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Technical Aerodrome Safeguarding Report

RPS Group

Botley West Solar Farm

June 2025

PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	August 2024	Initial issue
2	September 2024	Minor updates
3	June 2025	Updated to add Edinburgh Airport to the Examples of Solar Farms and Airports Coexisting

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EXECUTIVE SUMMARY

Purpose of this Technical Note

Pager Power has been retained to comment on the consultation response of Oxford Airport dated 17th July 2024. This Technical Aerodrome Safeguarding Report specifically relates to the concerns raised over the presence of the proposed solar development and possible impacts upon radio interference and emergency landing procedures.

Background

The proposed development is a ground-mounted solar development, with fixed panels planned to produce approximately 840MW of capacity. Oxford Airfield is a licensed airfield with a single asphalt runway (01/19), which is 1,526m in length.

Figure 1 below shows the location of the proposed development relative to Oxford Airport.

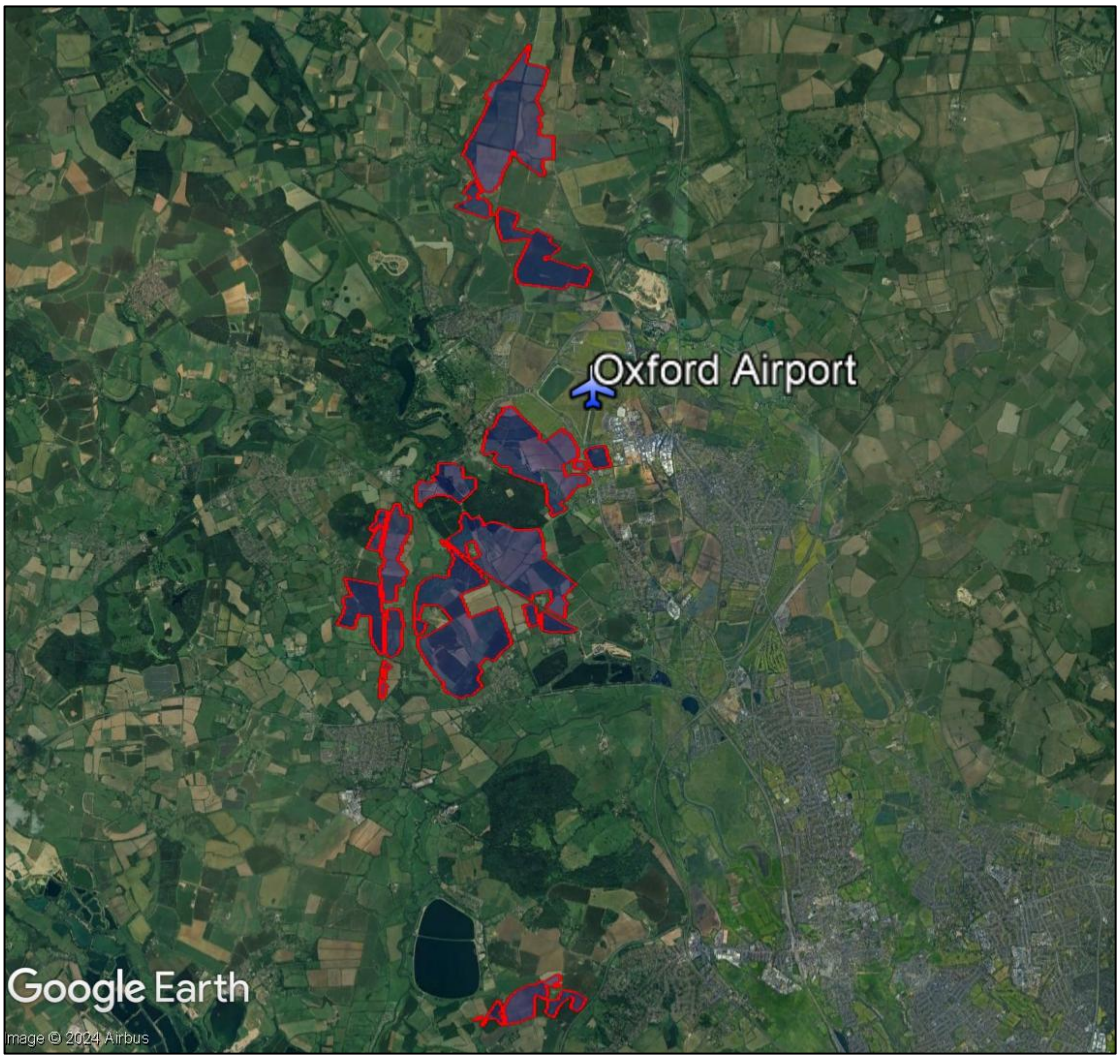

Figure 1 *Proposed development site location relative to Oxford Airport*

Figure 2 below shows a closer view of the proposed development located south-west of Oxford Airport.

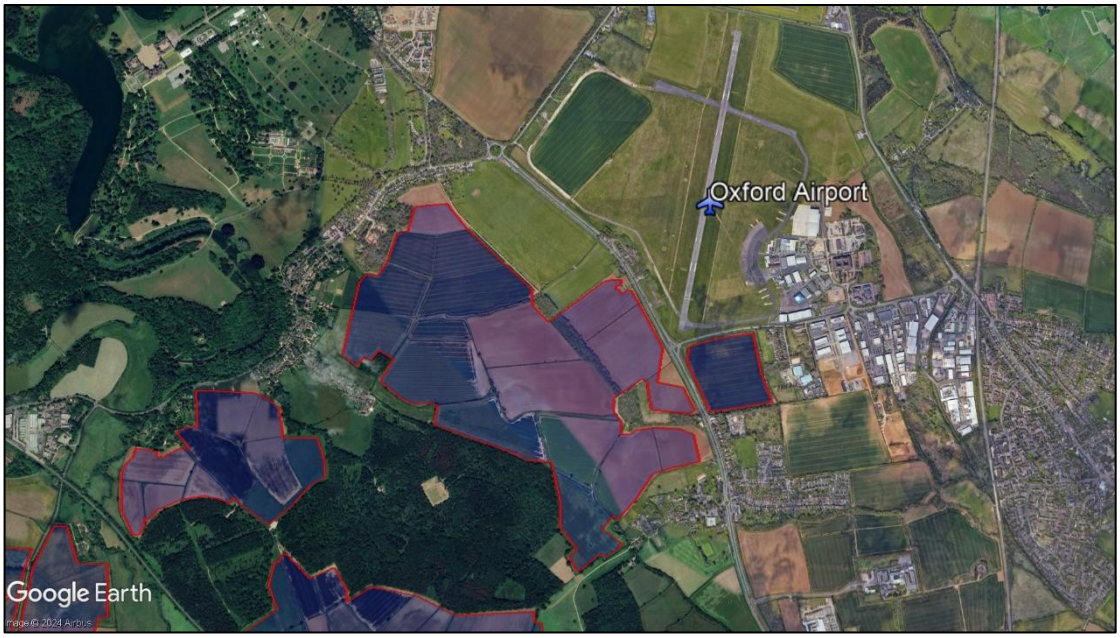

Figure 2 *Proposed development site layout near Oxford Airport*

Conclusions

Obstacle Limitation Surfaces

The OLS is infringed by a maximum of 1.15m, with panels sited nearest to the runway 01 threshold breaching the Inner Horizontal Surface (IHS) and the Take-Off Climb Surface (TOCS). It is expected that this small breach to the OLS may be operationally accommodatable given the low profile of the solar panels and the existing breaches from road infrastructure and vegetation which is located much closer to the threshold.

Electromagnetic Interference

The results of the assessment indicate that the panels nearest to the Communication, Navigation & Surveillance (CNS) equipment do not infringe upon the Building Restricted Areas, but panel areas to the south-west are likely to infringe upon the radar and ILS LLZ due to increased ground heights of the terrain. In these areas, the terrain already infringes the building restricted areas, and the extra 2.53m height would not be expected to significantly increase the risk upon radio communications, especially as panels, which could infringe, would be over 1km from the relevant navigation aid.

Pager Power is aware of studies relating to the effect of electromagnetic interference from solar panels upon radio communications equipment, in which it was determined that significant impacts may be possible within a distance of 10m from the solar panels. It is therefore expected that the current setback between the solar panels and any radio communications infrastructure will be sufficient to mitigate any impact upon the CNS equipment at Oxford Airport.

Emergency Procedures and EFATO

The risk of Engine Failure After Take-Off (EFATO) could require a designated EFATO-safeguarded zone to be established. This would take the form of an obstruction-free corridor through the solar development, which would be available for aircraft to use in the event of an EFATO incident. Two potential options are presented in the report, and it is recommended that further consultation is undertaken with Oxford Airport in order to ascertain their preference and any further comments they may have.

Public Safety Zones (PSZ) are not strictly related to EFATO, but it is not expected that the proposed development would increase the number of people congregating within the zone on a permanent basis and therefore there would be no increased risk in accordance with the relevant guidance.[1] It is however recommended that site offices and emergency assembly points etc., designated during construction and decommissioning be located outside of this zone in order to minimise risk.

Windshear and Heat-Induced Turbulence

Windshear turbulence from the solar arrays is not expected to be significant due to the low vertical profile of the panels and the horizontal distances between the PV arrays and the runway.

With regard to heat-induced turbulence, there is the potential that the proposed solar development could result in thermal updrafts under the approach path to runway 01, but it is expected that these would result in turbulence no more severe than is currently likely to occur from the nearby infrastructure. Many UK aerodromes have infrastructure sited underneath their approach paths that could potentially cause heat-induced turbulence; this is therefore a common occurrence which pilots should be expected to be aware of and navigate.

Glint and Glare

Solar reflections are geometrically possible towards the ATC Tower, however existing vegetation and buildings are predicted to partially screen views of the panels. The closest reflecting panel area is also at least 1.6km from the ATC Tower, and reflections are predicted to coincide with direct solar radiance. A low impact is predicted and no mitigation is recommended.

The analysis has shown that solar reflections are predicted towards the approach paths for runways 01 and 19. Solar reflections towards both approach paths will be outside of a pilot's primary field-of-view. This is deemed acceptable in line with the associated guidance and industry standards; a low impact is predicted, and mitigation is not required.

Overall, a low impact is predicted towards Oxford Airport, and no mitigation is recommended.

[1] Department for Transport, "Control of development in airport public safety zones" (8th October 2021)

OBSTACLE LIMITATION SURFACES

Overview

Obstacle Limitation Surfaces (OLS) are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e. ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed airfields. The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168. The size of the surfaces is dependent on the number of runways, their dimensions and the procedures carried out at the airfield.

Though OLS were not mentioned in Oxford Airport's consultation response, modelling is presented in the below section to provide context to the proposed development.

Oxford Airport Obstacle Limitation Surfaces

The OLS for Oxford Airport are presented in Figure 3 below. The proposed development boundaries for the fields closest to Oxford Airport are shown by the red polygons on the chart.

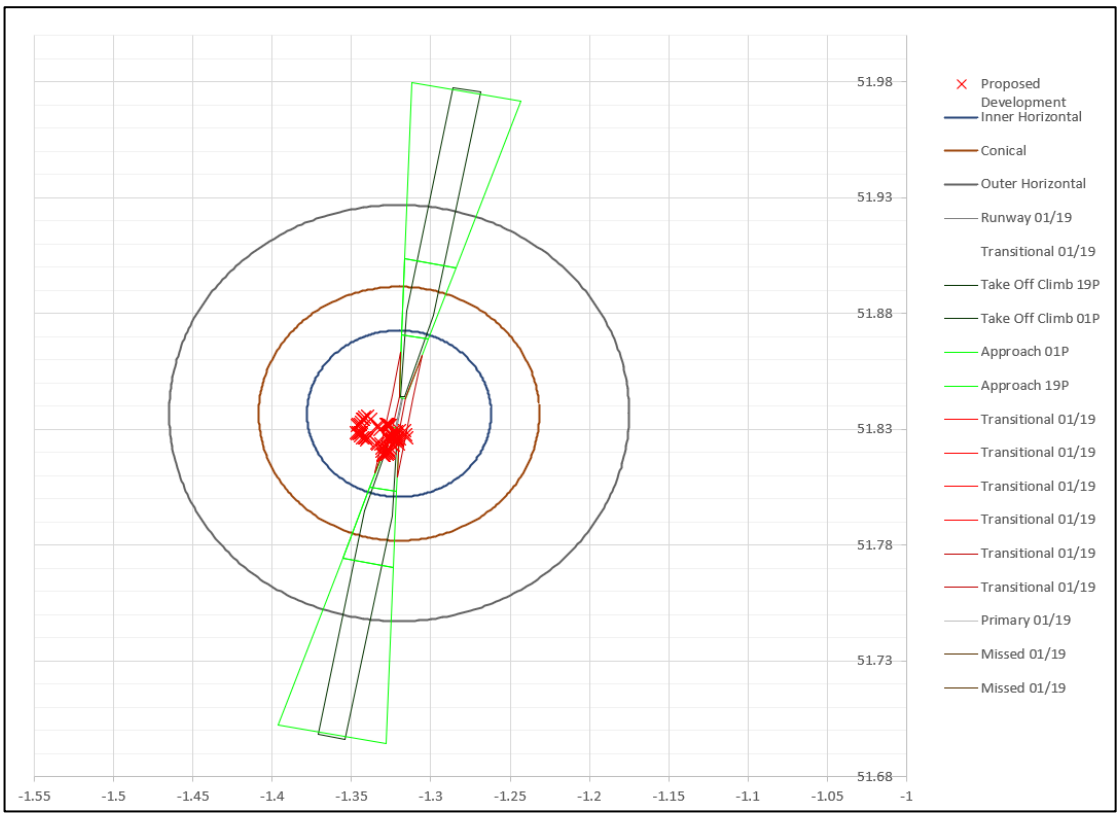

Figure 3 *Oxford Airport Obstacle Limitation Surfaces chart*

The OLS is infringed by a maximum of 1.15m, with panels sited nearest to the runway 01 threshold breaching the Inner Horizontal Surface (IHS) and the Take-Off Climb Surface (TOCS).

Figure 4 below shows a view of the road intersection directly south of the runway threshold, viewed facing away from the runway threshold. This shows a large volume of road infrastructure present in the area, which would also be expected to breach the OLS at Oxford Airport. In addition, there is a hedgerow running along this road which is of a height similar to that of the solar panels. It is therefore expected that the small breach to the OLS may be operationally accommodatable given the low profile of the solar panels and the existing breaches which are located much closer to the threshold.

Figure 4 *View of the road intersection directly south of the runway 01 threshold*

ELECTROMAGNETIC INTERFERENCE

Overview

Oxford Airport's consultation response requested:

> *A study of potential electrical interference to ground based or airborne radios, radio aids, compasses and electrical systems that might arise as a result of the proposed development*

The following sections will consider the impact of the proposed solar development upon radio communications equipment as physical obstructions and sources of electromagnetic interference.

Radio Navigational Aids

The following radio navigational aids are located at Oxford Airport and have been considered within this assessment:

- Primary Surveillance Radar (PSR);
- Distance Measuring Equipment (DME);
- Non-Directional Beacon (NDB);
- Instrument Landing System (ILS) [localiser and glide path].

The Oxford Airport radio navigational aid details[2] are presented in Table 1 on the following page.

[2] Navigational aid details found from NATS AIP data. Ground heights calculated based on OSGB data.

Facility Type	Facility	Longitude	Latitude	Distance from Proposed Development (km)	Base of Antenna at Ground Level (m amsl)
Radar	Oxford – PSR/SSR	0011938.7W	515014.84N	0.61	80.20
ILS Localiser	ILS/LLZ RWY 19 – IOXF	0011920.3W	514945.2N	0.06	74.13
ILS Glide Path	ILS/GP – IOXF	0011912.8W	515027.3N	1.08	80.81
DME	DME RWY 19 – IOXF	0011918.6W	515013.8N	0.66	80.52
NDB	NDB – OX	0011924.5W	515000.3N	0.27	79.91

Table 1 *All identified radio navigation aids at Oxford Airport*

Building Restricted Areas Assessment

The navigation aids identified in the above subsection have been assessed in accordance with the BRAs defined within ICAO EUR DOC 015 - European Guidance Material on Managing Building Restricted Areas.

The results of the assessment indicate that the panels nearest to the navigation aids do not infringe upon the building restricted areas, but areas to the south-west are likely to infringe due to increased ground heights of the terrain. In these areas, the terrain already infringes the building restricted areas, and the extra 2.53m height would not be expected to significantly increase the risk upon radio communications, especially as panels which could infringe would be over 1km from the relevant navigation aid.

Further Analysis

Pager Power is aware of studies relating to the effect of electromagnetic interference from solar panels upon radio communications equipment, in which it was determined that significant impacts may be possible within a distance of 10m from the solar panels. It is therefore recommended that the current setback between the solar panels and any radio communications infrastructure will be sufficient to mitigate any impact towards Oxford Airport.

EMERGENCY PROCEDURES AND EFATO

Overview

Oxford Airport's consultation response requested:

> *An alteration to the proposed layout sufficient to safeguard and area of land under the approach and departure route south of the airport in order to allow for the safe emergency landing of an aircraft afflicted by insurmountable technical issues and for the airport Rescue and Fire Fighting Service to access then land in order to deliver its Obligated Response.*

The following sections of this report consider the relevant emergency procedures and Engine Failure After Take-Off (EFATO) to suggest a suitable alteration to the solar layout that would provide sufficient area for emergency landings whilst retaining solar arrays where possible.

Engine Failure After Take-Off (EFATO)

Overview

In the event of catastrophic engine failure shortly after take-off, it is recommended that pilots attempt to land in the most appropriate area within 45° each side of the nose.[3] It is important to note that many airports do not have a suitable EFATO zone due to other constraints, and the most suitable landing zone is likely to change based on ground conditions and development in the area surrounding the aerodrome.

Analysis

The Combined Aerodrome Safeguarding Team (CAST) published an advice note in February 2024[4], which includes reference to EFATO considerations for solar farms. In this document it is stated that "the safeguarding of [EFATO zones] must be considered reasonably and pragmatically by both an aerodrome operator and a solar developer"[5]. It is further stated that if a designated EFATO safeguarded area is to be implemented, it should be located along the extended runway centreline.

With regard to the proposed development, the developer has already agreed to not site any panels in the field directly south of the runway 01 threshold. This means that the first solar panels would be sited 450m away from the runway threshold, along the extended runway centreline. This may be considered to be a suitably safeguarded zone without any extension of the zone, as this zone will already serve to provide a clear landing zone for aircraft that experience EFATO close to the ground, and therefore have less response time than those who may already have achieved significant altitude.

[3] Many flight training organisations recommend a smaller zone than this, such as 30° either side of the nose
[4] Combined Aerodrome Safeguarding Team, Advice Note 5 – Renewable Energy Developments
[5] Ibid, pg. 4

If it is considered that an extended safeguarded zone is required, this would most likely be achieved through an extension of this panel-free zone running along the extended runway centreline. Figure 5 below shows an example of this, with the safeguarded zone extending to the treeline, offering an unobstructed emergency landing strip extending to a distance 590m from the runway threshold. This could also assist with allowing emergency response vehicles to access a striken aircraft quickly in the event of an incident.

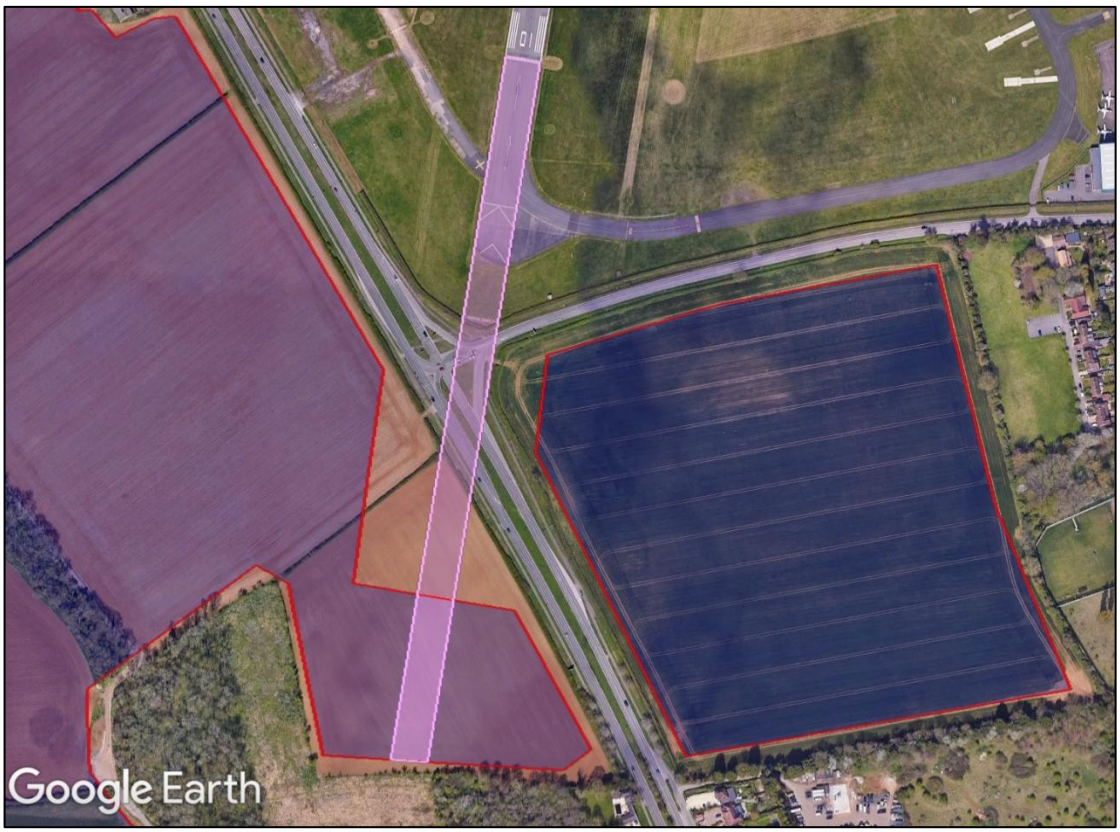

Figure 5 *The suggested designated EFATO safeguarded zone, running along the extended runway centreline*

Public Safety Zones

Public Safety Zones (PSZ) are intended to restrict the number of people congregating within areas directly adjoining runway thresholds, in order to reduce the number of people at risk in the event of an accident during take-off or landing. It is important to note that PSZs do not relate to obstruction risk and are not blanket 'no build zones'.

Developments are permitted within PSZs if they "involve a very low density of people coming and going"[6]. A solar farm such as the proposed development would be expected to meet this requirement, as once operational, regular access will only be required for maintenance purposes.

It is recommended that during the construction phase, site offices and evacuation assembly points are situated outside of the PSZ in order to comply with the policy.

[6] Department for Transport, "Control of development in airport public safety zones" (8th October 2021)

WINDSHEAR AND HEAT-INDUCED TURBULENCE

Background

Oxford Airport's consultation response requested:

> *A study of the effect of heat radiation from the proposed solar panels which might create air turbulence adversely affecting safety or comfort of flight.*

The following section of this report considers (at a high-level) potential windshear and heat-induced turbulence from the solar development.

Analysis

Windshear Turbulence

Windshear turbulence is unlikely to significantly impact aviation operations at Oxford Airport, due to the low vertical profile of the solar panels relative to the surrounding terrain.

Typically, effects of windshear turbulence may be possible within a horizontal radius of ten times the obstruction height[7]. Nearby buildings and infrastructure near Oxford Airport would be far more likely to result in windshear turbulence, and it is not considered that the proposed solar development will increase the risk of windshear turbulence.

Heat-induced Turbulence

Solar panels are designed to absorb light from the sun and typically operate most efficiently at a temperature of approximately 25°C. The panels are therefore designed to remain cool in direct sunlight, and it is not anticipated that panels would reach temperatures significantly greater than the surrounding ground.

There are currently many ground surfaces surrounding Oxford Airport which would be expected to have greater thermal conductivity and diffusivity than bare earth, such as asphalt on the runway and taxiways at Oxford Airport, the neighbouring business park and the A44 road. These surfaces all have the potential to create thermal updrafts which pilots on approach to Oxford Airport would likely already be routinely navigating.

Overall, there is the potential that the proposed solar development could result in thermal updrafts under the approach path to runway 01, but it is expected that these would result in turbulence no more severe than is currently likely to occur from the nearby infrastructure. Many UK aerodromes have infrastructure sited underneath their approach paths which could potentially cause heat-induced turbulence; this is therefore a common occurrence which pilots should be expected to be aware of and navigate.

[7] The maximum height of solar panels will be 2.53m above ground level

GLINT AND GLARE

Background

A Glint and Glare Assessment was previously produced by Pager Power for Botley West Solar Farm and an associated PIER Chapter has also been produced. The full document, reference 11216B, is available as part of the DCO documentation and a summary of the results relevant to Oxford Airport are presented below.

Results Summary

The results of the geometric calculation for aviation receptors at Oxford Airport are presented in Table 2 on the following page.

Conclusions

Solar reflections are geometrically possible towards the ATC Tower, however existing vegetation and buildings are predicted to partially screen views of the panels. The closest reflecting panel area is also at least 1.6km from the ATC Tower, and reflections are predicted to coincide with direct solar radiance. A low impact is predicted and no mitigation is recommended.

The analysis has shown that solar reflections are predicted towards the approach paths for runways 01 and 19. Solar reflections towards both approach paths will be outside of a pilot's primary field-of-view. This is deemed acceptable in line with the associated guidance and industry standards; a low impact is predicted, and mitigation is not required.

Overall, a low impact is predicted towards Oxford Airport, and no mitigation is recommended.

Receptor/ Runway	Geometric Modelling Result	Glare Intensity	Comment	Impact Classification	Mitigation Recommended?
ATC Tower	Solar reflections are geometrically possible		The reflecting panel area is partially screened by existing vegetation and at least 1.30km from the ATC Tower Any solar reflections would be close to the horizon and are predicted to coincide with direct sunlight	Low impact	No
Runway 01 Approach Path	Solar reflections are geometrically possible between the threshold and 1-miles from the threshold		Any solar reflections would be outside of a pilot's primary field-of-view	Low impact	No
Runway 19 Approach Path	Solar reflections are geometrically possible between 0.4-miles from the threshold and 2-miles from the threshold		Any solar reflections would be outside of a pilot's primary field-of-view	Low impact	No

Table 2 *Geometric analysis results – Oxford Airport*

EXAMPLES OF SOLAR FARMS AND AIRPORTS COEXISTING

Overview

The following section shows a number of UK civil and military aerodromes which coexist with solar farms. Whilst the scale of the solar farms and the distances between the airfield and the solar farm differ, all of these aerodromes would have needed to consider similar safeguarding concerns and continue to operate successfully in the presence of these developments.

Figures 6 to 27 on the following pages show examples of solar farms in the vicinity of UK aerodromes.

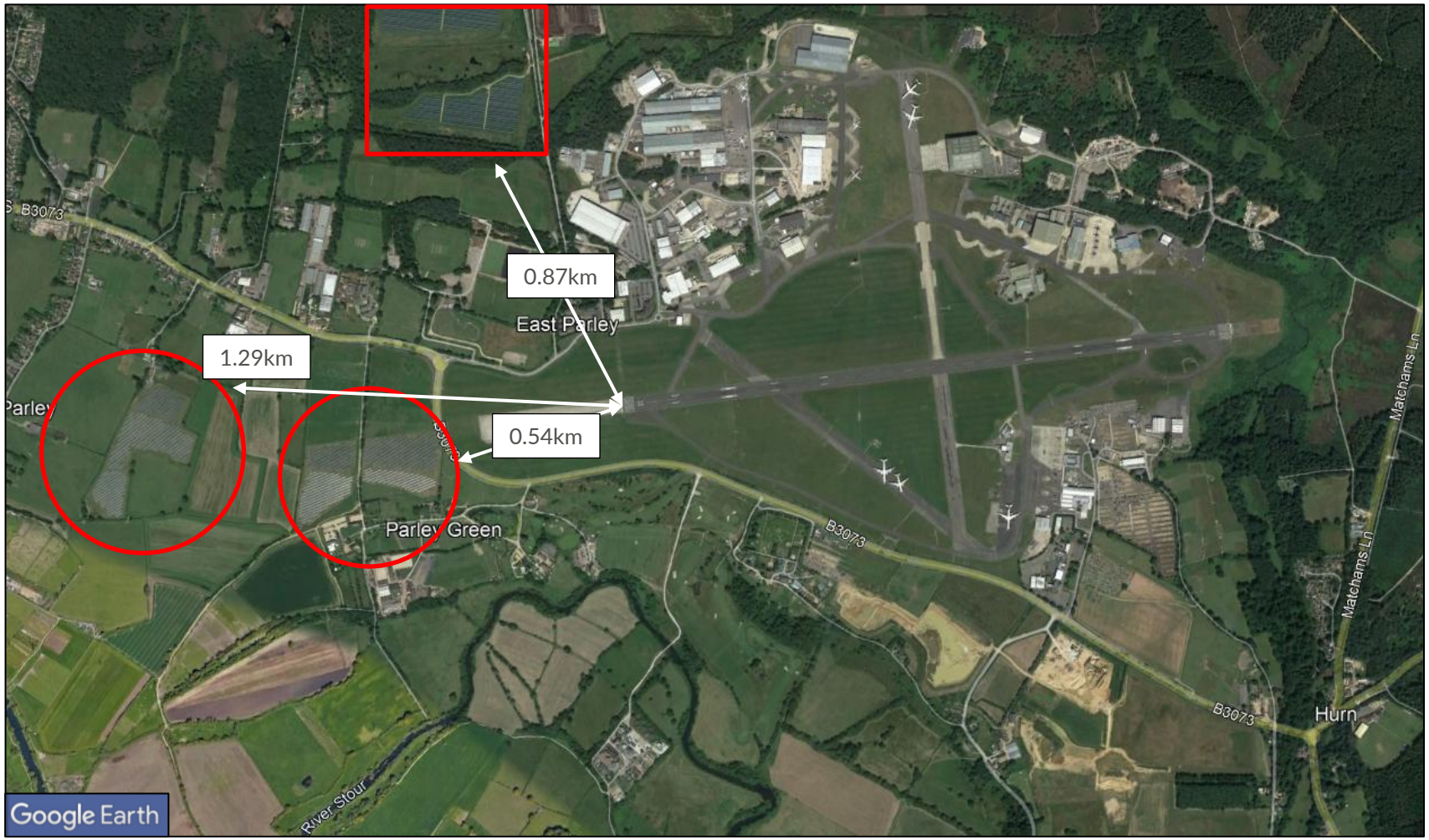

Figure 6 *Existing solar PV development on the approach to Bournemouth Airport*

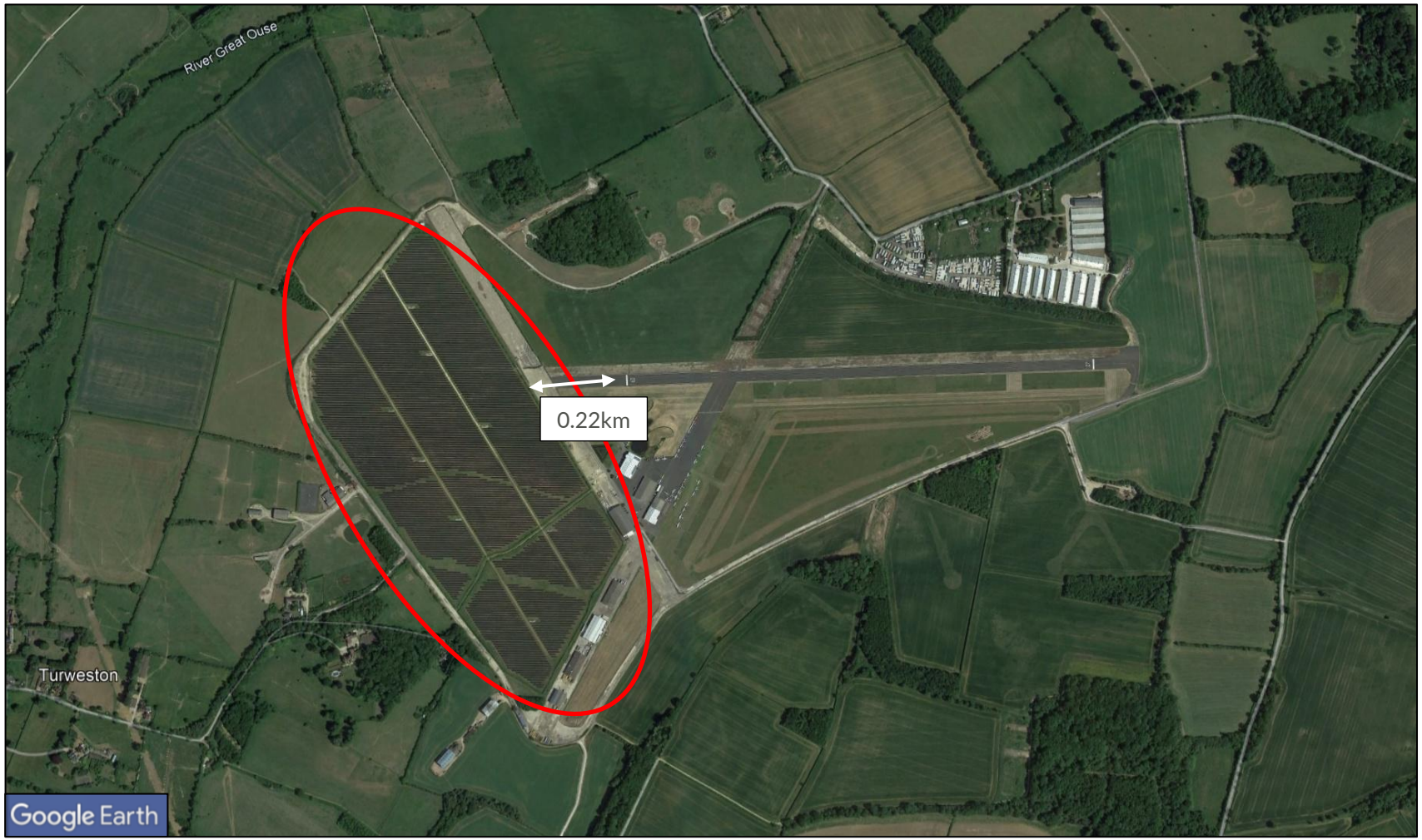

Figure 7 *Existing solar PV development on the approach to Turweston Airport*

Figure 8 *Existing solar PV development on the approach to Haverfordwest Airport*

Figure 9 *Existing solar PV development on the approach to RNAS Yeovilton*

Figure 10 *Existing solar PV development on the approach to RAF Cranwell*

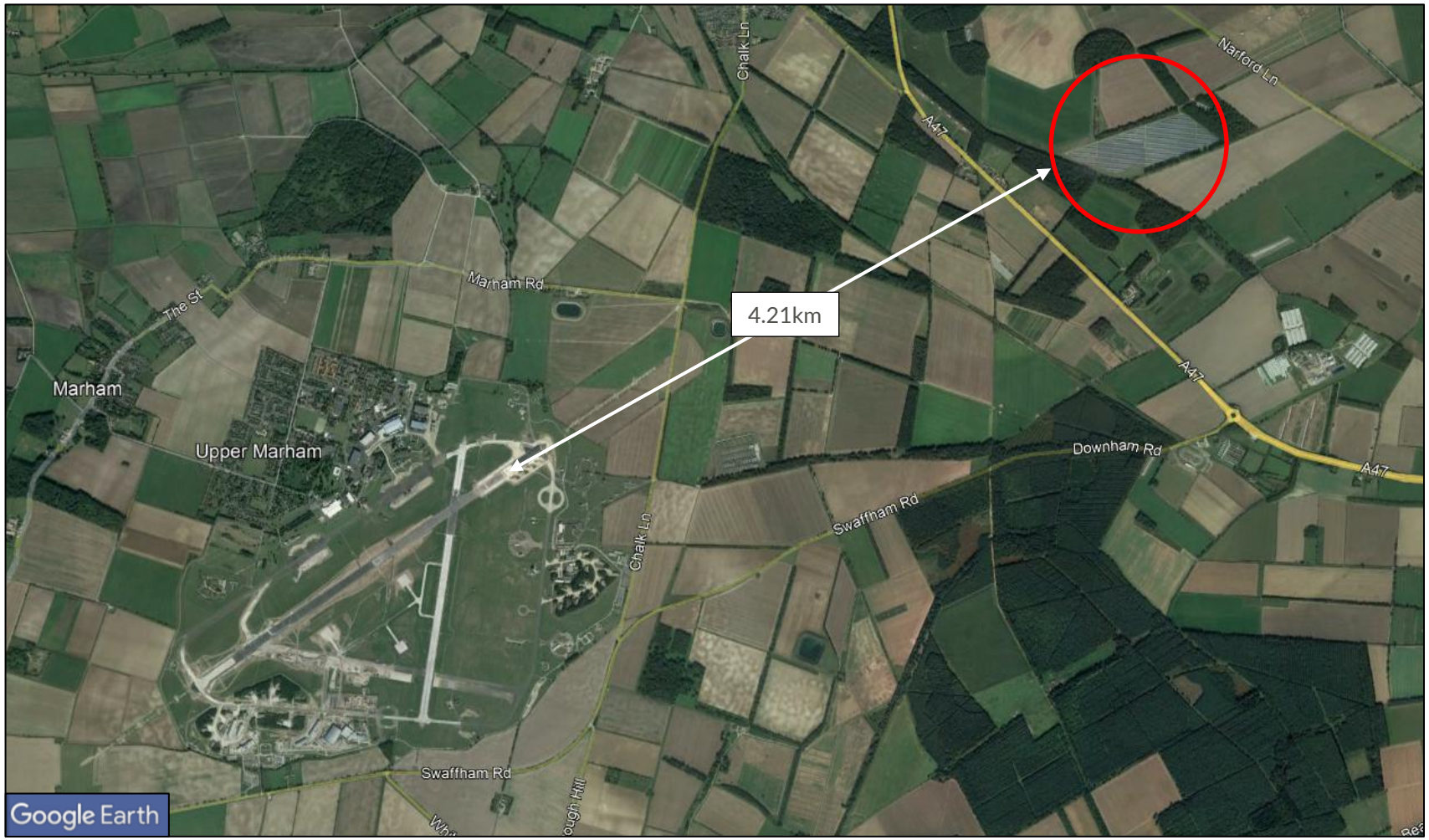

Figure 11 *Existing solar PV development on the approach to RAF Marham*

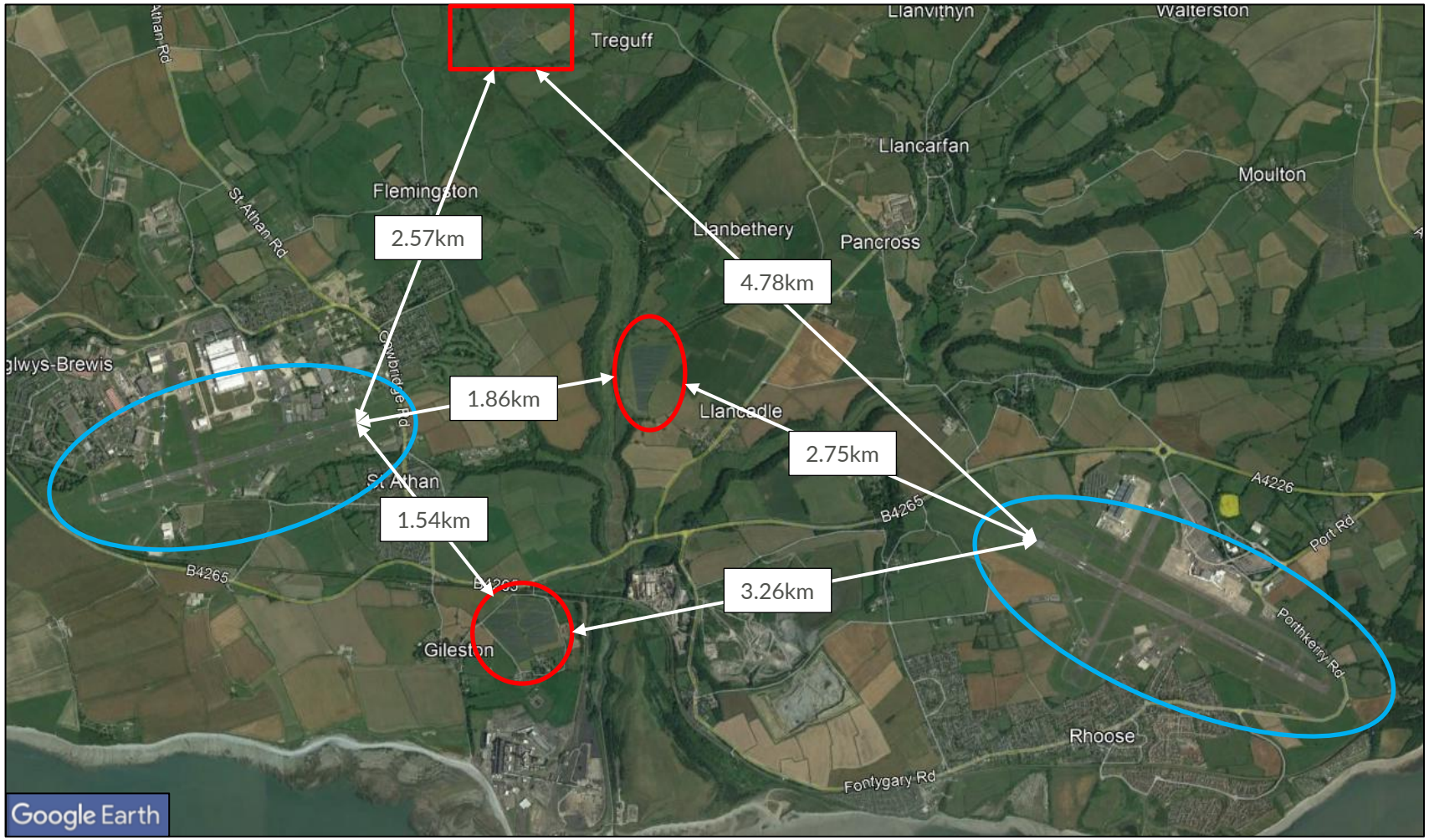

Figure 12 *Existing solar PV development on the approach to MOD St Athan and Cardiff Airport*

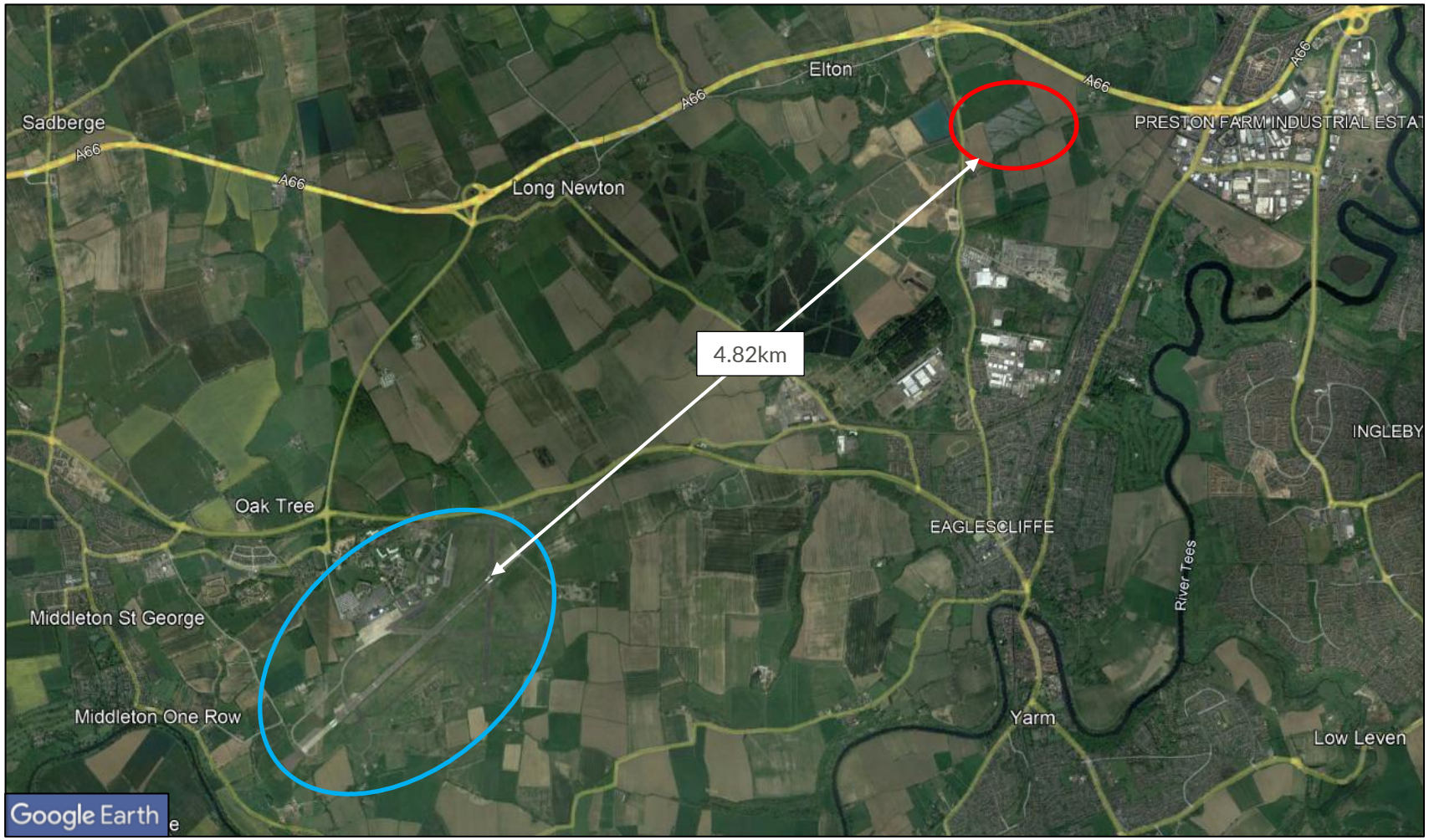

Figure 13 *Existing solar PV development on the approach to Teesside International Airport*

Figure 14 *Existing solar PV development on the approach to Barrow/Walney Island Airport*

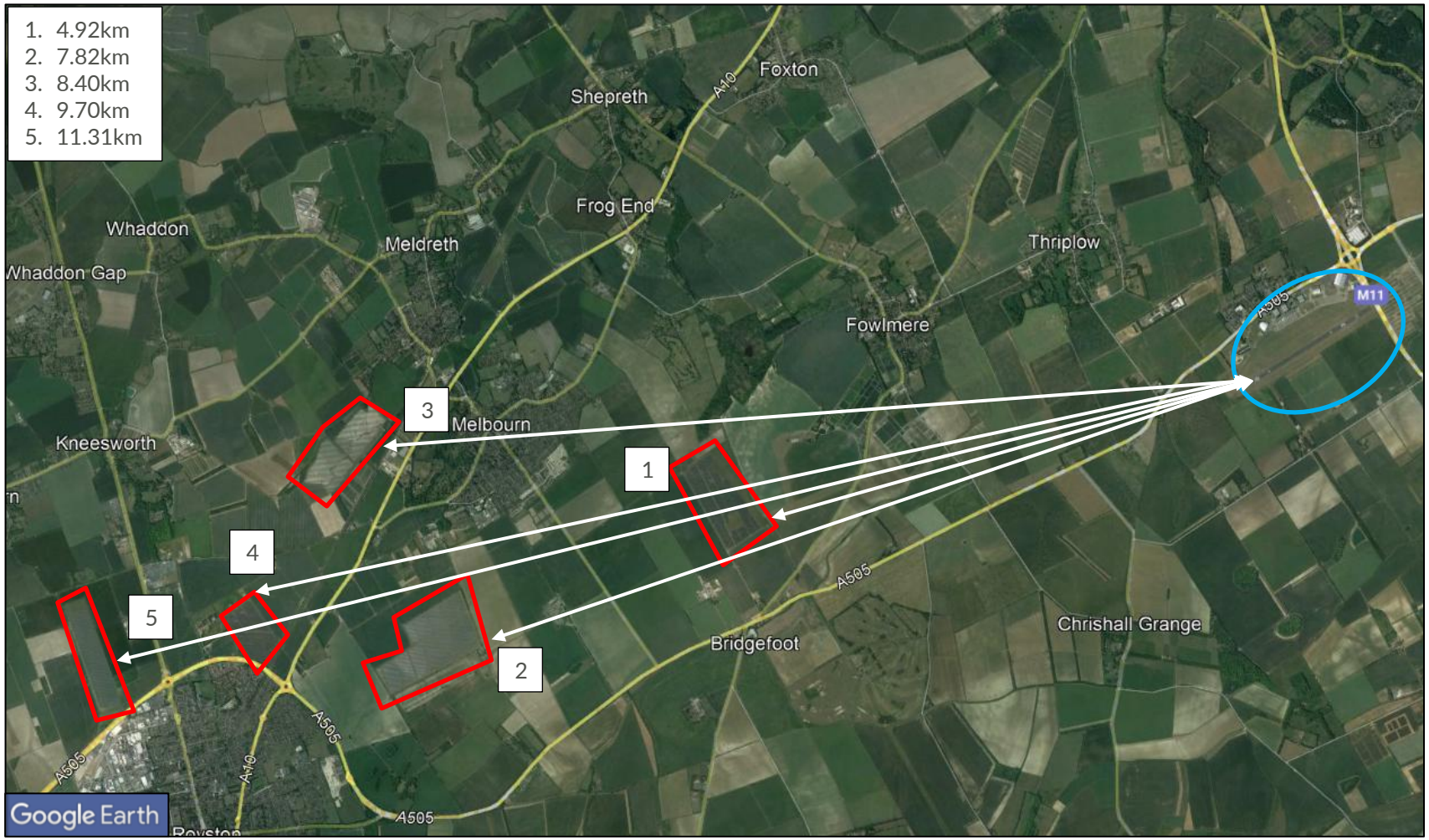

Figure 15 *Existing solar PV development close to the approach to Duxford*

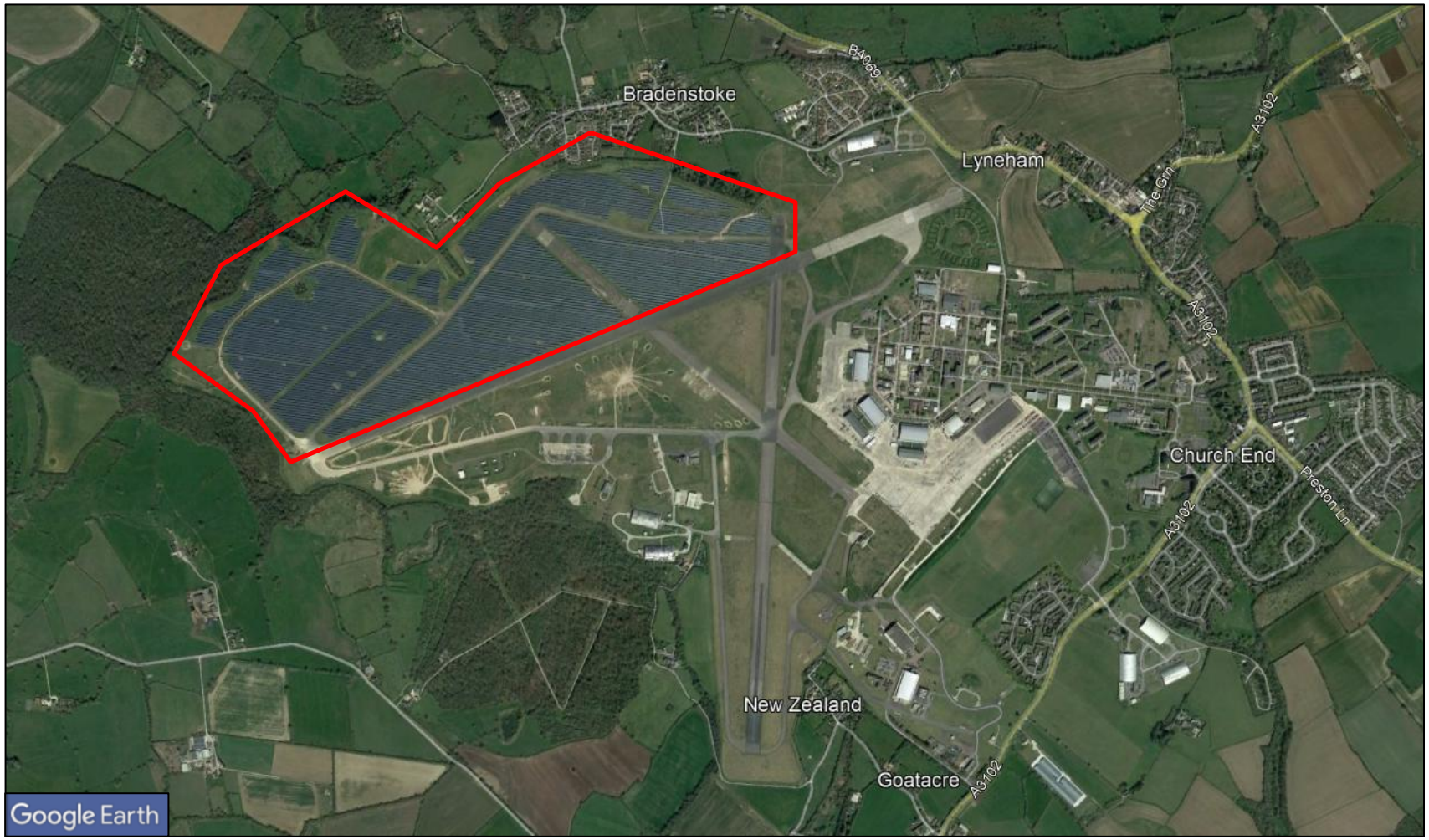

Figure 16 *Existing solar PV development in close proximity to MOD Lyneham/Cotswold Airport*

Figure 17 *Existing solar PV development in close proximity to MOD Boscombe Down*

Figure 18 *Existing solar PV development in close proximity to Dunsfold Aerodrome*

Figure 19 *Existing solar PV development in close proximity to Cranfield Airport*

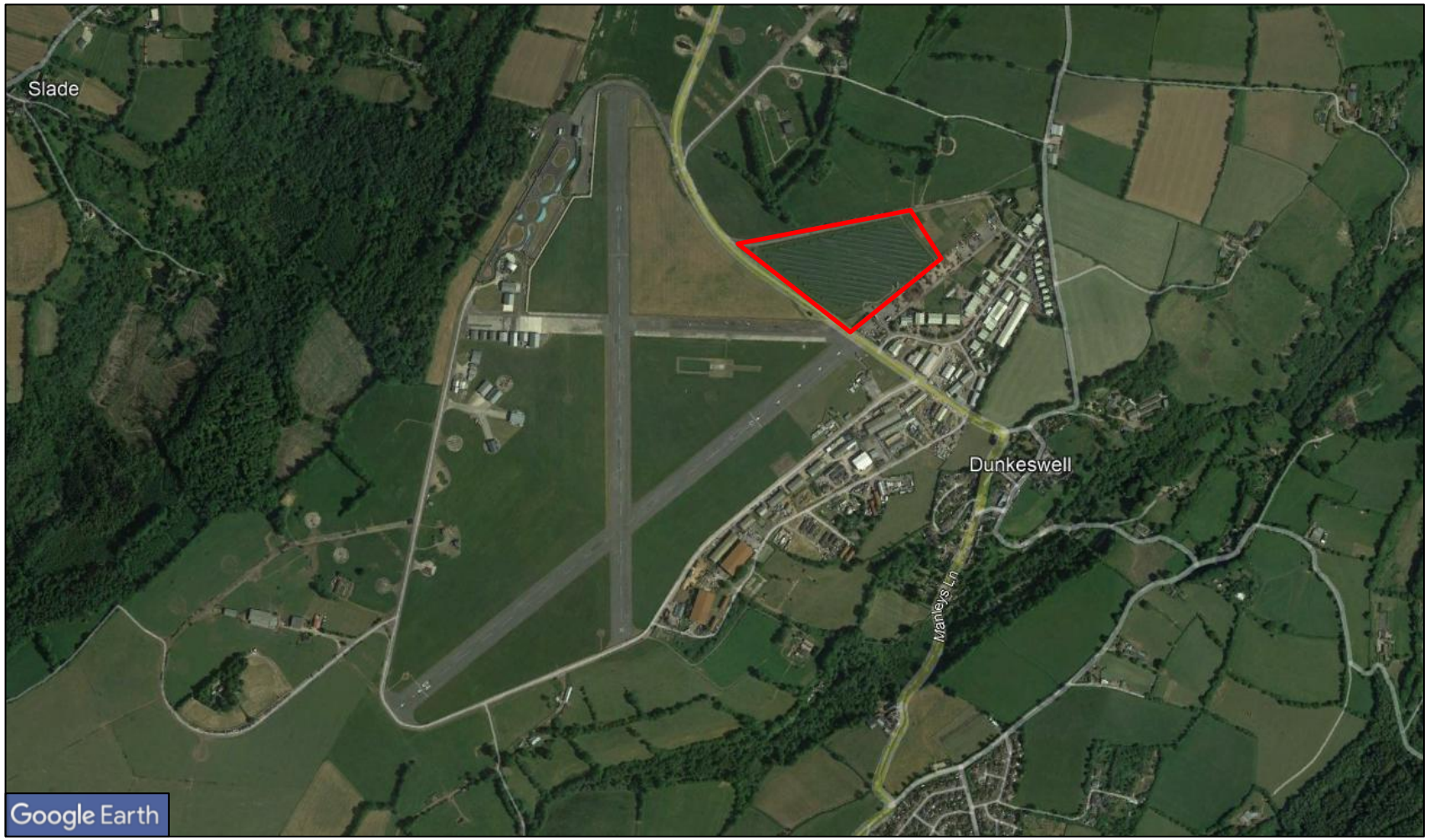

Figure 20 *Existing solar PV development in close proximity to Dunkeswell Aerodrome*

Figure 21 *Existing solar PV development in close proximity to London Southend Airport*

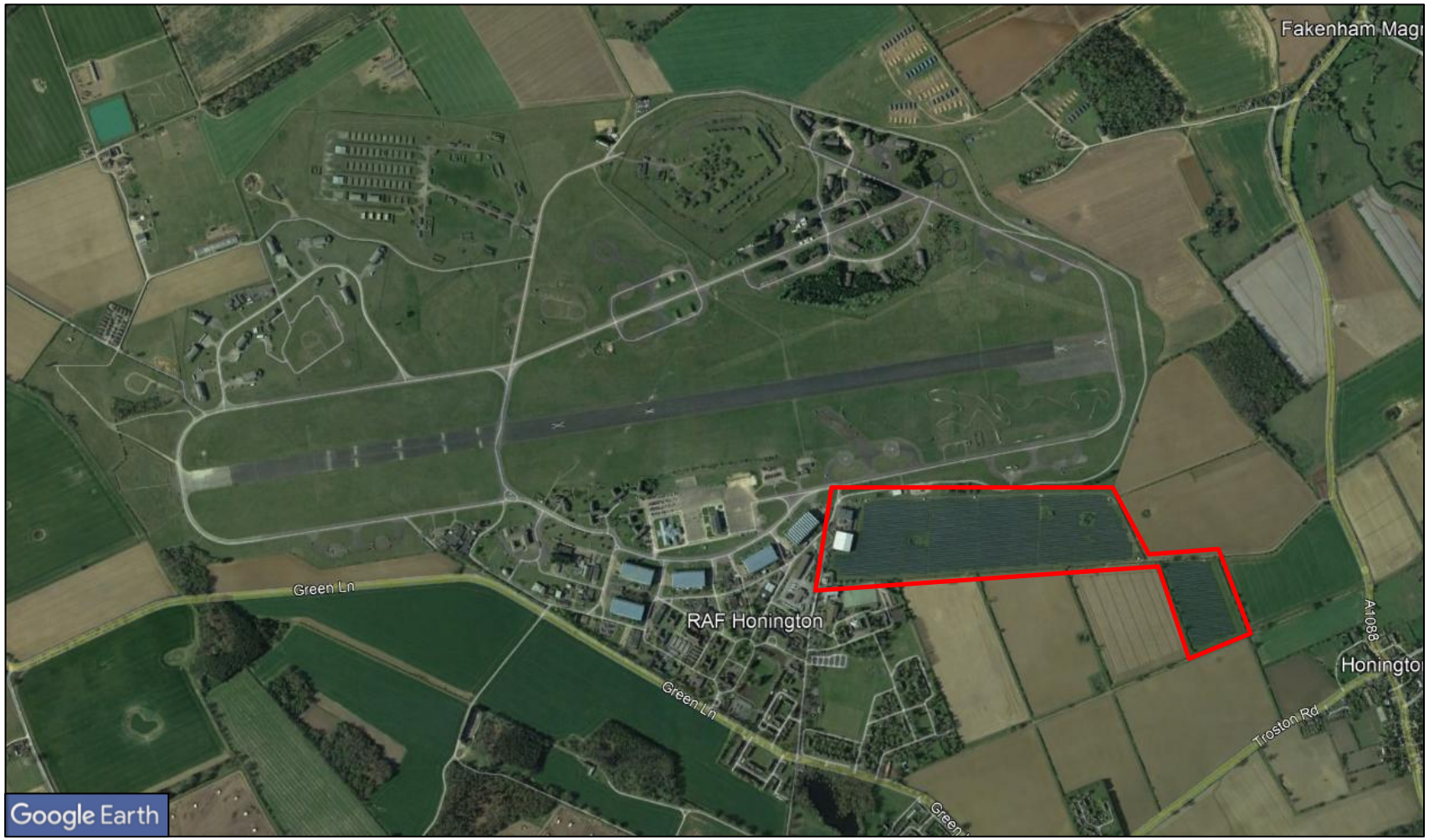

Figure 22 *Existing solar PV development in close proximity to RAF Honnington*

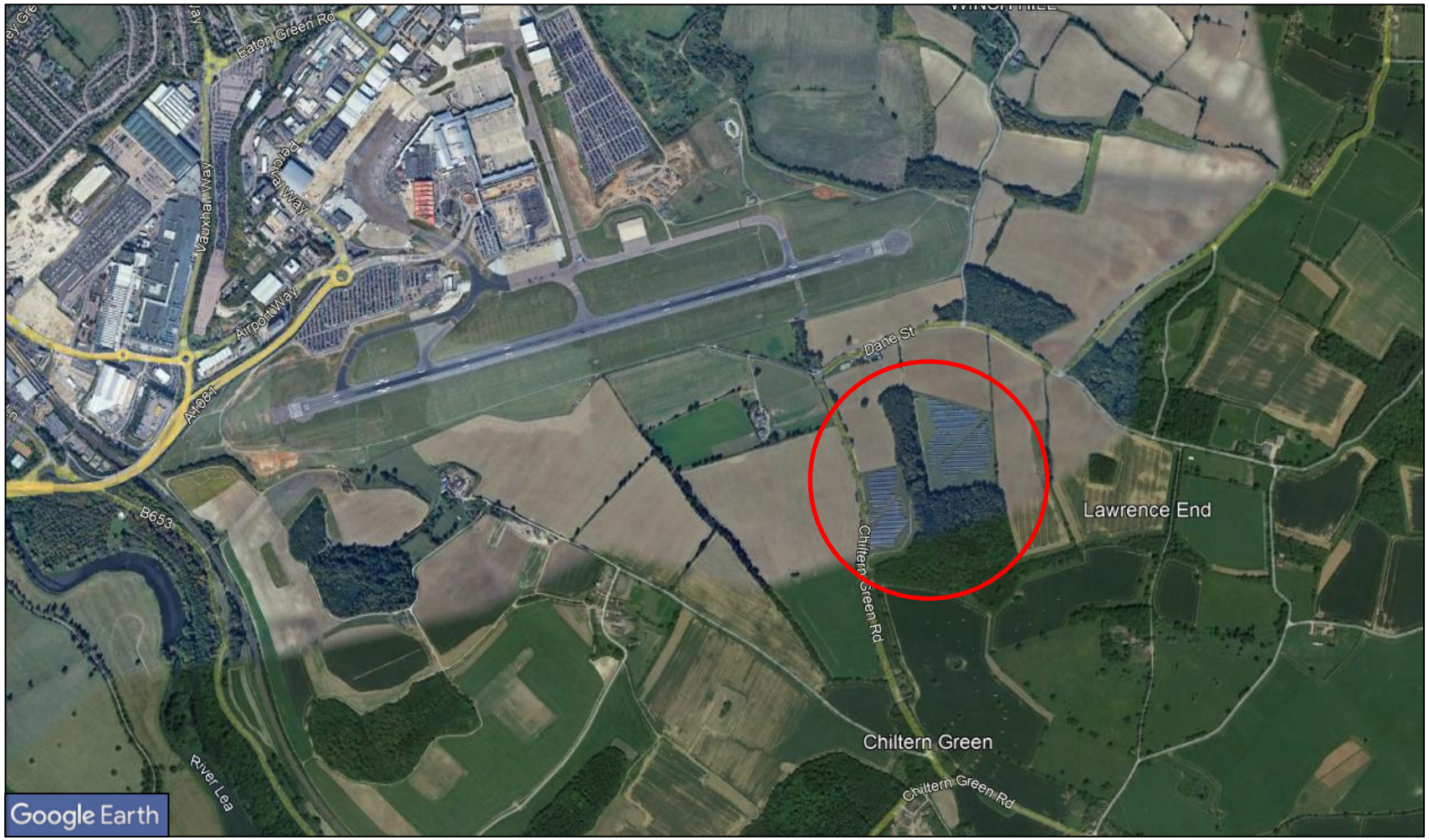

Figure 23 *Existing solar PV development in close proximity to Luton Airport*

Figure 24 *Existing solar PV development in close proximity to Nottingham Airport*

Figure 25 *Existing solar PV development in close proximity to Belfast International Airport*

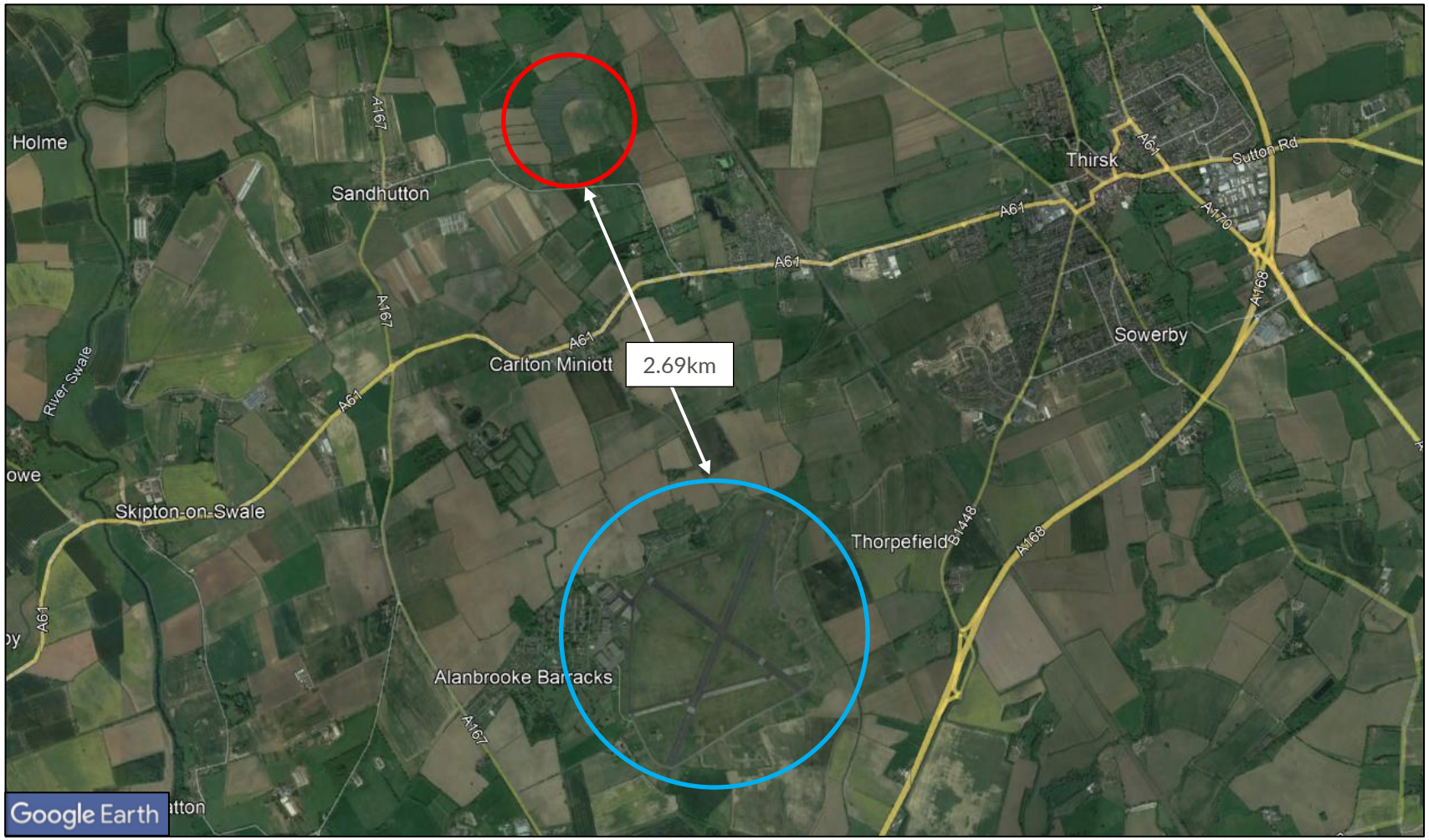

Figure 26 *Existing solar PV development in proximity to RAF Topcliffe*

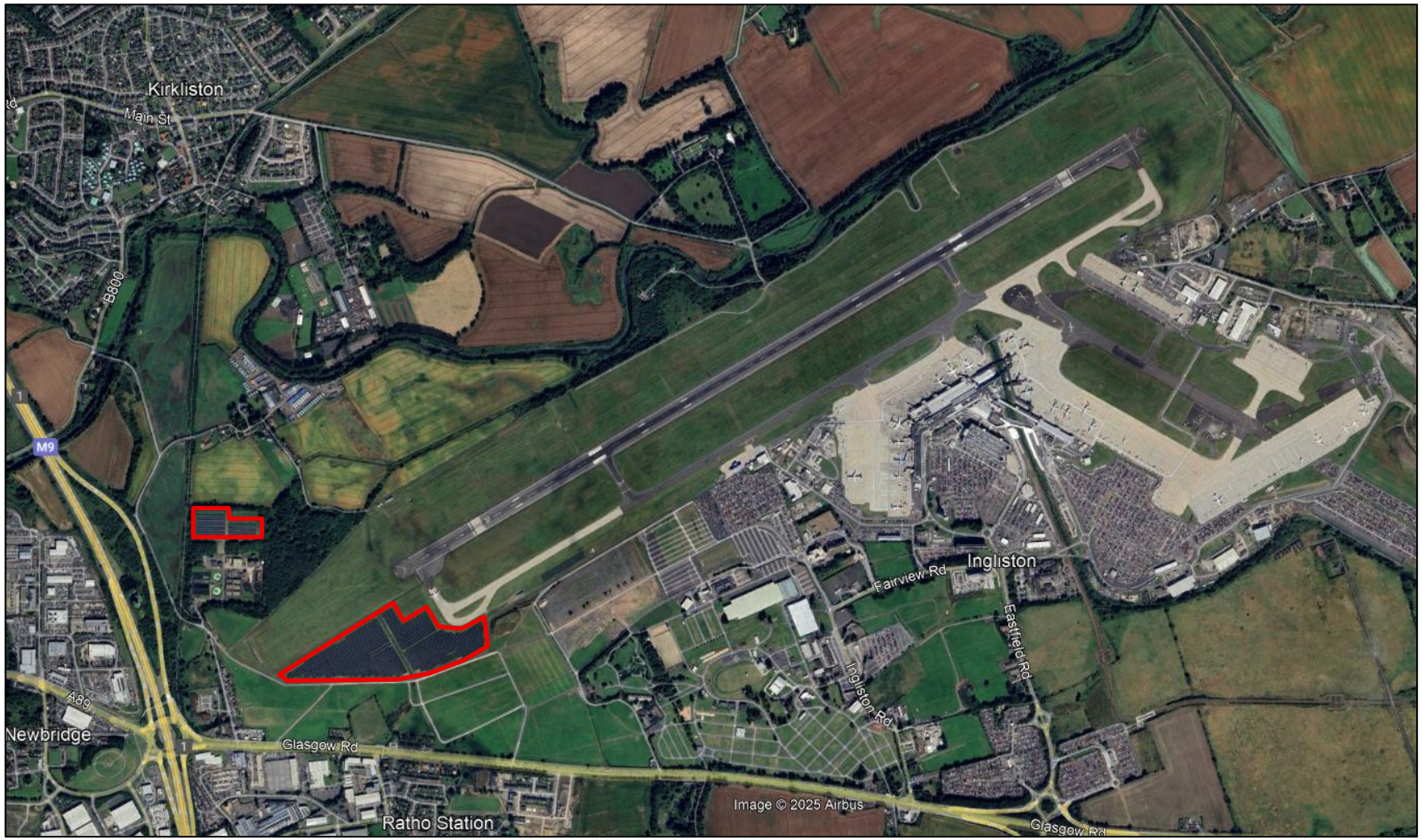

Figure 27 *Existing solar PV development in proximity to Edinburgh Airport*

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