



Glint and Glare Assessment

Heath Road Solar Farm

04/06/2025



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Contents

1. EXECUTIVE SUMMARY	6
2. INTRODUCTION	8
Background	8
Proposed Development Description	8
Site Description	8
Scope of Report	8
Statement of Authority	9
Definitions	10
3. LEGISLATION AND GUIDANCE	12
National Planning Policy Guidance (NPPG) on Renewable and Low Carbon Energy (UK)	12
Planning Guidance for the Development of Large-Scale Ground Mounted Solar PV Systems	12
Interim CAA Guidance – Solar Photovoltaic Systems (2010)	13
CAA – CAP738: Safeguarding of Aerodromes 3 rd Edition.....	14
US Federal Aviation Administration Policy	15
FAA Policy: Review of Solar Energy Systems Projects on Federally - Obligated Airports.....	16
Review of Local Plan	17
4. METHODOLOGY	18
Sun Position and Reflection Model	18
Identification of Receptors	20
Magnitude of Impact.....	21
5. BASELINE CONDITIONS.....	25
Ground Based Receptors Reflection Zones	25
6. IMPACT ASSESSMENT.....	33
Ground Based Receptors.....	33
7. CUMULATIVE ASSESSMENT.....	41
8. Ground Based Receptor Mitigation	42
9. SUMMARY	46
10. APPENDICES	48
Appendix A: Figures.....	48
Appendix B: Residential Receptor Glare Results	48
Appendix C: Road Receptor Glare Results	48

Appendix D: Aviation Receptor Glare Results.....	48
Appendix E: Visibility Assessment Evidence	48
Appendix F: Solar Module Glare and Reflectance Technical Memo.....	48

1. EXECUTIVE SUMMARY

- 1.1. This assessment considers the potential impacts on ground-based receptors such as roads, rail and residential dwellings as well as aviation assets. A 1km study area around the Application Site is considered adequate for the assessment of ground-based receptors, whilst a 30km study area is chosen for aviation receptors. Within 1km of the Application Site, there are 21 residential receptors, including one residential area, and 38 road receptors which were considered. As per the methodology section, where there are a number of residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for full assessment as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on either end of the group have been assessed in detail. Three residential receptors and 11 road receptors were dismissed as they are located within the no reflection zones. 18 aerodromes are located within the 30km study area; Three of which, Leicester Airport, East Midlands Airport and Lodge Farm, required a detailed assessment due to the Proposed Development falling within its respective safeguarding buffer zone, which is outlined in **paragraph 4.25**.
- 1.2. Geometric analysis was conducted at 18 individual residential receptors, including one residential area, and 27 road receptors as well as 14 runway approach paths and two air traffic control towers (ATCTs).
- 1.3. Following an initial assessment, rail receptors were scoped out as assets that will be impacted upon from the Proposed Development as no rail receptors fell within the 1km study area. The assessment concludes that:
- Solar reflections are possible at eight of the 18 residential receptors assessed within the 1km study area. The initial bald-earth scenario identified potential impacts as **Medium** at one receptor, **Low** at seven receptors, including one residential area, and **None** at the remaining 10 receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts reduce to **None** at all receptors.
 - Solar reflections are possible at 23 of the 27 road receptors assessed within the 1km study area. The initial bald-earth scenario identified potential impacts as **High** at seven receptors, **Low** at 16 receptors and **None** at the remaining four receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at two receptors and reduce to **None** at all remaining receptors. Once mitigation measures were considered, glint and glare impacts reduce to **None** at all receptors.
 - **No impact** on train drivers or railway infrastructure is predicted.
 - No glare was predicted to impact the runway approach paths or ATCT at East Midlands Airport. Therefore, the impact on East Midlands Airport is **None**. Only green glare is

predicted to impact upon Runway 22, 24, 28, 33 and 34 approach paths and ATCT at Leicester Airport and Runway 08 approach path at Lodge Farm. Green glare is an **acceptable impact** when pilots are approaching runways/helipads, according to FAA guidance. Therefore, the impact on these runway approach paths is **Not Significant**. Upon reviewing the actual visibility of the ATCT at Leicester Airport, the impact reduces to **None**. Therefore, the impact on aviation assets is **Low** and **Not Significant**.

- 1.4. Mitigation is required to screen the **High** impact views into the Proposed Development from Road Receptors 15 and 17. This includes native hedgerows to be planted/infilled and maintained to a height of at least 3m along the southern boundary of Array 2 in the Proposed Development as shown in the G&G Mitigation Planting figure.
- 1.5. The effects of glint and glare and their impact on local receptors has been analysed in detail and is predicted to be only **Low** and **None** impacts, and therefore **No Significant Effects**.

2. INTRODUCTION

BACKGROUND

- 2.1. Neo Environmental Ltd has been appointed by DWD Property Planning (the “Applicant”) to undertake a Glint and Glare Assessment for a proposed solar photovoltaic farm and associated infrastructure, including two cable route corridors to the point of connection (the “Proposed Development”) on lands c. 2.2km east of Barlestone, Leicestershire (the “Application Site”).

PROPOSED DEVELOPMENT DESCRIPTION

- 2.2. The Proposed Development will consist of the construction of ground-based PV panels mounted on metal frames, customer substation, DNO, power station, inverters, fencing, access gates, access tracks and all ancillary grid infrastructure and associated works.

SITE DESCRIPTION

- 2.3. The Application Site is located c. 2.2km to the east of the village of Barlestone. Centred at approximate Grid Reference N2305704 E445446, the Application Site covers a total area of c. 31.9 hectares. Comprising of two fields, the Proposed Development will be accessed via existing roads from Heath Road.

SCOPE OF REPORT

- 2.4. Although there may be small amounts of glint and glare from the metal structures associated with the solar farm, the main source of glint and glare will be from the panels themselves and this will be the focus of this assessment.
- 2.5. Solar panels are designed to absorb as much light as possible and not to reflect it. However, glint can be produced as a reflection of the sun from the surface of the solar PV panel. This can also be described as a momentary flash. This may be an issue due to visual impact and viewer distraction on ground-based receptors and on aviation.
- 2.6. Glare is significantly less intense in comparison to glint and can be described as a continuous source of bright light, relative to diffused lighting. This is not a direct reflection of the sun, but a reflection of the sky around the sun.

2.7. This report will concentrate on the effects of glint and glare and its impact on local receptors and will be supported with the following Figures and Appendices.

- Appendix A: Figures
 - Figure 1: Residential Based Receptors
 - Figure 2: Road Based Receptors
 - Figure 3: Site Layout
 - Figure 4: Panel Area Labels
 - Figure 5: G&G Mitigation Planting
 - Figure 6: Leicestershire Airport Aerodrome Chart
 - Figure 7: East Midlands Airport Aerodrome Chart
- Appendix B: Residential Receptor Glare Results
- Appendix C: Road Receptor Glare Results
- Appendix D: Aviation Receptor Glare Results
- Appendix E: Visibility Evidence Assessment
- Appendix F: Solar Module Glare and Reflectance Technical Memo¹

STATEMENT OF AUTHORITY

2.8. This Glint and Glare Assessment has been produced by Tom Saddington, Michael McGhee and David Thomson of Neo Environmental. Having completed a civil engineering degree in 2012, Michael has produced Glint and Glare assessments for over 1GW of solar farm developments across the UK and Ireland. Tom has an undergraduate degree in Bioengineering and graduated with an MSc in Environmental and Energy Engineering in January 2020. He has been working on various technical assessments including glint and glare reports for numerous solar farms in Ireland and the UK. David has an undergraduate degree in physics, as well as a MSc in sensor design, a MSc in nanoscience and a Diploma in acoustics and noise control. He is an Environmental Engineer who has worked on numerous Glint and Glare assessments for solar farms across the UK and Ireland.

¹ Sunpower Corporation (September 2009), T09014 Solar Module Glare and Reflectance Technical Memo

DEFINITIONS

- 2.9. This study examined the potential hazard and nuisance effects of glint and glare in relation to ground-based receptors, this includes the occupants of surrounding dwellings as well as road users. The FAA in their *“Technical Guidance for Evaluating Selected Solar Technologies on Airports”*² have defined the terms ‘Glint’ and ‘Glare’ as meaning;
- Glint – *“A momentary flash of bright light”*
 - Glare – *“A continuous source of bright light”*
- 2.10. Glint and glare are essentially the unwanted reflection of sunlight from reflective surfaces. This study used a multi-step process of elimination to determine which receptors have the potential to experience the effects of glint and glare. It then examined, using a computer-generated geometric model, the times of the year and the times of the day such effects could occur. This is based on the relative angles between the sun, the panels, and the receptor throughout the year.

General Nature of Reflectance from Photovoltaic Panels

- 2.11. In terms of reflectance, photovoltaic solar panels are by no means a highly reflective surface. They are designed to absorb sunlight and not to reflect it. Nonetheless, photovoltaic panels have a flat polished surface, which omits ‘specular’ reflectance rather than a ‘diffuse’ reflectance, which would occur from a rough surface. Several studies have shown that photovoltaic panels (as opposed to Concentrated Solar Power) have similar reflectance characteristics to water, which is much lower than the likes of glass, steel, snow and white concrete by comparison (See Appendix F). Similar levels of reflectance can be found in rural environments from the likes of shed roofs and the lines of plastic mulch used in cropping. In terms of the potential for reflectance from photovoltaic panels to cause hazard and/ or nuisance effects, there have been a number of studies undertaken in respect of schemes in close proximity to airports. The most recent of these was compiled by the Solar Trade Association (STA) in April 2016 and used a number of case studies and expert opinions, including that from Neo. The summary of this report states that *“the STA does not believe that there is cause for concern in relation to the impact of glint and glare from solar PV on aviation and airports...”*³.

2 Harris, Miller, Miller & Hanson Inc. (April 2018). Technical Guidance for Evaluating Selected Solar Technologies on Airports; 3.1.2 Reflectivity. Technical Guidance for Evaluating Selected Solar Technologies on Airports. Available at: <https://www.faa.gov/sites/faa.gov/files/airports/environmental/FAA-Airport-Solar-Guide-2018.pdf>

3 Solar Trade Association. (April 2016). Summary of evidence compiled by the Solar Trade Association to help inform the debate around permitted development for non - domestic solar PV in Scotland. Impact of solar PV on aviation and airports. Available at: <http://www.solar-trade.org.uk/wp-content/uploads/2016/04/STA-glint-and-glare-briefing-April-2016-v3.pdf>

Time Zones / Datum's

- 2.12. Locations in this report are given in Eastings and Northings using the 'British National Grid' grid reference system unless otherwise stated.
- 2.13. England uses British Summer Time (BST, UTC + 01:00) in the summer months and Greenwich Mean Time (UTC+0) in the winter period. For the purposes of this report all time references are in GMT.

3. LEGISLATION AND GUIDANCE

NATIONAL PLANNING POLICY GUIDANCE (NPPG) ON RENEWABLE AND LOW CARBON ENERGY (UK) ⁴

3.1. Paragraph 013 (Reference ID: 5-013-20150327) sets out planning considerations that relate to large scale ground-mounted solar PV farms. This determines that 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. Considerations to be taken into account by local planning authorities are;

- *“the proposal’s visual impact, the effect on landscape of glint and glare 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.”*

PLANNING GUIDANCE FOR THE DEVELOPMENT OF LARGE-SCALE GROUND MOUNTED SOLAR PV SYSTEMS

3.2. As outlined within the BRE document ‘Planning Guidance for the Development of Large-Scale Ground Mounted Solar PV Systems’⁵

“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

⁴ NPPG Renewable and Low Carbon Energy. Available at:
http://planningguidance.communities.gov.uk/blog/guidance/renewable-and-low-carbon-energy/particular-planning-considerations-for-hydropower-active-solar-technology-solar-farms-and-wind-turbines/#paragraph_012

⁵ BRE (2013) *Planning Guidance for the Development of Large Scale Ground Mounted Solar PV Systems*. Available at:
https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

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."

INTERIM CAA GUIDANCE – SOLAR PHOTOVOLTAIC SYSTEMS (2010)

- 3.3. There is little guidance on the assessment of glint and glare from solar farms with regards to aviation safety. The Civil Aviation Authority (CAA) has published interim guidance on 'Solar Photovoltaic Systems'⁶, they also intend to undertake a review of the potential impacts of solar PV developments upon aviation, however this is yet to be published.
- 3.4. The interim guidance identifies the key safety issues with regards to aviation, including *"glare, dazzling pilots leading them to confuse reflections with aeronautical lights."* It is outlined that solar farm developers should be aware of the requirements to comply with the Air Navigation Order (ANO), published in 2016 and amended in 2022. In particular, developers should be cognisant of the following articles of the ANO⁷, including:
- **Article 240** – *Endangering safety of an aircraft* – "A person must not recklessly or negligently act in a manner likely to endanger an aircraft, or any person in an aircraft."
 - **Article 224** - *Lights liable to endanger* – "A person must not exhibit in the United Kingdom any light which:
 - a) by reason of its glare is liable to endanger aircraft taking off or from landing at an aerodrome; or
 - b) by reason of its liability to be mistaken for an aeronautical ground light liable to endanger aircraft"
 - **Article 225** – *Lights which dazzle or distract* – "A person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft."
- 3.5. Relevant studies generally agree that there is potential for glint and glare from photovoltaic panels to cause a hazard or nuisance for surrounding receptors, but that the intensity of such

⁶ CAA (2010) Interim CAA Guidance – Solar Photovoltaic Systems. Available at: <https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&appid=11&mode=detail&id=4370>

⁷ CAA (2016) Air Navigation: The Order and Regulations. Available at: <https://www.caa.co.uk/media/1a2cigrq/air-navigation-order-2016-amended-april-2022-version.pdf>

reflections is similar to that emanating from still water. This is considerably lower than for other manmade materials such as glass, steel or white concrete (SunPower – 2009).

- 3.6. These Articles are considered within the assessment of glint and glare of the Proposed Development.

CAA – CAP738: SAFEGUARDING OF AERODROMES 3RD EDITION⁸

- 3.7. In 2003 the CAA first introduced the CAP738 document to help provide advice and guidance to ensure aerodrome safeguarding. Subsequently, there have been two updates to this document in 2006 and 2020.

- 3.8. Within the latest edition of CAP738, it outlines that the purpose of the document is to protect an aerodrome and to ensure safe operation. Specifically stating:

“Its purpose is to protect:

Aircraft from the risk of glint and glare e.g. solar panels.”

- 3.9. Within the section named as “Appendix C – Solar Photovoltaic Cells”, the following is stated:

“Policy

1. In 2010 the CAA published interim guidance on Solar Photovoltaic Cells (SPCs). At that time, it was agreed that we would review our policy based on research carried out by the Federal Aviation Authorities (FAA) in the United States, in addition to reviewing guidance issued by other National Aviation Authorities. New information and field experience, particularly with respect to compatibility and glare, has resulted in the FAA reviewing its original document ‘Technical Guidance for Evaluating Selected Solar Technologies on Airports’, which is likely to be subject to change, see link; <https://www.federalregister.gov/documents/2013/10/23/2013-24729/interimpolicy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports>

2. In the United Kingdom there has been a further increase in SPV cells, including some located close to aerodrome boundaries; to date the CAA has not received any detrimental comments or issues of glare at these established sites. Whilst this early indication is encouraging, those responsible for safeguarding should remain vigilant to the possibility.”

- 3.10. The above is stating that to date, there has not been any complications on airfields due to glare originating from solar farms across the UK.

⁸ Civil Aviation Authority (2020). CAP738 – Safeguarding of Aerodromes 3rd Edition. Available at: <https://publicapps.caa.co.uk/docs/33/CAP738%20Issue%203.pdf>

US FEDERAL AVIATION ADMINISTRATION POLICY

- 3.11. The US Federal Aviation Administration (FAA) in their Solar Guide (Federal Aviation Authority, 2018)⁹ incorporates a chapter on the impact and assessment of glint from solar panels. It concludes that (although subject to revision):

“Depending on site specifics (e.g., existing land uses, location and size of the project) an acceptable evaluation could involve one or more of the following levels of assessment:

(1) A qualitative analysis of potential impact in consultation with the Air Traffic Control Tower, pilots, and airport officials

(2) A demonstration field test with solar panels at the proposed site in coordination with Air Traffic Control Tower personnel

(3) A geometric analysis to determine days and times when there may be an ocular impact.”

- 3.12. The interim policy (Federal Register, 2013)¹⁰ demands that an ocular impact assessment must be assessed at 1-minute intervals from when the sun rises above the horizon until the sun sets below the horizon. Specifically, the developer must use the ‘Solar Glare Hazard Analysis Tool’ (SGHAT) tool specifically and reference its results as this was developed by the FAA and Sandia National Laboratories as a standard and approved methodology for assessing potential impacts on aviation interests, although it notes other assessment methods may be considered. The SGHAT tool has since been licensed to a private organisation who were also involved in its development and it is the software model used in this assessment.

- 3.13. Crucially, the policy provides a quantitative threshold which is lacking in the English guidance. This outlines that a solar development will not automatically receive an objection on glint grounds if low intensity glint is visible to pilots on final approach. In other words, low intensity glint with a low potential to form a temporary after-image (Green Glare) would be considered acceptable under US guidance. Due to the lack of legislation and guidance within England, this US document has been utilised as guidance for this report.

- 3.14. The FAA guidance states that for a solar PV development to obtain FAA approval or to receive no objection, the following two criteria must be met:

- No potential for glint or glare in the existing or planned Air Traffic Control Tower (ATCT); and

⁹ FAA (2018), Technical Guidance for Evaluating Selected Solar Technologies on Airports. Available at <https://www.faa.gov/sites/faa.gov/files/airports/environmental/FAA-Airport-Solar-Guide-2018.pdf>

¹⁰ FAA (2013), Interim Policy, *FAA Review of Solar Energy System Projects on Federally Obligated Airports*. Available at <https://www.federalregister.gov/documents/2013/10/23/2013-24729/interim-policy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports>

- No potential for glare or “low potential for after-image” (Green Glare) along the final approach path for any existing or future runway landing thresholds (including planned or interim phases), as shown by the approved layout plan (ALP). The final approach path is defined as 2 miles from 50 feet above the landing threshold using a standard 3-degree glide path.
- 3.15. The geometric analysis included later in this report, which defines the extent and time at which glint may occur, is required by the FAA as the methodology to be used when assessing glint and glare impacts on aviation receptors. This report follows the methodology required by the FAA as it offers the most robust assessment method currently available.

FAA POLICY: REVIEW OF SOLAR ENERGY SYSTEMS PROJECTS ON FEDERALLY - OBLIGATED AIRPORTS¹¹

- 3.16. The FAA updated their Interim Policy from 2013 as part of their commitment to “*update policies and procedures as part of an iterative process as new information and technologies become available.*” The main development regarding Glint and Glare since the Interim Policy is the following:

“Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs.”

- 3.17. This is outlining that solar panels are similar to nuisances that are already caused by other existing infrastructure, such as; car parks, glass buildings and water bodies. Furthermore, the ATCT has been outlined as the key receptor to be assessed when determining Glint and Glare impacts from a solar farm.

¹¹ FAA (2021). FAA Policy: Review of Solar Energy Systems Projects on Federally – Obligated Airports. Available at: <https://www.federalregister.gov/documents/2021/05/11/2021-09862/federal-aviation-administration-policy-review-of-solar-energy-system-projects-on-federally-obligated>

REVIEW OF LOCAL PLAN

Hinckley and Bosworth Local Plan

- 3.18. The Hinckley and Bosworth Local Plan 2006 to 2026¹² was adopted in December 2009.
- 3.19. There are no policies contained within the Plan which are of relevance to this glint and glare report.
- 3.20. Hinckley and Bosworth Borough Council are currently working on a new Local Plan¹³ which will set out land allocations and planning policies for the period 2024 to 2045. The Draft Local Plan (June 2021-August 2021) has completed its initial Regulation 18 and Regulation 19 Consultation, and a further round of Regulation 18 Consultation in July 2024-September 2024. The Local Development Scheme (LDS) indicates that the timeframes going forwards that a further round of Regulation 18 and 19 consultations will need to be programmed in late 2025-early 2026 to allow for changes arising from the new NPPF, NPPG and standard housing method introduced in December 2024. The Local Plan submission to the Secretary of State (Regulation 22) is anticipated for late 2026 and in late 2027 for adoption.
- 3.21. There are no policies contained within the draft Local Plan which are of relevance to this glint and glare report.

¹² Hinckley and Bosworth Local Plan 2006 to 2026, available at: <https://www.hinckley-bosworth.gov.uk/localplandocs>

¹³ Hinckley and Bosworth Draft Local Plan 2020 – 2039, available at: <https://www.hinckley-bosworth.gov.uk/localplanreview>

4. METHODOLOGY

- 4.1. A desk-based assessment was undertaken to identify when and where glint and glare may be visible at receptors within the vicinity of the Proposed Development, throughout the day and the year.

SUN POSITION AND REFLECTION MODEL

Sun Data Model

- 4.2. The calculations in the solar position calculator are based on equations from Astronomical Algorithms¹⁴. The sunrise and sunset results are theoretically accurate to within a minute for locations between +/- 72° latitude, and within 10 minutes outside of those latitudes. However, due to variations in atmospheric composition, temperature, pressure and conditions, observed values may vary from calculations.

Solar Reflection Model

- 4.3. The position of the sun is calculated at one-minute intervals of a typical year, in this instance the year being assessed was 2023.
- 4.4. In order to determine if a solar reflection will reach a receptor the following variables are required:
- Sun position;
 - Observer location, and;
 - Tilt, orientation, and extent of the modules in the solar array.
- 4.5. The model assumes that the azimuth and horizontal angle of the sun is the same across the whole solar farm. This is considered acceptable due to the distance of the sun from the Proposed Development and the miniscule differences in location of the sun over the Proposed Development.
- 4.6. Once the position of the sun is known for each time interval, a vector reflection equation determines the reflected sun vector, based on the normal vector of the solar array panels. This assumes that the angle of reflection is equal to the angle of incidence reflected across a normal plane. In this instance, the plane being the vector which the solar panels are facing.

¹⁴ Jean Meeus, Astronomical Algorithms (Second Edition), 1999

- 4.7. On knowing the vector of the solar reflection, the azimuth is calculated and the horizontal reflection from multiple points within the solar farm. These are then compared with the azimuth and horizontal angle of the receptor from the solar farm to determine if it is within range to receive solar reflections.
- 4.8. The solar reflection in the model is considered to be specular as a worst-case scenario. In practice the light from the sun will not be fully reflected as solar panels are designed to absorb light rather than reflect it. The text above and **Appendix F** outlines the reflective properties of solar glass and compares it to other reflective surfaces. Although the exact figures in this report could be argued, it is included as a visual guide and it agrees with most other reports, in that solar glass has less reflective properties than other types of glass, bodies of water and snow, and that the amount of reflective energy drops as the angle of incidence decreases.
- 4.9. The panel reflectivity has been modelled to assume an anti-reflective coating (ARC) which is the industry standard for photo-voltaic panels and further reduces the reflective properties of the PV panels.

Determination of Ocular Impact

- 4.10. The software used for this assessment is based on the Sandia Laboratories Solar Glare Hazard Analysis Tool (SGHAT). This tool is specifically mentioned in the FAA guidance as the software which should be used in this type of assessment.
- 4.11. Determination of the ocular impact requires knowledge of the direct normal irradiance, PV module reflectance, size and orientation of the array, optical properties of the PV module, and ocular parameters. These values are used to determine the retinal irradiance and subtended source angle used in the ocular hazard plot.
- 4.12. The ocular impact¹⁵ of viewed glare 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).
- 4.13. Green glare can be ignored when looking at residential and some aviation receptors. Green glare does not cause temporary flash blindness and happens at an instant with very slight disturbance. As per FAA guidelines mitigation is only required for green glare when affecting an Air Traffic Control Tower, but not for when affecting pilots. Therefore, it can be assumed that green glare is acceptable for residential receptors.
- 4.14. The subtended source angle represents the size of the glare viewed by an observer, while the retinal irradiance determines the amount of energy impacting the retina of the observer. Larger source angles can result in glare of high intensity, even if the retinal irradiance is low.

¹⁵ Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation, Journal of Solar Energy Engineering-Transactions of the Asme, 133(3).

- 4.15. The modelling software outputs a hazard plot for each receptor predicted to be impacted by glare from the photovoltaic (PV) array. An orange dot is plotted for each minute of glare indicating the irradiance (power density) of the reflected solar light. A yellow dot is plotted to show the irradiance of the Sun when it is viewed directly. The hazard plot shows that the irradiance of the Sun is approximately three orders of magnitude greater than the reflected irradiance, i.e., the power density of solar reflections from photovoltaic panels are approximately 0.1% that of viewing the Sun. Due to the disparity in irradiance, whenever the Sun is observed in the same frame as solar reflections from a PV array, the Sun will be main source of glare impacts upon the observer. In such a case, the impact is deemed to be **Low** as a worst-case scenario.

Relevant Parameters of the Proposed Development

- 4.16. The photovoltaic panels are oriented in a southwards direction to maximise solar gain and will remain in a fixed position throughout the day and during the year (i.e. they will not rotate to track the movement of the sun). The panels will face southwards and will be inclined at an angle of 25 degrees.
- 4.17. The height of the panels above ground level is a maximum of 2.8m and points at the top of the panels are used to determine the potential for glint and glare generation.

IDENTIFICATION OF RECEPTORS

Ground Based Receptors

- 4.18. Glint is most likely to impact upon a ground-based receptor close to dusk and dawn, when the sun is at its lowest in the sky. Therefore, any effect would likely occur early in the day or late in the day, reflected to the west at dawn and east at dusk.
- 4.19. A 1km study area from the panels was deemed appropriate for the assessment of ground-based receptors as this seemed to contain a good spread of residential and road receptors in most directions from the Proposed Development. The further distance a receptor is from a solar farm, the less chance it has of being affected by glint and glare due to scattering of the reflected beam and atmospheric attenuation, in addition to obstructions from ground sources, such as any intervening vegetation or buildings.
- 4.20. An observer height of 2m was utilised for residential receptors, as this is a typical height for a ground-floor window. With regards to road users, a receptor height of 1.5m was employed as this is typical of eye level.
- 4.21. An assessment was undertaken to determine zones where solar reflections will never be directed near ground level.

- 4.22. Where there are several residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for full assessment as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on either end of the group have been analysed in detail with the worst-case impacts attributed to that receptor.

Aviation

- 4.23. Glint is only considered to be an issue with regards to aviation safety when the solar farm lies within close proximity to a runway, particularly when the aircraft is descending to land. En-route activities are not considered an issue as the flight will most likely be at a higher altitude than the solar reflection.
- 4.24. Should a solar farm be proposed within the safeguarded zone of an aerodrome then a full geometric study may be required which would determine if there is potential for glint and glare at key locations, most likely on the descent to land.
- 4.25. Buffer zones to identify aviation assets vary depending on the safeguarding criteria of that asset. All aerodromes within 30km will be identified, however generally the detailed assessments are only required within: 20km for large international aerodromes, 10km for military aerodromes and 5km for small aerodromes.

MAGNITUDE OF IMPACT

Static Receptors

- 4.26. Although there is no specific guidance set out to identify the magnitude of impact from solar reflections, the following criteria has been set out for the purposes of this report:
- **High** - Solar reflections impacts of over 30 hours per year or over 30 minutes per day
 - **Medium** - Solar reflections impacts between 20 and 30 hours per year or between 20 minutes and 30 minutes per day
 - **Low** - Solar reflections impacts up to 20 hours per year or up to 20 minutes per day
 - **None** - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening

Moving Receptors (Road and Rail)

- 4.27. Again, no specific guidance is available to identify the magnitude of impact from solar reflections on moving receptors except in aviation, however it is thought that a similar

approach should be applied to moving receptors as aviation, based on the ocular impact and the potential for after-image.

4.28. The FAA guidance states that for a solar PV development to obtain FAA approval or to receive no objection the following criteria must be met:

- No potential for glare or “*low potential for after-image*” along the final approach path for any existing or future runway landing thresholds (including planned or interim phases), as shown by the approved layout plan (ALP).

4.29. The following criteria has been set out for the purposes of this report:

- **High** - Solar reflections impacts consisting of any amount of yellow glare.
- **Low** - Solar reflections impacts consisting of any amount of only green glare.
- **None** - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening.

4.30. The FAA produced an evaluation of glare as a hazard and concluded in their report¹⁶ that:

“The more forward the glare is and the longer the glare duration, the greater the impairment to the pilots’ ability to see their instruments and to fly the aircraft. These results taken together suggest that any sources of glare at an airport may be potentially mitigated if the angle of the glare is greater than 25 deg from the direction that the pilot is looking in. We therefore recommend that the design of any solar installation at an airport consider the approach of pilots and ensure that any solar installation that is developed is placed such that they will not have to face glare that is straight ahead of them or within 25 deg of straight ahead during final approach.”

4.31. It is reasonable to assume that although this report was assessing pilots vision impairment that it can be also used to drivers of other vehicles. Therefore, the driver’s field of view will also be analysed where required and if the glare is out with 25 degrees either side of their line of sight then any impacts will reduce to **None**.

Moving Receptors (Aviation)

Approach Paths

4.32. Each final approach path which has the potential to receive glint is assessed using the SGHAT model. The model assumes an approach bearing on the runway centreline, a 3-degree glide path with the origin 50ft (15.24m) above the runway threshold.

¹⁶ Federal Aviation Authority, Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach (2015), Available at <https://libraryonline.erau.edu/online-full-text/faa-aviation-medicine-reports/AM15-12.pdf>

- 4.33. The computer model considers the pilots field of view. The azimuthal field of view (AFOV) or horizontal field of view (HFOV) as it is sometimes referred, refers to the extents of the pilot's horizontal field of view measured in degrees left and right from directly in front of the cockpit. The vertical field of view (VFOV) refers to the extents of the pilot's vertical field of view measured in degrees from directly in front of the cockpit. The HFOV is modelled at 50 degrees left and right from the front of the cockpit whilst the VFOV is modelled at 30 degrees.
- 4.34. The FAA guidance states that there should be no potential for glare or '*low potential for after-image*' at any existing or future planned runway landing thresholds for the Proposed Development to be acceptable.

Air Traffic Control Tower (ATCT)

- 4.35. An air traffic controller uses the visual control room to monitor and direct aircraft on the ground, approaching and departing the aerodrome. It is essential that air traffic controllers have a clear unobstructed view of the aviation activity. The key areas on an aerodrome are the views towards the runway thresholds, taxiways, and aircraft bays.
- 4.36. The FAA guidance states that no solar reflection towards the ATCT should be produced by a proposed solar development, however this should be assessed on a site by site case and will depend on the operations at a particular aerodrome.
- 4.37. In order to determine the impact on the ATCT, the location and height of the tower will need to be fed into the SGHAT model and where there is a potential for '*low potential for After-Image*' or more, then mitigation measures will be required.

Assessment Limitations

- 4.38. Below is a list of assumptions and limitations of the model and methods used within this report:
- The model 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;
 - The model 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;
 - Due to variations in atmospheric composition, temperature, pressure and conditions, observed values may vary slightly from calculated positions;
 - The model does not account for the effects of diffraction; however, buffers are applied as a factor of safety; and

- The model assumes clear skies at all times and does not account for meteorological effects such as cloud cover, fog, or any other weather event which may screen the sun.
- 4.39. Due to these assumptions and limitations the model overestimates the number of minutes of glint and glare which are possible at each receptor and presents the worst-case scenario. Where glint and glare are predicted a visibility assessment is carried out to determine a more accurate, real-world prediction of the impacts.

5. BASELINE CONDITIONS

GROUND BASED RECEPTORS REFLECTION ZONES

- 5.1. Based on the relatively flat topography in the area, solar reflections between five degrees below the horizontal plane to five degrees above it are described as near horizontal. Reflections from the proposed solar farm within this arc have the potential to be seen by receptors at or near ground level.
- 5.2. Further analysis showed that this will only occur between the azimuth of 238.92 degrees and 298.18 degrees in the western direction (late day reflections) and 34.36 degrees and 129.27 degrees in the eastern direction (morning reflections) and therefore any ground-based receptor outside these arcs will not have any impact from solar reflections.
- 5.3. **Figure 1 and 2 of Appendix A** show the respective study areas whilst also subtracting from this the areas where solar reflections will not impact on ground-based receptors due to the reasons set out in **paragraphs 5.1 to 5.2**.

Residential Receptors

- 5.4. Residential receptors located within 1km of the Application Site have been identified (**Table 5 - 1**). The number in brackets indicates which residential area the receptor belongs to. Glint was assumed to be possible if the receptor is located within the ground-based receptor zones outlined previously.
- 5.5. There are three residential receptors (Receptors 19 - 21) which are within the no-reflection zones and are clearly identifiable in **Figure 1: Appendix A**. The process of how these are calculated is explained in **paragraphs 5.1 to 5.2** of this report.

Table 5 - 1: Residential Based Receptors

Receptor	Easting	Northing	Glint and Glare Possible
1	445868	306211	Yes
2	445846	305785	Yes
3	446070	305733	Yes
4	446807	305769	Yes
5	446651	305309	Yes
6	444716	305854	Yes

Receptor	Easting	Northing	Glint and Glare Possible
7	445178	305801	Yes
8	444367	305504	Yes
9	444819	305383	Yes
10	445009	305197	Yes
11 (1)	444450	305228	Yes
12 (1)	444491	305192	Yes
13 (1)	444475	305119	Yes
14 (1)	444533	305135	Yes
15 (1)	444602	305139	Yes
16 (1)	444664	305129	Yes
17 (1)	444451	305067	Yes
18 (1)	444432	304988	Yes
19	444982	306584	No
20	445690	306418	No
21	445286	305131	No

Road / Rail Receptors

- 5.6. There are three roads within the 1km study area that require a detailed Glint and Glare Assessment; The B585, Merrylees Road and Heath Road. There are some minor roads which serve dwellings; however, these have been dismissed as vehicle users of these roads will likely be travelling at low speeds and therefore, there is a negligible risk of safety impacts resulting from glint and glare of the Proposed Development.
- 5.7. There are no railway lines within the 1km study area which require a detailed assessment.
- 5.8. The ground receptor no-reflection zones are clearly identifiable on **Figure 2: Appendix A** and the process of how these are calculated is explained in **paragraphs 5.1 to 5.2** of this report.
- 5.9. **Table 5 - 2** shows a list of receptors points within the study area which are 200m apart.

Table 5 - 2: Road Based Receptors

Receptor	Easting	Northing	Glint and Glare Possible
1	444401	304958	Yes
2	444463	305149	Yes
3	444522	305339	Yes
4	444567	305527	Yes
5	444596	305731	Yes
6	444622	305927	Yes
7	444649	306130	Yes
8	444624	306308	Yes
9	444468	306430	Yes
10	444585	305125	Yes
11	444762	305190	Yes
12	444933	305293	Yes
13	445110	305386	Yes
14	445298	305476	Yes
15	445465	305561	Yes
16	445652	305625	Yes
17	445843	305650	Yes
18	446033	305709	Yes
19	446226	305752	Yes
20	446420	305783	Yes
21	446623	305790	Yes
22	446816	305795	Yes
23	446311	305873	Yes
24	446153	306000	Yes
25	446003	306121	Yes
26	445825	306215	Yes

Receptor	Easting	Northing	Glint and Glare Possible
27	444497	306556	Yes
28	445644	306303	No
29	445460	306391	No
30	445264	306444	No
31	445079	306516	No
32	444885	306557	No
33	444687	306580	No
34	445661	306494	No
35	445720	306690	No
36	445631	306846	No
37	445502	306995	No
38	445438	307185	No

Aviation Receptors

5.10. Aerodromes within 30km of the Proposed Development can be found in **Table 5 - 3**.

Table 5 - 3: Airfields within close proximity

Airfield	Distance (km)	Use
Lodge Farm	3.78	Small grass strip
Wharf Farm	5.88	Small grass strip
Gopsall House Airfield	9.03	Small grass strip
Glebe Farm	9.43	Small grass strip
Stoke Golding Airfield	9.45	Small grass strip
Crown Hill Barn Airfield	10.26	Small grass strip
Cottage Farm	12.62	Small grass strip
Grange Wood Airfield	18.95	Small grass strip
East Midlands Airport	19.73	Licensed airport
Leicester Airport	19.77	Licensed airport

Airfield	Distance (km)	Use
Camp Farm	20.39	Small grass strip
Charity Farm	20.51	Small grass strip
Riding Bank Farm	20.62	Small grass strip
Horse Leys Farm	21.78	Small grass strip
Catton Airfield	24.11	Small grass strip
Fisherwick Airfield	26.37	Small grass strip
Sittles Farm	28.61	Small grass strip
Husbands Bosworth Airfield	29.44	Small grass strip

- 5.11. There are three aerodromes, Leicester Airport, East Midlands Airport and Lodge Farm, which require detailed assessments due to the proposed site being within the airfields' safeguarding buffer zones outlined in **paragraph 4.25**.

Leicester Airport

- 5.12. Leicester Airport (ICAO code EGBG) is an VFR only aerodrome. It is located approximately 4NM (7.41km) east-southeast of Leicester.
- 5.13. The elevation of the aerodrome is 469ft (142.95m). It has three asphalt runways and two grass runways, details of which are given in **Table 5 - 4**.

Table 5 - 4: Runways at Leicester Airport

Runway Designation	True Bearing (°)	Length (m)	Width (m)
04	39.80	490	18
22	219.80	490	18
06	049.20	340	30
24	229.20	340	30
10	096.20	935	30
28	276.20	935	30
15	149.20	495	18
33	329.20	495	18
16	149.90	418	30

34	329.90	418	30
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- 5.14. The threshold location and height of the runway at Leicester Airport are given in **Table 5 - 5**.

Table 5 - 5: Runway Threshold Locations and Heights

Runway Designation	Threshold Latitude	Threshold Longitude	Height AOD (m)
04	52° 36' 13.73" N	001° 01' 48.80" W	140
22	52° 36' 26.08" N	001° 01' 32.28" W	141
06	52° 36' 18.09" N	001° 01' 51.61" W	142
24	52° 36' 25.65" N	001° 01' 37.68" W	142
10	52° 36' 29.87" N	001° 02' 19.99" W	136
28	52° 36' 26.72" N	001° 01' 30.76" W	141
15	52° 36' 27.93" N	001° 02' 02.36" W	140
33	52° 36' 14.24" N	001° 01' 48.98" W	139
16	52° 36' 27.32" N	001° 01' 58.80" W	141
34	52° 36' 15.57" N	001° 01' 47.38" W	140

- 5.15. The ARP is located south of the midpoint of Runway 10/28. The actual location of the ARP and ATCT is given in **Table 5 - 6**. The height of the ATCT is estimated to be 10m based off a Google image search.

Table 5 - 6: Leicester Airport Reference Point

	Latitude	Longitude	Eastings	Northings
ARP	52° 36' 28.52" N	001° 01' 59.36" W	465632	301562
ATCT	52° 36' 22.28" N	001° 02' 04.25" W	465480	301371

East Midlands Airport

- 5.16. East Midlands Airport (ICAO code EGNX) is IFR/VFR aerodrome. It is located approximately 7NM (12.96km) southwest of Derby.
- 5.17. The elevation of the aerodrome is 306ft (93.27m). It has one ungrooved asphalt runway, details of which are given in **Table 5 - 7**.

Table 5 - 7: Runways at East Midlands Airport

Runway Designation	True Bearing (°)	Length (m)	Width (m)
09	088.26	2893	45
27	268.29	2893	45

- 5.18. The threshold location and height of the runway at East Midlands Airport are given in **Table 5 - 8**.

Table 5 - 8: Runway Threshold Locations and Heights

Runway Designation	Threshold Latitude	Threshold Longitude	Height AOD (m)
09	52° 49' 50.38" N	001° 20' 48.90" W	93.27
27	52° 49' 52.81" N	001° 18' 30.87" W	85.96

- 5.19. The ARP is located at the midpoint of Runway 09/27. The actual location of the ARP and the ATCT is given in **Table 5 - 9**. The height of the ATCT is 52m.

Table 5 - 9: East Midlands Airport Reference Point

	Latitude	Longitude	Eastings	Northings
ARP	52° 49' 51.46" N	001° 19' 38.59" W	445425	326154
ATCT	52° 49' 34.79" N	001° 19' 55.58" W	445102	325632

Lodge Farm

- 5.20. Lodge Farm is a VFR only private airfield. It is located approximately 0.8NM (1.5km) southwest of Barlestone.
- 5.21. The elevation of the aerodrome is 364ft (111m). It has one grass strip runway, details of which are given in **Table 5 - 10**.

Table 5 - 10: Runways at Lodge Farm

Runway Designation	True Bearing (°)	Length (m)	Width (m)
08	082.3	350	20
26	262.3	350	20

- 5.22. The threshold location and height of the runway at Lodge Farm are given in Table 5 - 11.

Table 5 - 11: Runway Threshold Locations and Heights

Runway Designation	Threshold Latitude	Threshold Longitude	Height AOD (m)
08	52° 38' 11.43" N	001° 23' 33.83" W	109
26	52° 38' 12.95" N	001° 23' 15.71" W	109

- 5.23. There is no ARP or air traffic control tower at Lodge Farm.

6. IMPACT ASSESSMENT

- 6.1. Following the methodology outlined earlier in this report, geometrical analysis comparing the azimuth and horizontal angle of the receptors from the Proposed Development and the solar reflection was conducted. Although this assessment did not take into account obstructions such as vegetation and buildings, discussion on the potentially impacted receptors is provided where necessary.

GROUND BASED RECEPTORS

Residential Receptors

- 6.2. **Table 6 - 1** identifies the receptors that will experience solar reflections based on solar reflection modelling and whether the reflections will be experienced in the morning (AM), evening (PM), or both. The number in brackets indicates which residential area the receptor belongs.
- 6.3. The three receptors (Receptors 19 - 21) which were within the no-reflection zones outlined previously have been excluded from the detailed modelling as they will never receive any glint and glare impacts from the Proposed Development.
- 6.4. **Appendix B** shows the analysis with the ground mounted solar panels at a tilt angle of 25 degrees. **Table 6 - 1** shows the worst-case impact at each receptor.

Table 6 - 1: Potential for Glint and Glare impact on Residential Receptors

Receptor	Glint Possible from Site		Potential Glare Impact (per year)		Magnitude of Impact
	AM	PM	Minutes	Hours	
1	No	No	0	0	None
2	No	Yes	285	4.75	Low
3	No	Yes	313	5.22	Low
4	No	No	0	0	None
5	No	Yes	72	1.2	Low
6	No	No	0	0	None
7	Yes	No	265	4.42	Low
8	Yes	No	785	13.08	Low

Receptor	Glint Possible from Site		Potential Glare Impact (per year)		Magnitude of Impact
	AM	PM	Minutes	Hours	
9	Yes	No	1682	28.03	Medium
10	No	No	0	0	None
11 (1)	Yes	No	887	14.78	Low
12 (1)	Yes	No	360	6	Low
13 (1)	No	No	0	0	None
14 (1)	No	No	0	0	None
15 (1)	No	No	0	0	None
16 (1)	No	No	0	0	None
17 (1)	No	No	0	0	None
18 (1)	No	No	0	0	None

- 6.5. As can be seen in **Table 6 - 1**, there is a **Medium** impact at one receptor, **Low** impact at seven receptors, including one residential area, and a **None** impact at the remaining 10 receptors. **Appendix B** shows detailed analysis of when the glare impacts are possible, whilst also showing which parts of the solar farm the solar glare is reflected from.
- 6.6. **Appendix E** shows Google Earth images that give an insight into how each receptor will be impacted by glint and glare from the Proposed Development. There is a mixture of images used, which include aerial, ground level and street level. The aerial images show the location of the receptor with the solar farm drawn as a white polygon and can be seen on the images when the solar farm is theoretically visible. The area of the solar farm from where reflections may be possible has been drawn as a yellow polygon. The ground level terrain is based on the height data of the surrounding land showing no intervening vegetation or buildings. The white and yellow polygons can be seen in this view also. The street view gives a good indication as to whether the area of the solar farm where reflections are theoretically possible will be visible from the receptor point.

Receptors 2 and 3

- 6.7. The 'Glare Reflections on PV Footprint' chart in **Appendix B** shows that reflections from a southern section of Array 1 and a northern section of Array 2 (see **Appendix A: Figure 4**) in the Proposed Development can potentially impact on the receptors.
- 6.8. The first image in **Appendix E** is an aerial image showing the position of the receptors (yellow pins) in relation to the Proposed Development, and the location from which the second image

was taken (red dot). The second image is a street view image with a view of the vegetation to the west of the receptor. This image confirms that the vegetation is sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 5

- 6.9. The 'Glint Reflections on PV Footprint' chart in **Appendix B** shows that reflections from all, except a northeast and southwest section, of Array 2 (see **Appendix A: Figure 4**) in the Proposed Development can potentially impact on the receptor.
- 6.10. The first image in **Appendix E** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Development, and the location from which the second image was taken (red dot). The second image is a street view image with a view of the vegetation to the south of the Proposed Development. This image confirms that the vegetation is sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 7

- 6.11. The 'Glint Reflections on PV Footprint' chart in **Appendix B** shows that reflections from a northern section of Array 2 (see **Appendix A: Figure 4**) in the Proposed Development can potentially impact on the receptor.
- 6.12. The first image in **Appendix E** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Development. The second image is a ground level image taken from the position of the receptor with a view towards the Proposed Development. These images confirm that the topography and intervening buildings are sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 8

- 6.13. The 'Glint Reflections on PV Footprint' chart in **Appendix B** shows that reflections from most, except a southern section, of Array 2 (see **Appendix A: Figure 4**) in the Proposed Development can potentially impact on the receptor.
- 6.14. The first image in **Appendix E** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Development, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Development. This image confirms that the vegetation is sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptor 9

- 6.15. The 'Glint Reflections on PV Footprint' chart in **Appendix B** shows that reflections from the southern half of Array 2 (see **Appendix A: Figure 4**) the Proposed Development can potentially impact on the receptor.
- 6.16. The first image in **Appendix E** is an aerial image showing the position of the receptor (yellow pin) in relation to the Proposed Development, and the location from which the second image was taken (red dot). The second image is a street view image with a view of the vegetation to the west of the Proposed Development. This image confirms that the vegetation is sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Receptors 11 and 12

- 6.17. The 'Glint Reflections on PV Footprint' chart in **Appendix B** shows that reflections from a southern section of Array 2 (see **Appendix A: Figure 4**) the Proposed Development can potentially impact on the receptors.
- 6.18. The first image in **Appendix E** is an aerial image showing the position of the receptors (yellow pins) in relation to the Proposed Development, and the location from which the second image was taken (red dot). The second image is a street view image with a view towards the Proposed Development. This image confirms that the vegetation is sufficient to screen views of the Proposed Development where glint and glare is possible. Therefore, the impact reduces to **None**.

Residential Area 1

- 6.19. This encompasses a number of residential receptors including those at Receptors 11 - 18 (assessed previously) (See **Figure 1: Appendix A**). Each receptor assessed represents multiple receptors as they are in close proximity of each other, so the worst-case scenario is assumed for the impact of glint and glare. All receptors were considered within the visibility analysis, and it was concluded their impacts were similar. As per the assessments of these eight receptors, the impacts on the other receptors within this area are assessed as being **None (worst case scenario)**.

Road Receptors

- 6.20. **Table 6 - 2** shows a summary of the modelling results for each of the Road Receptor Points whilst the detailed results and ocular impact charts can be viewed in **Appendix C**.
- 6.21. The 11 receptors within the no-reflection zones outlined previously have been excluded from the detailed modelling as they will never receive glint and glare impacts from the Proposed Development.

Table 6 - 2: Potential for Glint and Glare impact on Road Receptors

Receptor	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)	Magnitude of Impact
1	99	0	0	Low
2	1348	0	0	Low
3	1121	1591	0	High
4	4517	1239	0	High
5	5403	148	0	High
6	3026	0	0	Low
7	793	0	0	Low
8	0	0	0	None
9	0	0	0	None
10	940	0	0	Low
11	798	0	0	Low
12	1004	0	0	Low
13	1140	0	0	Low
14	1340	0	0	Low
15	2127	1454	0	High
16	1642	2369	0	High
17	1097	3669	0	High
18	4882	799	0	High
19	5447	0	0	Low
20	5408	0	0	Low
21	4418	0	0	Low
22	2687	0	0	Low
23	5213	0	0	Low
24	2835	0	0	Low
25	812	0	0	Low

Receptor	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)	Magnitude of Impact
26	0	0	0	None
27	0	0	0	None

- 6.22. As can be seen in **Table 6 - 2**, there are seven receptor points which have potential glare impacts with the “potential for after-image” (yellow glare), which is a **High** impact and 16 receptor points which have potential glare impacts with the “low-potential for after-image”, which is a **Low** impact. **Appendix C** shows detailed analysis of when the glint and glare impacts are possible, whilst also showing from which parts of the solar farm the solar glare is reflected from.
- 6.23. **Appendix E** shows Google Earth images that give an insight into how each receptor will be impacted by glint and glare from the Proposed Development. There is a mixture of images used, which include aerial, ground level and street level. The aerial images show the location of the receptor with the solar farm drawn as a white polygon and can be seen on the images when the solar farm is theoretically visible. The area of the solar farm from where reflections may be possible has been drawn as a yellow or green polygon. The field of view of a driver has been drawn as a red cone, as outlined in **paragraph 4.31**. The ground level terrain is based on the height data of the surrounding land showing no intervening vegetation or buildings. The white, yellow and green polygons can be seen in this view also. Field of view cones for drivers have been drawn using red lines. The street view gives a good indication as to whether the area of the solar farm where reflections are theoretically possible will be visible from the receptor point.
- 6.24. As can be seen in **Appendix E**, views of the Proposed Development from all receptors, except receptors 15 and 17, are blocked by a mixture of intervening vegetation, topography and buildings or are outside the field of view of the driver. Therefore, impacts upon these receptors reduce to **None**.

Aviation Receptors

- 6.25. **Table 6 - 3** shows a summary of the modelling results for each of the runway approach paths as well as at the ATCT whilst the detailed results and ocular impact charts can be viewed in **Appendix D**.

Table 6 - 3: Summary of Component Glare Results

Component	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)
Leicester Airport			

Component	Green Glare (mins)	Yellow Glare (mins)	Red Glare (mins)
Runway 04	0	0	0
Runway 22	153	0	0
Runway 06	0	0	0
Runway 24	1764	0	0
Runway 10	0	0	0
Runway 28	1453	0	0
Runway 15	0	0	0
Runway 33	3878	0	0
Runway 16	0	0	0
Runway 34	3753	0	0
ATCT	1235	0	0
East Midlands Airport			
Runway 09	0	0	0
Runway 27	0	0	0
ATCT	0	0	0
Lodge Farm			
Runway 08	3515	0	0
Runway 26	0	0	0

- 6.26. As can be seen in **Table 6 - 3**, no glare is predicted to impact the runway approach paths or air traffic control tower at East Midlands Airport, the Runway 04, 06, 10, 15 or 16 approach paths at Leicester Airport or the Runway 26 approach path at Lodge Farm. The impact on these aviation assets is therefore **None**. Only green glare is predicted to impact upon the Runway 22, 24, 28, 33 and 34 approach paths and the ATCT at Leicester Airport and the Runway 08 approach path at Lodge Farm.
- 6.27. Green glare is an **acceptable impact** when pilots are approaching runways/helipads, according to FAA guidance. Therefore, the impact on these runway approach paths is **Low** and **Not Significant**. The first image in **Appendix E** is an aerial image showing the location of the Proposed Development in relation to the Leicester Airport ATCT, and the location from which the second image was taken (yellow dot). The second image is a street view image with a view

towards the ATCT. This image confirms that the vegetation is sufficient to block all views of the Proposed Development. Therefore, the impact reduces to **None**.

7. CUMULATIVE ASSESSMENT

- 7.1. The Proposed Development is c. 0.5km north of the existing Lindbridge Farm Solar Farm (planning ref: **14/01270/FUL**). No Glint and Glare Assessment was submitted in relation to this solar farm development. Impacts are currently **None** for all residential based receptors and **High** at two road-based receptors. Once mitigation measures are taken into account, impacts for all road-based receptors are **None**. Impacts are currently **Low** impacts upon the Runway 22, 24, 28 and 34 approach paths at Leicester Airport and the Runway 08 approach path at Lodge Farm. However, these impacts will remain **Low** when taking into account the existing solar farm development. Therefore, it is **anticipated that there will not be any cumulative effects** on aviation receptors as a result of the construction of the Proposed Development.

8. GROUND BASED RECEPTOR MITIGATION

8.1. Mitigation is required to screen the **High** impact views into the Proposed Development from Road Receptors 15 and 17. This includes:

- Native hedgerows to be planted/infilled and maintained to a height of at least 3m along the southern boundary of the Proposed Development as shown in **Figure 5 of Appendix A**. This will screen views from Road Receptors 15 and 17. Therefore, the impact reduces to **None**.

8.2. **Table 7 - 1 and Table 7 - 2** show the impacts at each stage of the glint and glare analysis, with the final residual impacts considered once the mitigation is in place. The number in brackets indicates which residential area the receptor belongs.

Table 7 - 1: Potential Residual Glint and Glare Impacts on Residential Receptors

Receptor	Magnitude of Impact		
	After Geometric Analysis	After Visibility Analysis	Residual Impacts
1	None	Low	None
2	Low	None	None
3	Low	None	None
4	None	None	None
5	Low	None	None
6	None	None	None
7	Low	None	None
8	Low	None	None
9	Medium	None	None
10	None	None	None
11 (1)	Low	None	None
12 (1)	Low	None	None
13 (1)	None	None	None
14 (1)	None	None	None

Receptor	Magnitude of Impact		
	After Geometric Analysis	After Visibility Analysis	Residual Impacts
15 (1)	None	None	None
16 (1)	None	None	None
17 (1)	None	None	None
18 (1)	None	None	None

Table 7 - 2: Potential Residual Glint and Glare Impacts on Road Receptors

Receptor	Magnitude of Impact		
	After Geometric Analysis	After Visibility Analysis	Residual Impacts
1	Low	None	None
2	Low	None	None
3	High	None	None
4	High	None	None
5	High	None	None
6	Low	None	None
7	Low	None	None
8	None	None	None
9	None	None	None
10	Low	None	None
11	Low	None	None
12	Low	None	None
13	Low	None	None
14	Low	None	None
15	High	High	None
16	High	None	None
17	High	High	None

Receptor	Magnitude of Impact		
	After Geometric Analysis	After Visibility Analysis	Residual Impacts
18	High	None	None
19	Low	None	None
20	Low	None	None
21	Low	None	None
22	Low	None	None
23	Low	None	None
24	Low	None	None
25	Low	None	None
26	None	None	None
27	None	None	None

8.3. Table 7 - 3 and Table 7 - 4 show the overall impacts for all residential and road receptors.

Table 7 - 3: Solar Reflections: Residential Receptors

Magnitude	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
High	0	0	0
Medium	1	0	0
Low	7	0	0
None	10	18	18
High – Solar reflections impacts of over 30 hours per year or over 30 minutes per day Medium - Solar reflections impacts between 20 and 30 hours per year or between 20 minutes and 30 minutes per day Low - Solar reflections impacts between 0 and 20 hours per year or between 0 minutes and 20 minutes per day None - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening			

Table 7 - 4: Solar Reflections: Road Receptors

Magnitude	Theoretical Visibility	Actual Visibility (No Mitigation)	Actual Visibility with Mitigation
High	7	2	0
Low	16	0	0
None	4	25	27
• High - Solar reflections impacts with yellow glare (potential for after-image). • Low - Solar reflections impacts with only green glare (low potential for after-image) • None - Effects not geometrically possible or no visibility of reflective surfaces likely due to high levels of intervening screening or being outside the drivers field of view			

9. SUMMARY

- 9.1. This assessment considers the potential impacts on ground-based receptors such as roads, rail and residential dwellings as well as aviation assets. A 1km study area around the Application Site is considered adequate for the assessment of ground-based receptors, whilst a 30km study area is chosen for aviation receptors. Within 1km of the Application Site, there are 21 residential receptors, including one residential area, and 38 road receptors which were considered. As per the methodology section, where there are a number of residential receptors within close proximity, a representative dwelling or dwellings is/are chosen for full assessment as the impacts will not vary to any significant degree. Where small groups of receptors have been evident, the receptors on either end of the group have been assessed in detail. Three residential receptors and 11 road receptors were dismissed as they are located within the no reflection zones. 18 aerodromes are located within the 30km study area; Three of which, Leicester Airport, East Midlands Airport and Lodge Farm, required a detailed assessment due to the Proposed Development falling within its respective safeguarding buffer zone, which is outlined in **paragraph 4.25**.
- 9.2. Geometric analysis was conducted at 18 individual residential receptors, including one residential area, and 27 road receptors as well as 14 runway approach paths and two air traffic control towers (ATCTs).
- 9.3. Following an initial assessment, rail receptors were scoped out as assets that will be impacted upon from the Proposed Development as no rail receptors fell within the 1km study area. The assessment concludes that:
- Solar reflections are possible at eight of the 18 residential receptors assessed within the 1km study area. The initial bald-earth scenario identified potential impacts as **Medium** at one receptor, **Low** at seven receptors, including one residential area, and **None** at the remaining 10 receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts reduce to **None** at all receptors.
 - Solar reflections are possible at 23 of the 27 road receptors assessed within the 1km study area. The initial bald-earth scenario identified potential impacts as **High** at seven receptors, **Low** at 16 receptors and **None** at the remaining four receptors. Upon reviewing the actual visibility of the receptors, glint and glare impacts remain **High** at two receptors and reduce to **None** at all remaining receptors. Once mitigation measures were considered, glint and glare impacts reduce to **None** at all receptors.
 - **No impact** on train drivers or railway infrastructure is predicted.
 - No glare was predicted to impact the runway approach paths or ATCT at East Midlands Airport. Therefore, the impact on East Midlands Airport is **None**. Only green glare is

predicted to impact upon Runway 22, 24, 28, 33 and 34 approach paths and ATCT at Leicester Airport and Runway 08 approach path at Lodge Farm. Green glare is an **acceptable impact** when pilots are approaching runways/helipads, according to FAA guidance. Therefore, the impact on these runway approach paths is **Not Significant**. Upon reviewing the actual visibility of the ATCT at Leicester Airport, the impact reduces to **None**. Therefore, the impact on aviation assets is **Low** and **Not Significant**.

- 9.4. Mitigation is required to screen the **High** impact views into the Proposed Development from Road Receptors 15 and 17. This includes native hedgerows to be planted/infilled and maintained to a height of at least 3m along the southern boundary of Array 2 in the Proposed Development as shown in the G&G Mitigation Planting figure.
- 9.5. The effects of glint and glare and their impact on local receptors has been analysed in detail and is predicted to be only **Low** and **None** impacts, and therefore **No Significant Effects**.

10. APPENDICES

APPENDIX A: FIGURES

- Figure 1: Residential Based Receptors
- Figure 2: Road Based Receptors
- Figure 3: Site Layout
- Figure 4: Panel Area Labels
- Figure 5: G&G Mitigation Planting
- Figure 6: Leicester Airport Aerodrome Chart
- Figure 7: East Midlands Airport Aerodrome Chart

APPENDIX B: RESIDENTIAL RECEPTOR GLARE RESULTS

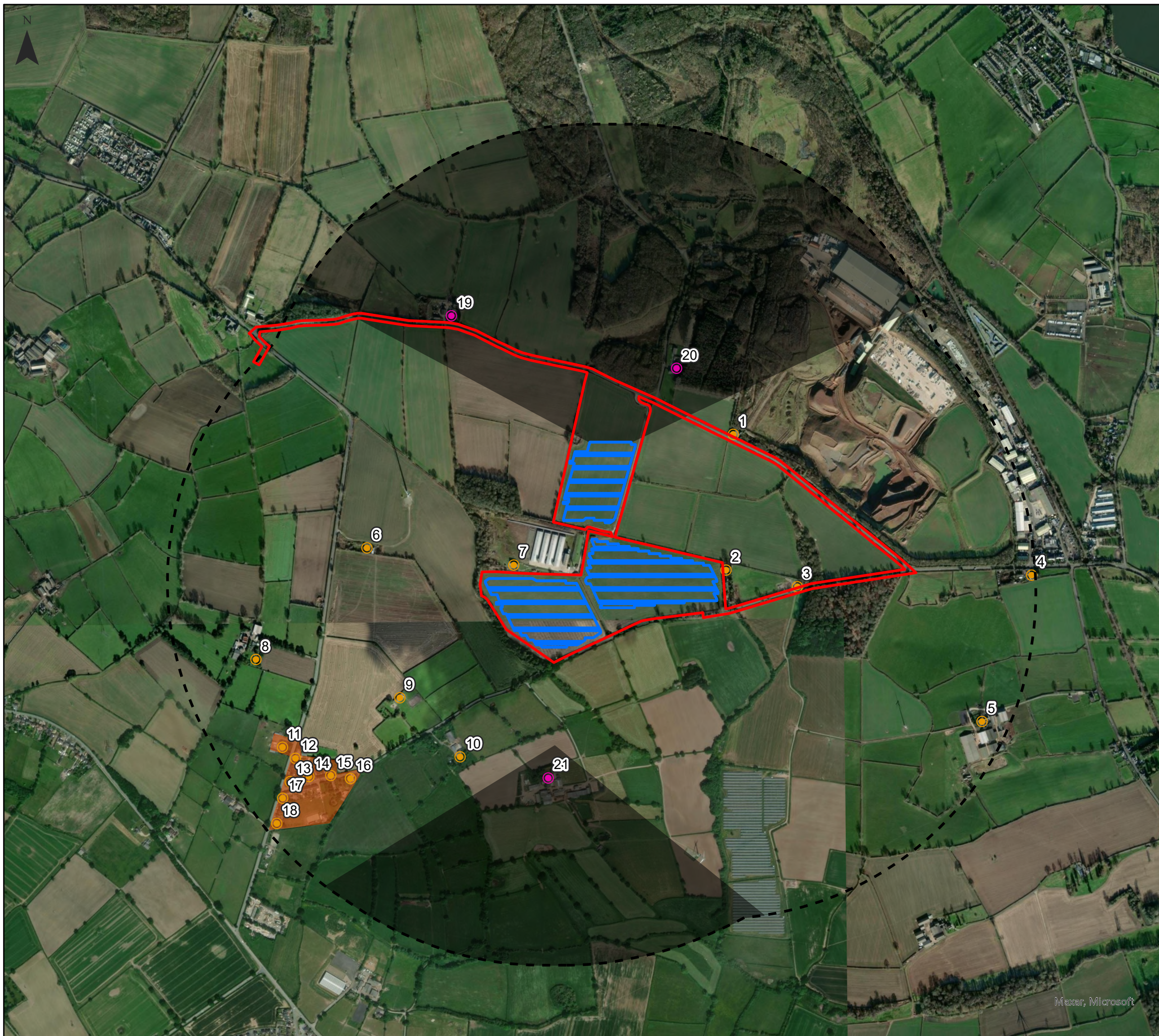
APPENDIX C: ROAD RECEPTOR GLARE RESULTS

APPENDIX D: AVIATION RECEPTOR GLARE RESULTS

APPENDIX E: VISIBILITY ASSESSMENT EVIDENCE

APPENDIX F: SOLAR MODULE GLARE AND REFLECTANCE TECHNICAL MEMO¹⁷

¹⁷ Sunpower Corporation (September 2009), T09014 Solar Module Glare and Reflectance Technical Memo

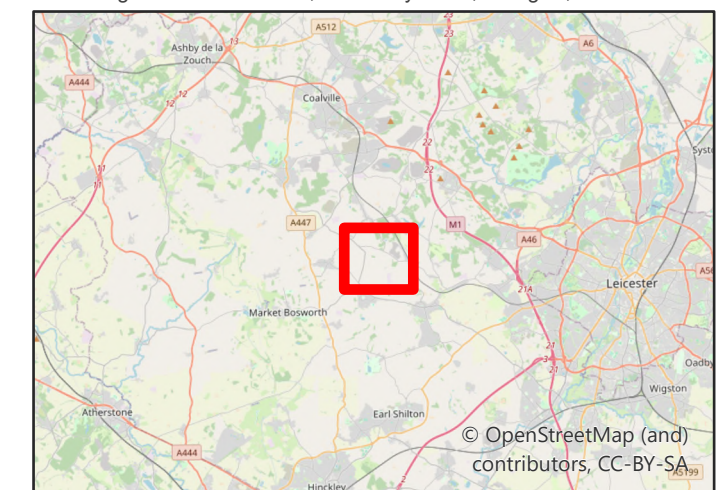


Heath Road Solar Farm Residential Based Receptors Figure 1

Key

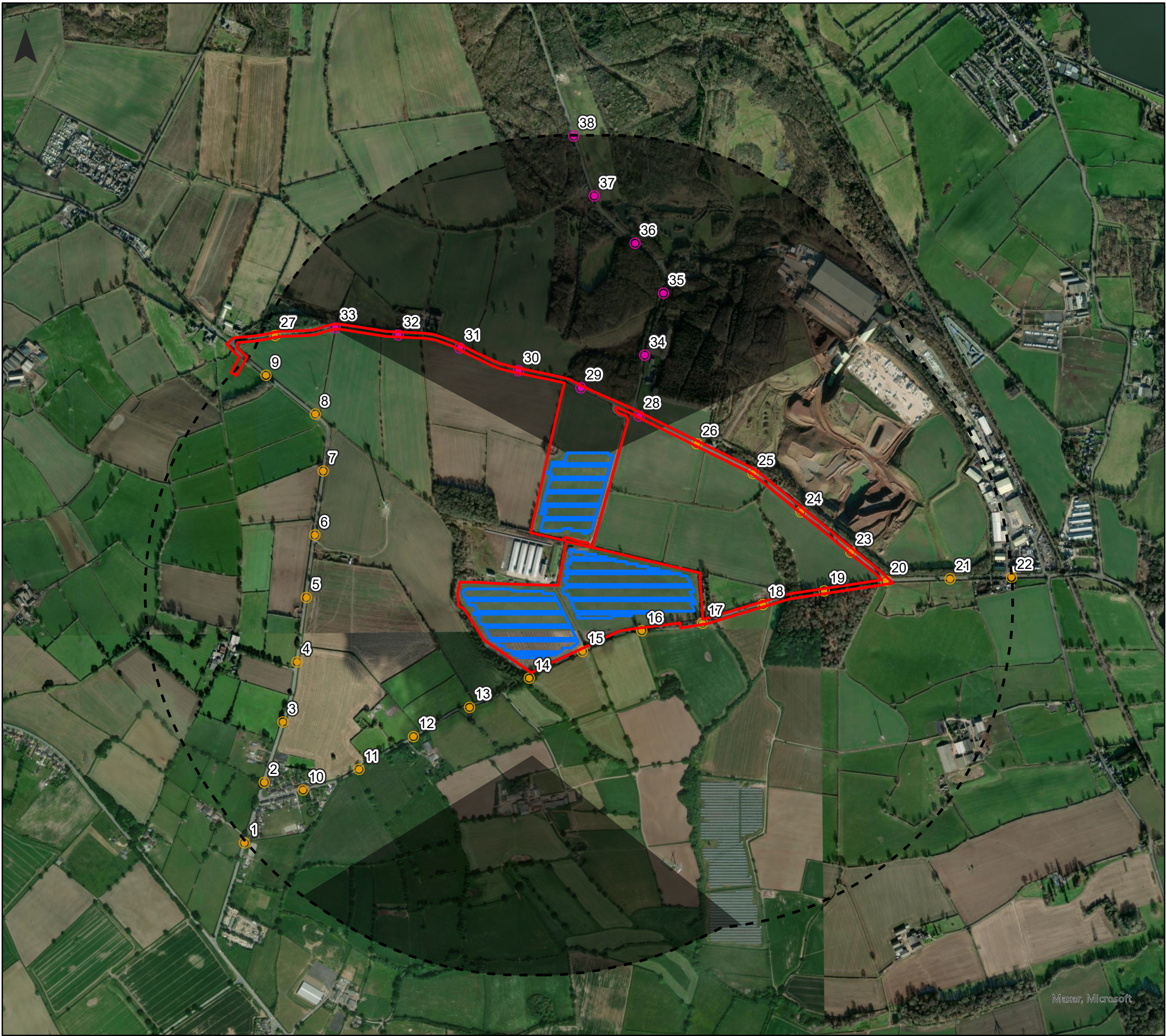
- Development Boundary
- Panel Boundary
- 1km Study Area
- Glare Not Possible at Receptor
- Glare Possible at Receptor
- Residential Area
- Non-Reflection Zone

Neo Office Address:
Wright Business Centre, 1 Lonmay Road, Glasgow, G33 4EL



Date: 04/06/2025
Drawn By: David Thomson
Scale (A3): 1:12,000
Drawing No: NEO01234/0011/C

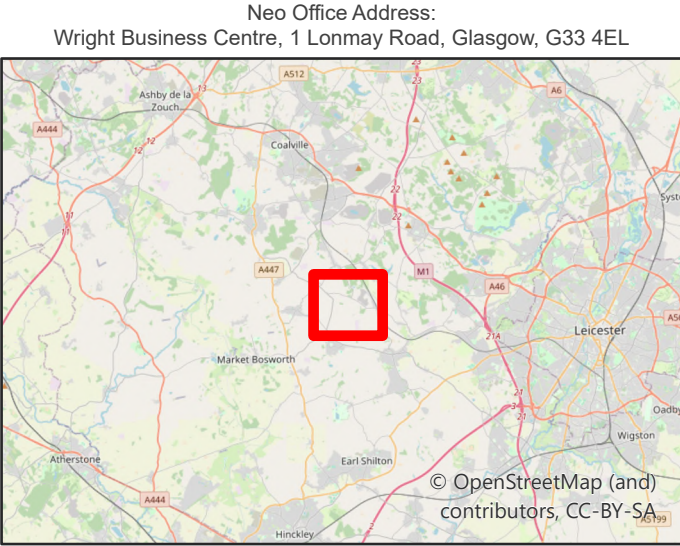




Heath Road Solar Farm
Road Based Receptors
Figure 2

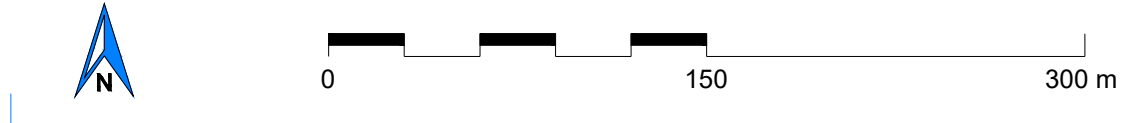
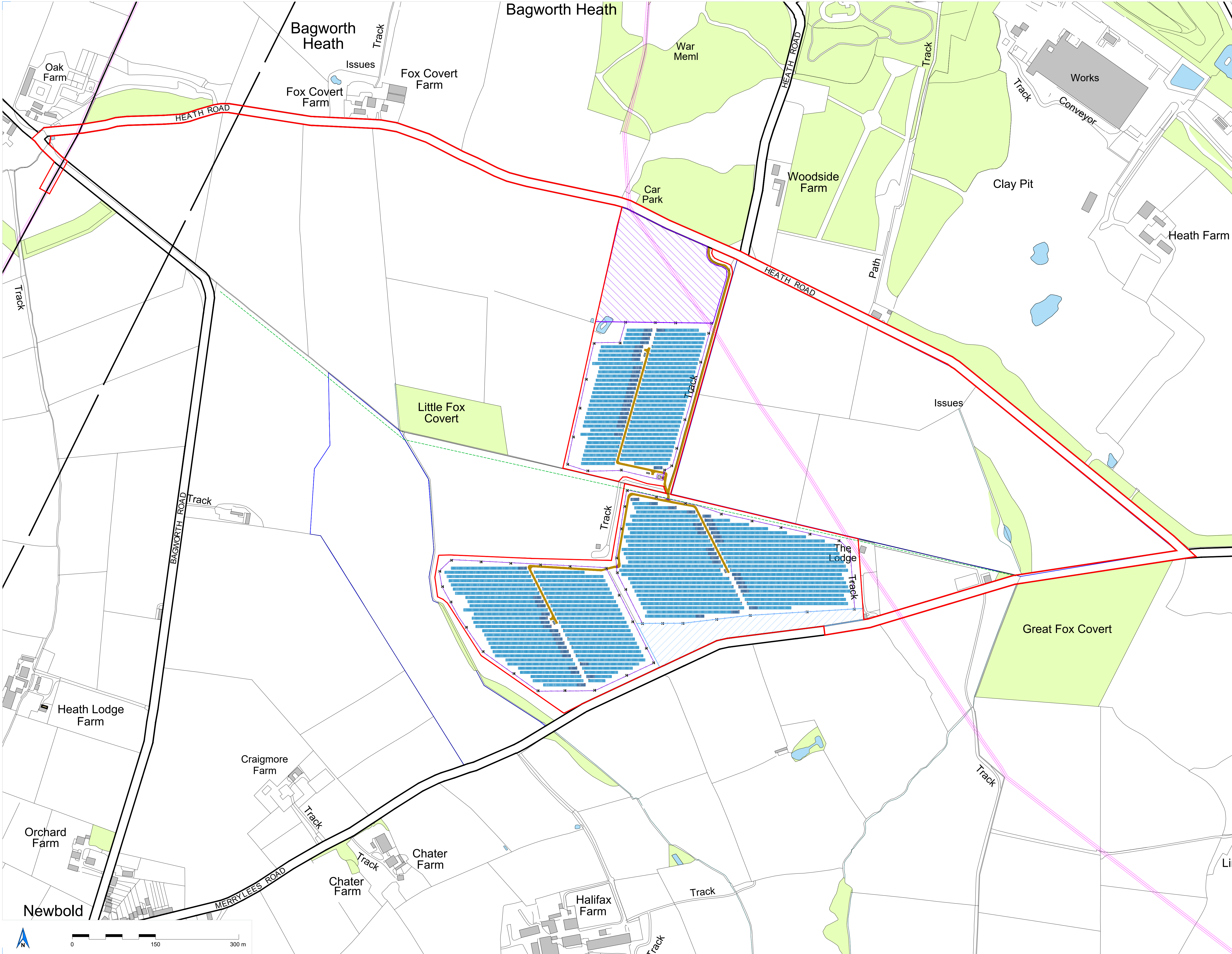
Key

- Development Boundary
- Panel Boundary
- 1km Study Area
- Glare Not Possible at Receptor
- Glare Possible at Receptor
- Non-Reflection Zone



Date: 04/06/2025
Drawn By: David Thomson
Scale (A3): 1:12,000
Drawing No: NEO01234/002I/C





- Notes:
1. All dimensions to be confirmed on site prior to installation.
 2. All dimensions are indicative only and in m unless otherwise specified.
 3. Drawing based on satellite data:
Imagery date: 16/06/21

Reference drawings		
Data-Solar_GroundMount_Project Form_Heath Road.docx	~	17/08/22
RC107 - 21-11-10 - Heath Road Fixed Layout REV3.pdf	~	17/08/22
RC107 - 22-01-17 - Heath Road NMC.amx	~	17/08/22
Heath Road Updated.amx	~	13/11/23
VML_Sk404.dwg	~	13/11/23
RC107 - Heath Road.dwg	~	13/11/23
2302103-TK01A-TK02A-TK03.dwg	~	22/07/24
Drainage Strategy - DRAPI 1 new RLB.pdf	~	22/07/24
Tree Survey.pdf	~	22/07/24

- Legend:
- Site boundary (31.90 ha)
 - Perimeter fence
 - Maintenance track
 - Customer substation
 - DNO
 - 20ft. Power Station
 - Inverter
 - Gate
 - OHL
 - Footpath
 - Skylark mitigation
 - Ecological enhancement area
 - CCTV



Revisions:

Rev	Date	Comments	Drawn	Approve
0	19/08/22	First issue	AP	DB
1	02/09/23	Changes in PV layout	GU	AP
2	02/09/23	Changes in PV layout	GU	AP
3	21/11/23	PV area added, site boundaries changed, configuration changed	IM	NM
4	11/11/23	Layout update	FJ	NM
5	23/07/24	Design constraints implemented	EL	GU
6	12/08/24	Layout update	IV	GU
7	19/08/24	Layout update	IV	GU
8	11/09/24	Layout update	IV	GU
9	11/11/24	Site boundary, skylark and ecological areas	IV	GU
10	14/11/24	Compound area removed	IV	GU
11	10/02/25	Site boundary updated	IV	GU

Project: Heath Road
Location: Heath Road and Merry Lees, Bagworth, LE9 9NR, UK
52.648197°, -1.329302°
Title: Indicative Proposed Site Layout

Drawn: Detra Solar / IV Checked: AM
Scale: 1:3000@A1 Date: 12/02/25
Drawing No: RCN1008-PL-01 Rev: 11

renewable connections
Level 4, LDN/W, 3 Noble Street
London, EC2V 7EE
+44 (0)20 7749 2650
www.renewableconnections.co.uk

detra SOLAR
Detra Solar
Lvovo str. 25-104,
LT-09320 Vilnius
www.detrasolar.com

Do not scale from this drawing. Site verify all dimensions prior to construction.
Report all discrepancies to the drawing originator immediately. This drawing is to be read in conjunction with all relevant documents and drawings.

Appendix A: Figure 4 – Panel Area Labels

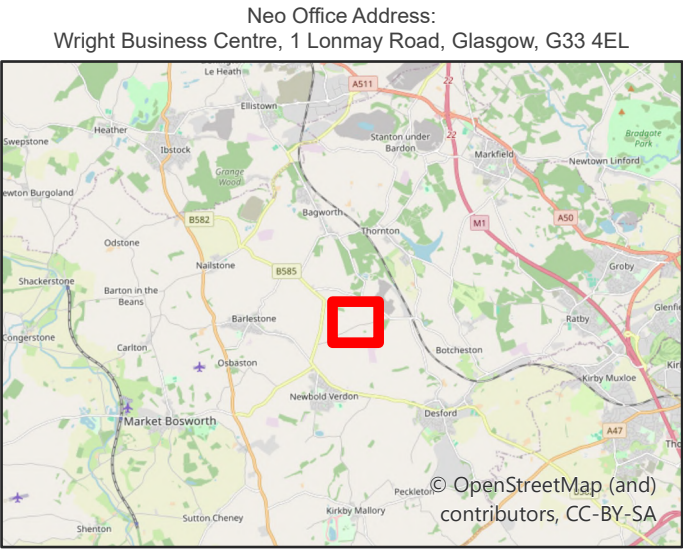




Heath Road Solar Farm
G&G Mitigation Planting
Figure 5

Key

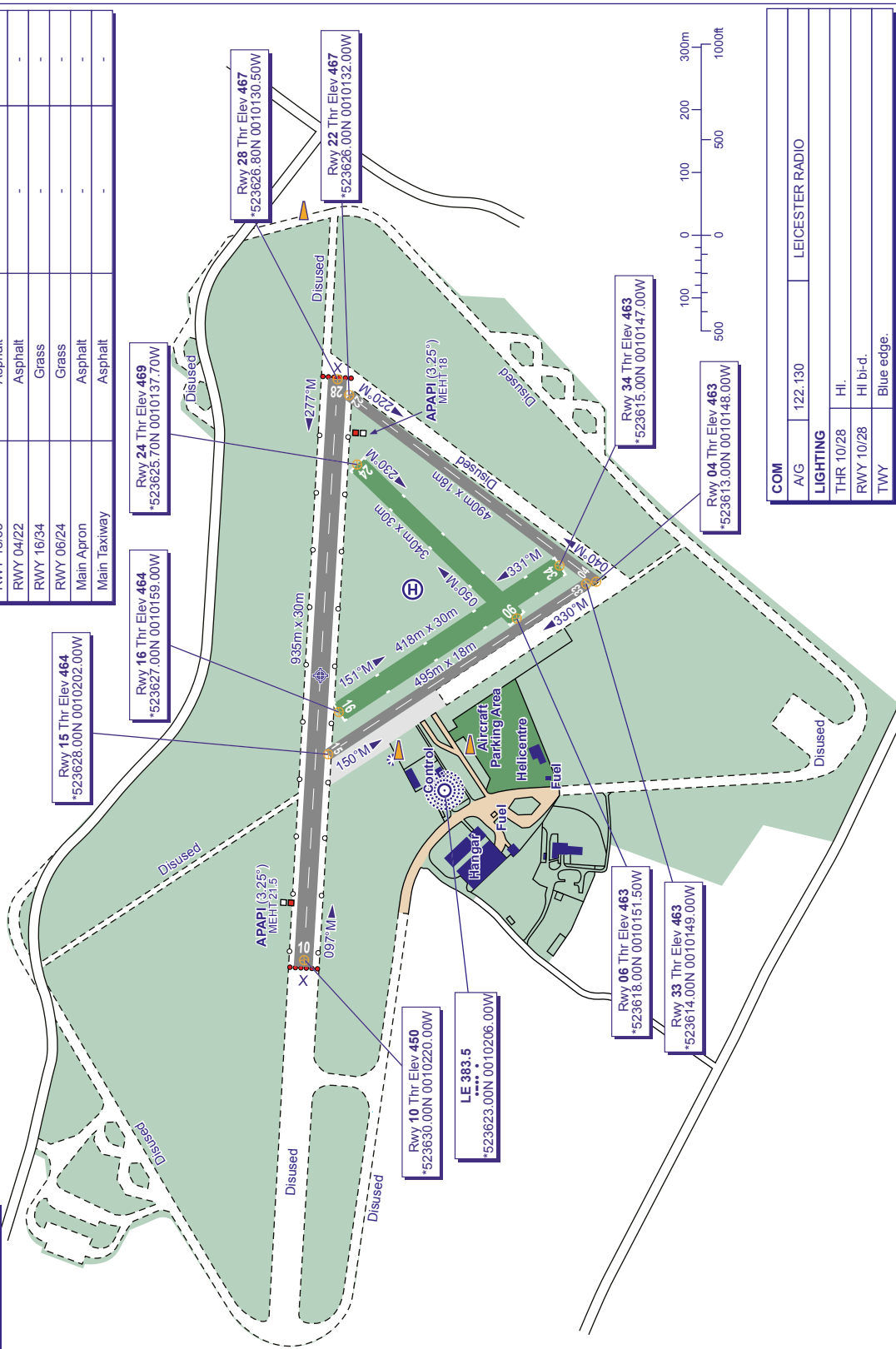
-  Development Boundary
-  G&G Mitigation Planting



BEARINGS ARE MAGNETIC ELEVATIONS AND HEIGHTS ARE IN FEET	
ELEVATIONS IN FEET AMSL	469



APRON / RWY / TWY	SURFACE	BEARING
RWY 10/28	Asphalt	
RWY 15/33	Asphalt	
RWY 04/22	Asphalt	
RWY 16/34	Grass	
RWY 06/24	Grass	
Main Apron	Asphalt	
Main Taxiway	Asphalt	

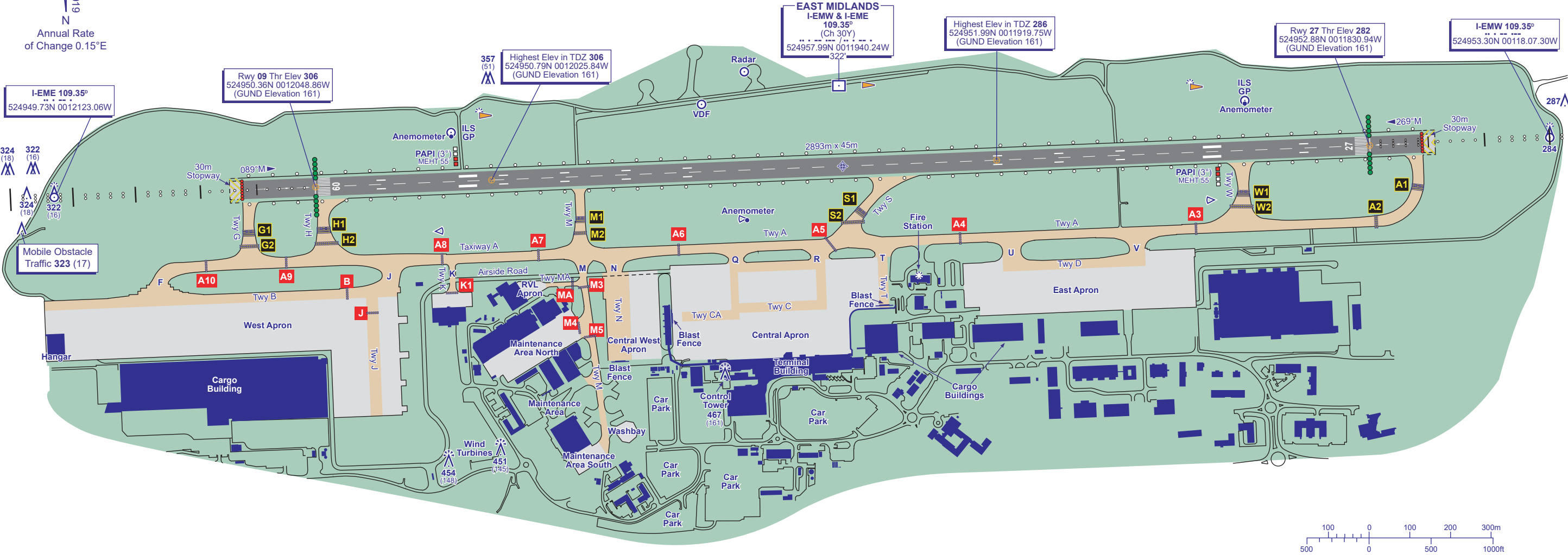


COM		
A/G	122.130	LEICESTER RADIO
LIGHTING		
THR 10/28	Hl.	
RWY 10/28	Hl bi-d.	
TWY	Blue edge.	

GUND (Geoid Undulation) = The height of the Geoid (MSL) above the Reference Ellipsoid (WGS 84) at the stated position.	
BEARINGS ARE MAGNETIC ELEVATIONS AND HEIGHTS ARE IN FEET	
ELEVATIONS IN FEET AMSL HEIGHTS IN FEET ABOVE AD	467 (161)

VAR 0.7°W - 2019
N
Annual Rate
of Change 0.15°E

RUNWAY/TAXIWAY/APRON PHYSICAL CHARACTERISTICS		
APRON / RWY / TWY	SURFACE	BEARING STRENGTH
RWY 09/27	Asphalt (Ungrooved PFC)	87/F/C/W/T
Central Apron	Concrete	63/R/D/X/U
Central-West Apron	Concrete	74/R/C/W/T
East Apron	Concrete	63/R/D/X/U
West Apron	Concrete	78/R/C/W/T
Taxiway A/G/H/M/S/W	Asphalt	66/F/C/W/U
Taxiway B/F/J	Concrete	78/R/C/W/T
Taxiway K	Asphalt	32/F/D/X/T
Taxilane C/CA/D/Q/RT/U/V	Concrete	63/R/D/X/U
Taxilane N	Concrete	74/R/C/W/T

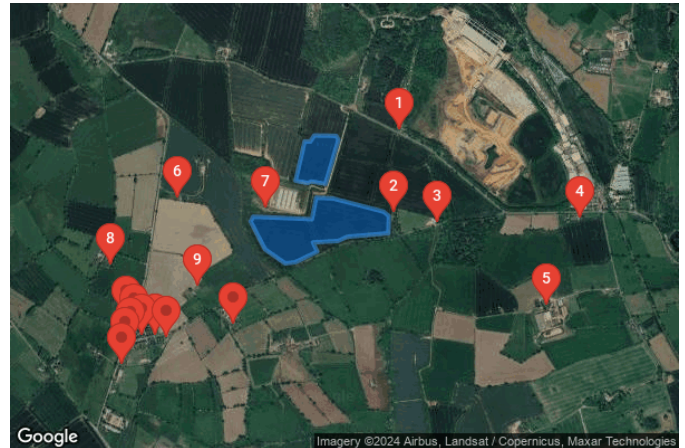


Heath Road Solar Farm

Heath Road Solar Farm Residential Receptors

Created Jun 14, 2023
Updated Aug 22, 2024
Time-step 1 minute
Timezone offset UTC0
Minimum sun altitude 0.0 deg
Site ID 92886.16328

Project type Advanced
Project status: active
Category 10 MW to 100 MW



Misc. Analysis Settings

DNI: varies (1,000.0 W/m² peak)
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad

PV Analysis Methodology: Version 2
Enhanced subtended angle calculation: On

Summary of Results Glare with potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	25.0	180.0	9,660	164	-
PV array 2	25.0	180.0	15,204	4,485	-

PV Array(s)

Total PV footprint area: 164,540 m²

Name: PV array 1

Footprint area: 39,239 m²

Axis tracking: Fixed (no rotation)

Tilt: 25.0 deg

Orientation: 180.0 deg

Rated power: -

Panel material: Light textured glass with AR coating

Vary reflectivity with sun position? Yes

Correlate slope error with surface type? Yes

Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.651500	-1.330007	139.67	2.80	142.47
2	52.651480	-1.328312	136.60	2.80	139.40
3	52.651298	-1.328141	136.19	2.80	138.99
4	52.649241	-1.329138	136.98	2.80	139.78
5	52.649352	-1.330233	139.08	2.80	141.88
6	52.649280	-1.330512	139.13	2.80	141.93
7	52.649391	-1.331434	139.68	2.80	142.48
8	52.651220	-1.330737	141.02	2.80	143.82
9	52.651213	-1.330297	140.28	2.80	143.08

Name: PV array 2

Footprint area: 125,300 m²

Axis tracking: Fixed (no rotation)

Tilt: 25.0 deg

Orientation: 180.0 deg

Rated power: -

Panel material: Light textured glass with AR coating

Vary reflectivity with sun position? Yes

Correlate slope error with surface type? Yes

Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.647712	-1.334703	131.60	2.80	134.40
2	52.647595	-1.330175	138.00	2.80	140.80
3	52.648597	-1.329854	137.84	2.80	140.64
4	52.648558	-1.328545	135.07	2.80	137.87
5	52.647946	-1.324661	131.89	2.80	134.69
6	52.647738	-1.324253	131.75	2.80	134.55
7	52.646944	-1.324296	124.61	2.80	127.41
8	52.646774	-1.327472	133.52	2.80	136.32
9	52.646579	-1.328180	133.95	2.80	136.75
10	52.646514	-1.330111	133.19	2.80	135.99
11	52.646084	-1.329768	130.92	2.80	133.72
12	52.645590	-1.331463	125.28	2.80	128.08
13	52.645538	-1.332235	125.20	2.80	128.00
14	52.646189	-1.333780	128.22	2.80	131.02
15	52.647490	-1.334896	130.74	2.80	133.54

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	52.651740	-1.323409	133.78	2.00	135.78
OP 2	52.647896	-1.323812	133.19	2.00	135.19
OP 3	52.647448	-1.320477	124.54	2.00	126.54
OP 4	52.647636	-1.309502	114.80	2.00	116.80
OP 5	52.643562	-1.312061	123.41	2.00	125.41
OP 6	52.648591	-1.340469	147.61	2.00	149.61
OP 7	52.648103	-1.333681	138.17	2.00	140.17
OP 8	52.645469	-1.345687	147.18	2.00	149.18
OP 9	52.644459	-1.338948	143.88	2.00	145.88
OP 10	52.642696	-1.336215	137.14	2.00	139.14
OP 11	52.642991	-1.344419	141.38	2.00	143.38
OP 12	52.642669	-1.343877	141.19	2.00	143.19
OP 13	52.642013	-1.344113	139.73	2.00	141.73
OP 14	52.642153	-1.343284	141.07	2.00	143.07
OP 15	52.642187	-1.342257	141.74	2.00	143.74
OP 16	52.642088	-1.341337	142.46	2.00	144.46
OP 17	52.641554	-1.344496	138.52	2.00	140.52
OP 18	52.640819	-1.344765	136.53	2.00	138.53

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	25.0	180.0	9,660	164	-	-
PV array 2	25.0	180.0	15,204	4,485	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1 (green)	0	0	41	847	1028	1010	1035	946	250	0	0	0
pv-array-1 (yellow)	0	0	0	0	0	0	1	0	0	0	0	0
pv-array-2 (green)	0	0	231	462	1054	1108	1094	654	347	0	0	0
pv-array-2 (yellow)	0	0	1	245	10	44	18	189	56	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	1491	164
OP: OP 3	1255	0
OP: OP 4	1481	0
OP: OP 5	177	0
OP: OP 6	2654	0
OP: OP 7	1197	0
OP: OP 8	1405	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0

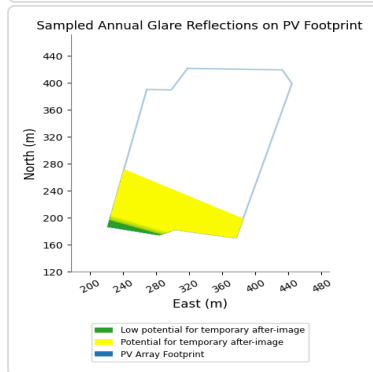
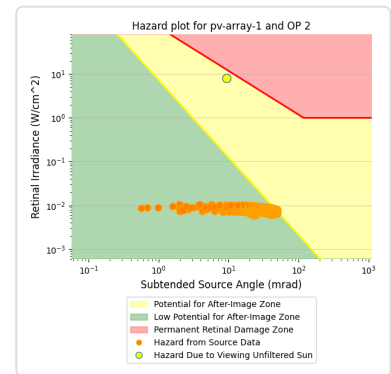
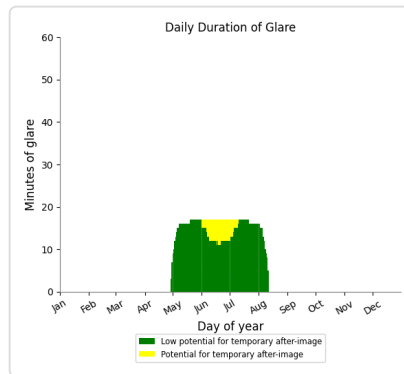
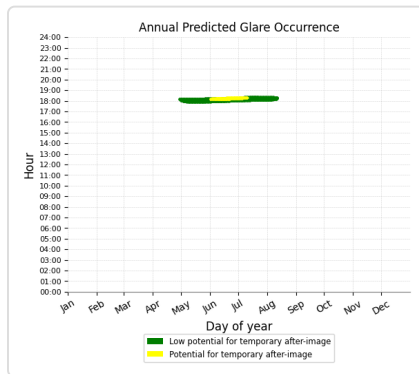
PV array 1: OP 1

No glare found

PV array 1: OP 2

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

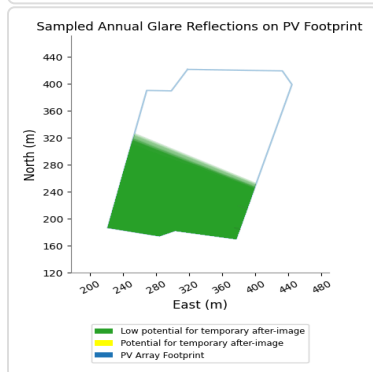
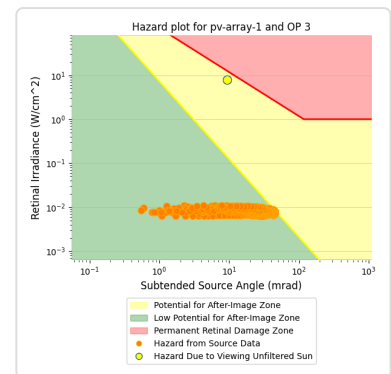
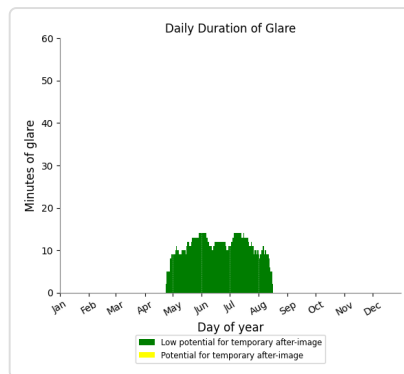
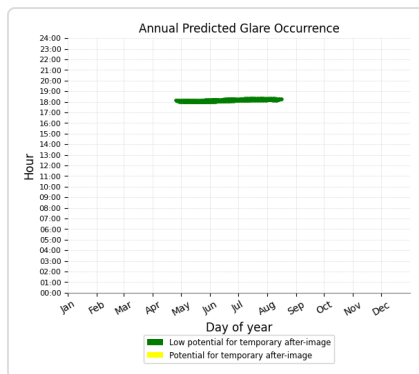
- 1,491 minutes of "green" glare with low potential to cause temporary after-image.
- 164 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 3

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

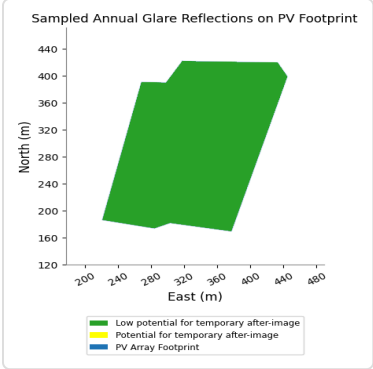
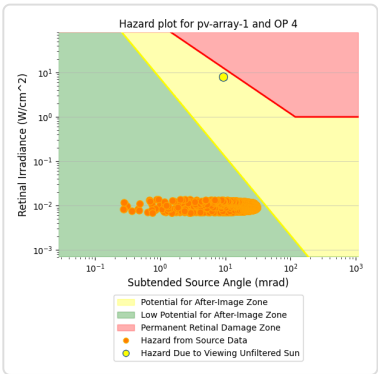
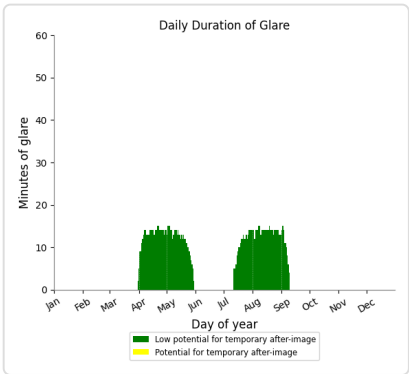
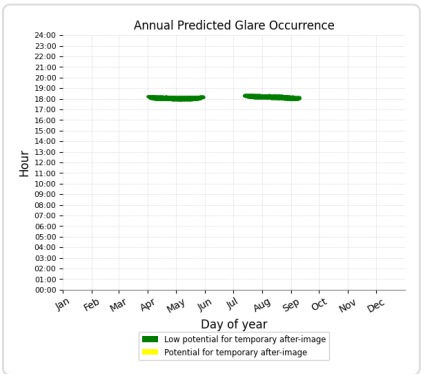
- 1,255 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 4

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

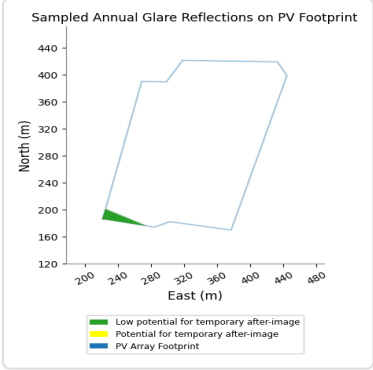
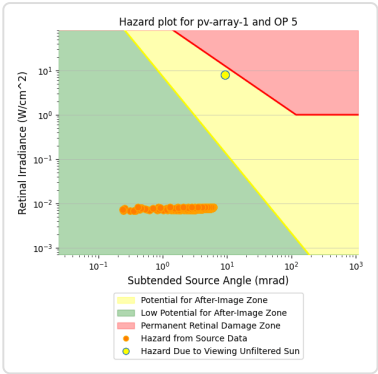
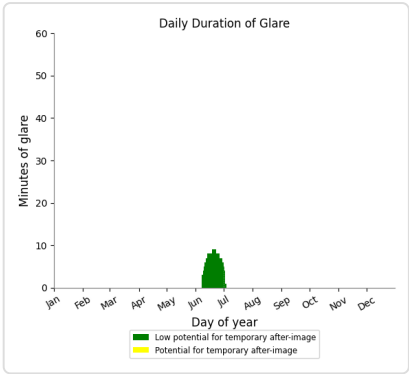
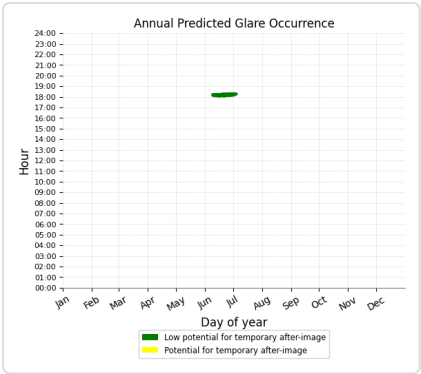
- 1,481 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 5

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

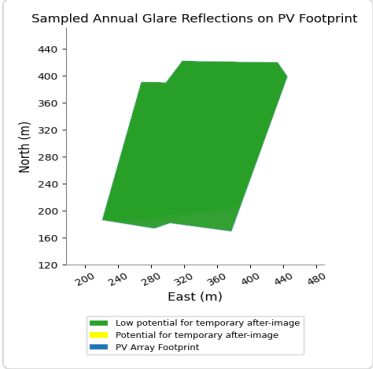
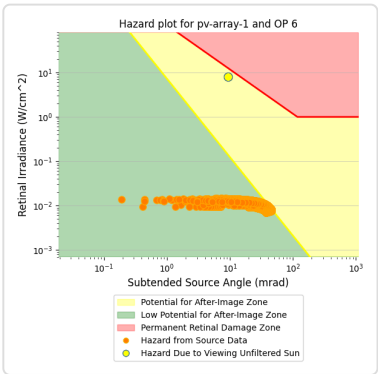
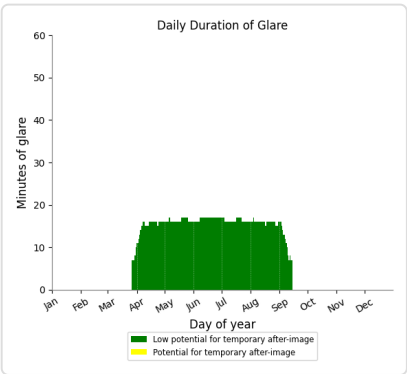
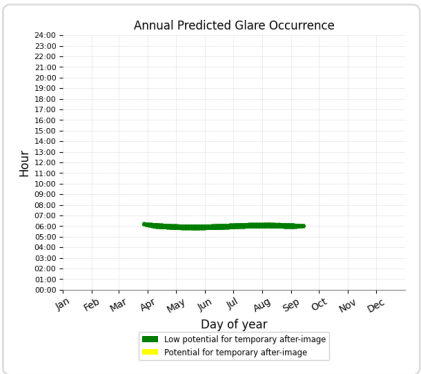
- 177 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 6

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

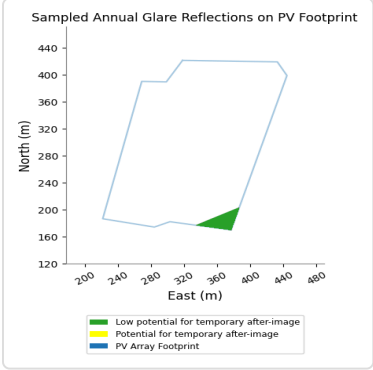
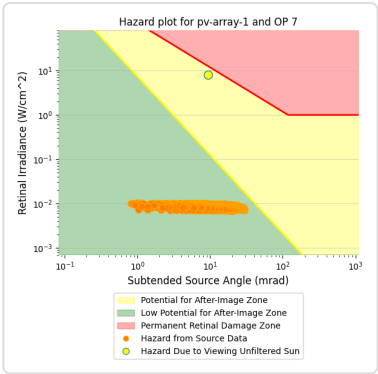
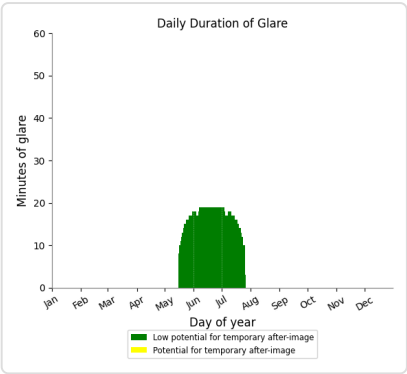
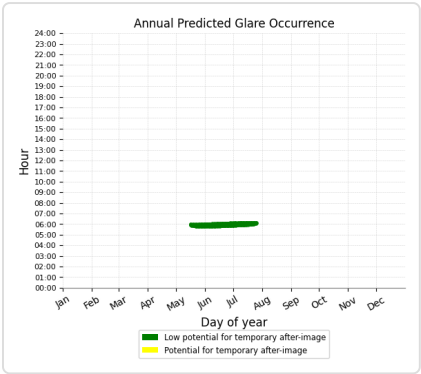
- 2,654 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 7

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

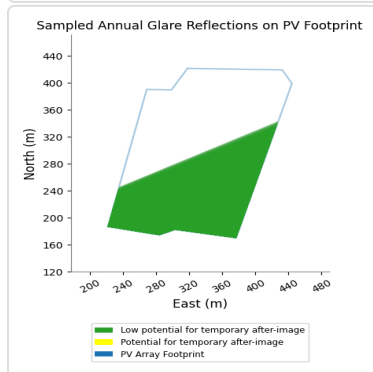
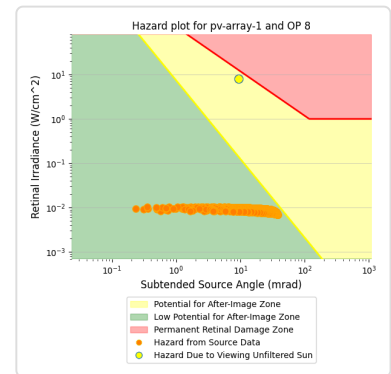
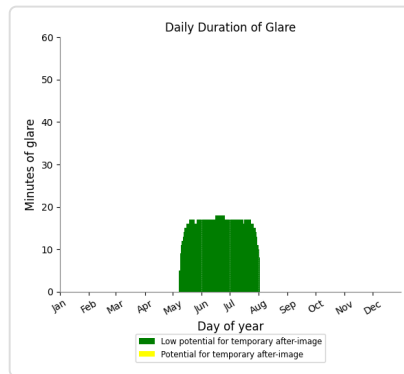
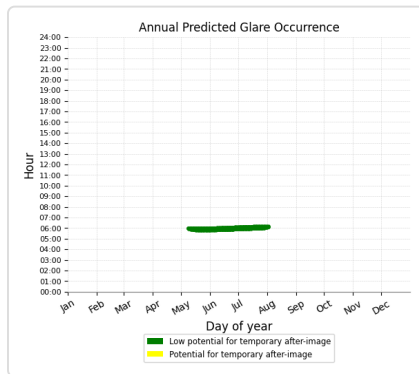
- 1,197 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 1: OP 8

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

- 1,405 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 1: OP 9

No glare found

PV array 1: OP 10

No glare found

PV array 1: OP 11

No glare found

PV array 1: OP 12

No glare found

PV array 1: OP 13

No glare found

PV array 1: OP 14

No glare found

PV array 1: OP 15

No glare found

PV array 1: OP 16

No glare found

PV array 1: OP 17

No glare found

PV array 1: OP 18

No glare found

PV array 2 potential temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	504	121
OP: OP 3	621	313
OP: OP 4	158	0
OP: OP 5	1599	72
OP: OP 6	351	0
OP: OP 7	1266	265
OP: OP 8	1950	785
OP: OP 9	1341	1682
OP: OP 10	0	0
OP: OP 11	1079	887
OP: OP 12	1317	360
OP: OP 13	1178	0
OP: OP 14	1156	0
OP: OP 15	975	0
OP: OP 16	616	0
OP: OP 17	878	0
OP: OP 18	215	0

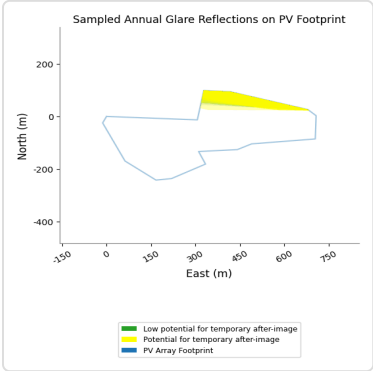
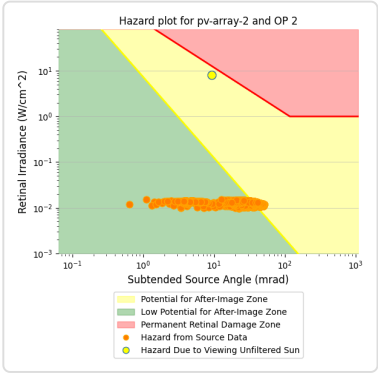
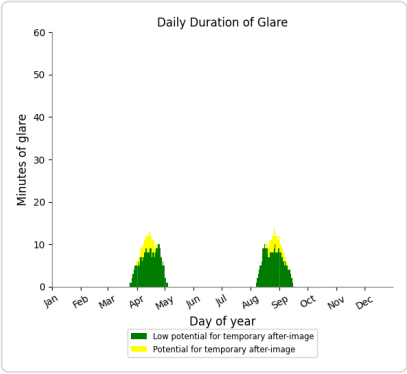
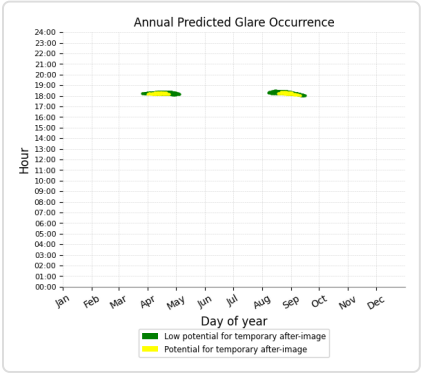
PV array 2: OP 1

No glare found

PV array 2: OP 2

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

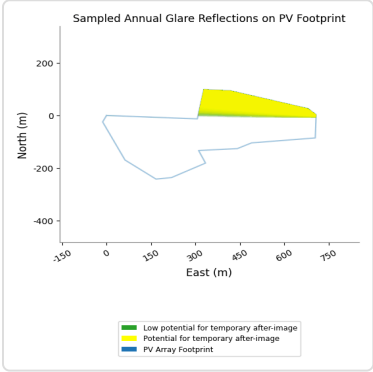
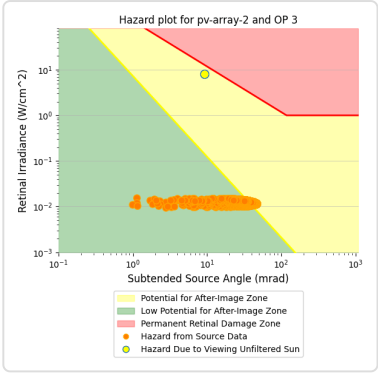
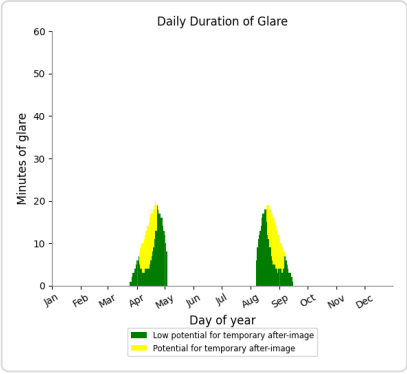
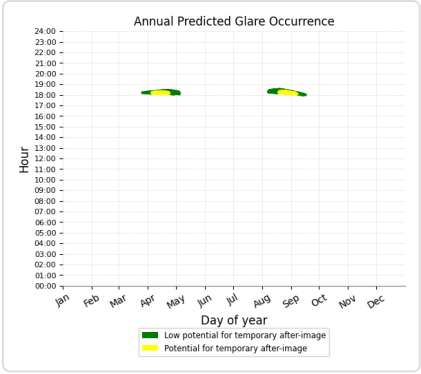
- 504 minutes of "green" glare with low potential to cause temporary after-image.
- 121 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 2: OP 3

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

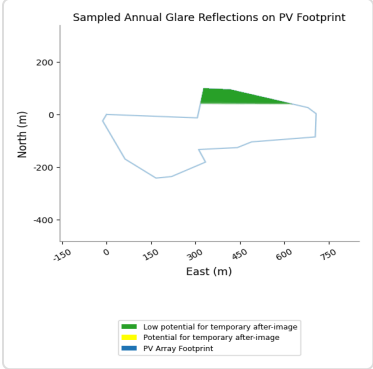
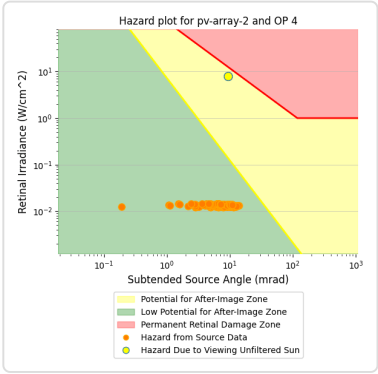
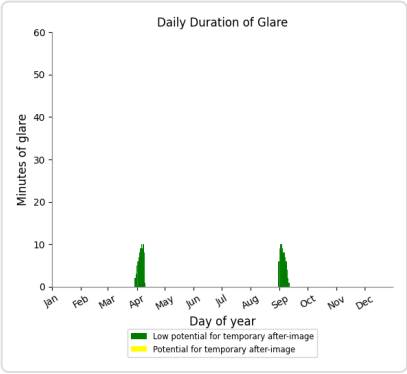
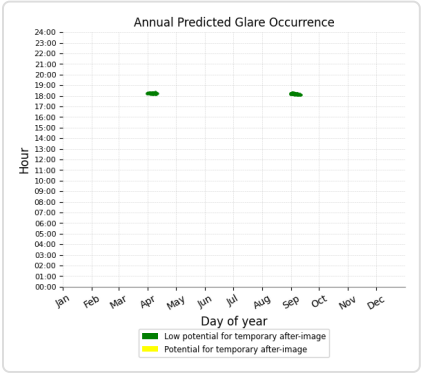
- 621 minutes of "green" glare with low potential to cause temporary after-image.
- 313 minutes of "yellow" glare with potential to cause temporary after-image.



PV array 2: OP 4

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

- 158 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 5

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

- 1,599 minutes of "green" glare with low potential to cause temporary after-image.
- 72 minutes of "yellow" glare with potential to cause temporary after-image.

