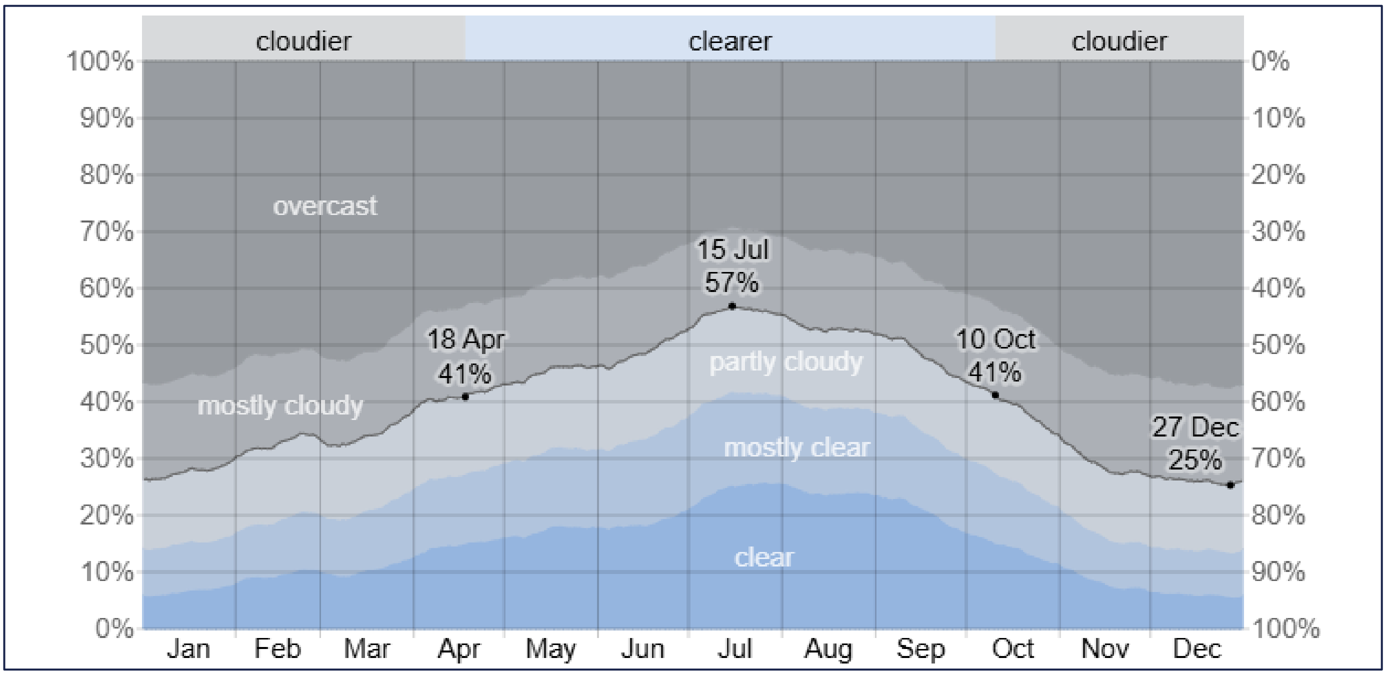
Figure 6.8: Dense vegetation between R9 and Green Hill B

© Google Street View

6.1.3.2 Cloud Cover

As the worst-case approach, the model assumes clear sky conditions all year round. In the affected months (year-round) cloudier conditions (overcast and mostly cloudy) exist in Brixworth (closest weather data available) for 43-75% of the time, as shown below in Figure 6.9.

Figure 6.9: Cloud Cover at Brixworth



© weatherspark.com

Considering the cloud cover that is likely to occur in the area, the modelled glare from the Scheme is likely to occur 43% less of often than predicted as a minimum.

6.1.4 Residual Impact

Receptor	Residual Impact	
	Fixed Panels	Tracking Panels
R1	**No Impact**	**Low Impact** (upon applying professional judgement)
R2	**Low Impact**	**Low Impact**
R3	**Low Impact** (upon applying professional judgement)	**Low Impact** (upon applying professional judgement)
R4	**Low Impact** (upon applying professional judgement)	**Low Impact**
R5	**Low Impact** (upon applying professional judgement)	**Low Impact**
R6	**Low Impact** (upon applying professional judgement)	**Low Impact**
R7	**Low Impact** (upon applying professional judgement)	**No Impact**
R8	**Low Impact** (upon applying professional judgement)	**No Impact**
R9	**Low Impact** (upon applying professional judgement)	**Low Impact**
R10	**Low Impact**	**No Impact**
R11	**No Impact**	**No Impact**
R12	**No Impact**	**No Impact**
R13	**No Impact**	**No Impact**
R14	**No Impact**	**No Impact**
R15	**No Impact**	**No Impact**
R16	**No Impact**	**No Impact**
R17	**No Impact**	**No Impact**
R18	**No Impact**	**No Impact**
R19	**No Impact**	**No Impact**
R20	**No Impact**	**No Impact**
R21	**No Impact**	**No Impact**
R22	**No Impact**	**No Impact**
R23	**No Impact**	**No Impact**

7. Conclusions

Modelling was undertaken as part of the ES Chapter Technical Appendix for Green Hill Solar Farm for ground-based receptors nearby to Green Hill B.

Glare was predicted from fixed panels towards 9 of the 23 modelled residential dwellings. A 'low impact' was classified at all of the affected residential dwellings.

Glare was predicted from tracking panels towards 7 of the 23 modelled residential dwellings. A 'low impact' was classified at all of the affected residential dwellings.

It is recommended that the current screening outlined within this report is maintained to an appropriate height and density such that it obstructs line of sight between the assessed receptors and proposed arrays.

Appendices

Appendix A: Assumptions, Limitations & Fixed Model Variables

1. The sun position and glare analysis will be determined throughout the year on a 1-minute basis.
2. The maximum amount of solar power striking surface normal to the sun per unit area (Peak direct normal irradiance, DNI) is set at 1,000 W/m^2. This will be scaled for each time step to account for changing sun position.
3. The average subtended angle of the sun as viewed from earth is 9.3 mrad.
4. The ocular transmission coefficient for the radiation that is absorbed in the eye before reaching the retina, is set to 0.5.[18,19]
5. Observer pupil diameter is set at the typical value of 0.002 m for daylight.[18,19]
6. Eye focal length for the distance between the nodal point (where rays intersect in the eye) and the retina is set at the typical value of 0.017 m. [18,19]
7. 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, models have been validated 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.[20]
8. The algorithm assumes that the PV array is aligned with a plane defined by the total heights (ground elevation plus PV array height) of the coordinates outlined in the Google map.
9. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors. As such, calculated DNI may vary from actual DNI experienced by observer.
10. The system output calculation is a DNI-based approximation that assumes clear, sunny skies all year-round.
11. 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.
12. Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
13. Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
14. PV array tracking assumes the modules move instantly when tracking the sun, and when reverting to the rest position.

[18] Ho, C. K., Ghanbari, C. M., and Diver, R. B., 2011, Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation, ASME J. Sol. Energy Eng., 133.
[19] Sliney, D.H. and B.C. Freasier, 1973, Evaluation of Optical Radiation Hazards, Applied Optics, 12(1), p. 1-24.
[20] [redacted]

Appendix B: Dwelling Receptor Details

Receptor	Latitude (°)	Longitude (°)	Receptor	Latitude (°)	Longitude (°)
1	52.31255	-0.82508	**13**	52.31716	-0.842
2	52.31178	-0.82105	**14**	52.31794	-0.84064
3	52.31002	-0.81839	**15**	52.31831	-0.8401
4	52.30455	-0.82926	**16**	52.31859	-0.83994
5	52.30259	-0.83069	**17**	52.31885	-0.8395
6	52.30293	-0.82397	**18**	52.31879	-0.83819
7	52.30345	-0.85322	**19**	52.31896	-0.8369
8	52.30423	-0.85321	**20**	52.31892	-0.83599
9	52.30707	-0.85318	**21**	52.31896	-0.83512
10	52.31164	-0.84868	**22**	52.31896	-0.83432
11	52.3127	-0.84511	**23**	52.31785	-0.83168
12	52.31357	-0.84624	**-**	-	-