



Parc Ynni Calon y Gwynt

ENVIRONMENTAL STATEMENT

Appendix 7M: Night-time Assessment





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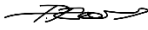
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1 INTRODUCTION

1.1 PURPOSE OF THIS APPENDIX

- 1.1.1 This appendix provides a Night-time Assessment of the visual effects of the aviation warning lights, required on four of the 11 turbines within the Proposed Development. The accompanying figures in **Annex 7M.1** also inform the assessment of effects on the Special Qualities of the Eryri National Park and proposed Glyndŵr National Park in **Appendix 7I** and **7J** respectively.
- 1.1.2 The Aviation Lighting Strategy is detailed in the Parc Ynni Calon y Gwynt Windfarm Reduced Lighting Scheme Proposal, produced by Straten Consulting Services Ltd (**Appendix 14A**) and illustrated in **Figure 7M.1 Lighting Strategy Plan** in **Annex 7M.1**

1.2 METHODOLOGY

- 1.2.1 This assessment accords with the NatureScot *Guidance on Aviation Lighting Impact Assessment*¹. The methodology for the Night-time Assessment is set out in **Appendix 7A**. The main difference between day-time effects and night-time effects is that the 'night-time' assessment period aligns with the operating period of the visible aviation warning lights between dusk and dawn².
- 1.2.2 The *Guidance on Aviation Lighting Impact Assessment*¹ advises the assessment should follow three steps:
- Step 1: Defining the lighting proposal;
 - Step 2: Understanding the baseline; and
 - Step 3: Assessing the effects of the aviation lighting.
- 1.2.3 Importantly, the Night-time Assessment is not a technical lighting impact assessment based on quantitative measurement of light levels. Rather, the assessment relies on professional judgement and combines both qualitative analysis of what the human eye can reasonably perceive and quantitative analysis of the proposed light intensity at different distances and angles of elevation relative to the source, taking into account a range of factors such as meteorological conditions and the perception of darkness at the viewpoint or receptor location. As with the day-time landscape and visual assessment, the sensitivity of the receptor to the Proposed Development (aviation warning lights) and the magnitude of change are combined to determine the level of effect likely to result from the aviation warning lights.
- 1.2.4 The sensitivity of the receptor and the magnitude of change are likely be different from the daytime assessment. For example, the *Guidance on Aviation Lighting Impact Assessment*¹ advise that people in settlements may be considered as of Low susceptibility to the aviation warning lights, due to the number of light sources present in most settlements. This contrasts with High sensitivity of people in settlements to the daytime visibility of the wind farm.
- 1.2.5 The magnitude of change is restricted to the aviation warning lights alone and is not concerned with other unlit components of the Proposed Development.

¹ NatureScot (2024) *Guidance on Aviation Lighting Impact Assessment*. (Online). Available at: <https://www.nature.scot/doc/guidance-aviation-lighting-impact-assessment> (Accessed March 2026)

² The visible aviation warning lights (as opposed to infra-red lights not visible to the human eye) would come on 30 minutes after sunset and switch off 30 minutes before sunrise.

- 1.2.6 The evaluation of significance and the nature of these effects is also described following the methodology used for the assessment of landscape, visual and cumulative effects which is set out in **Appendix 7A**. Due to changes in sensitivity and magnitude the results of the assessment can be notable different from the daytime component of the LVIA.

DEFINING THE STUDY AREA

- 1.2.7 The Study Area for the Night-time Assessment is the same as the LVIA Study Area (27 km from the turbine positions) to allow for the Zones of Theoretical Visibility (ZTV) plots of the proposed aviation warning lights to inform the assessment of effects on the Special Qualities of the Eryri National Park (ENP) and proposed Glyndŵr National Park in **Appendix 7I** and **7J** respectively.

PRODUCTION OF ZTV PLOTS

- 1.2.8 Night-time ZTVs of the proposed aviation warning lights were calculated using ReSoft© Wind Farm computer software to produce an area of potential visibility of the aviation warning lights, calculated at hub height. The ZTV plots provide an indication of the areas from where the aviation warning lights may be theoretically visible but do not take account of intervening screening from localised landform, buildings or vegetation. The ZTVs therefore provide a starting point in the assessment process. Accordingly, they tend towards giving a 'worst-case' or over-estimated scenario of the potential visibility. The ZTVs are contained in **Annex 7M.1** and include the following:
- **Figure 7M.4 Nacelle Lights Zone of Theoretical Visibility (ZTV) with Night-time Viewpoints** provides a hub height ZTV within the 27 km study area for the four turbines which would be lit by aviation warning lights positioned on their nacelles or hubs. The figure indicates the areas from which these lights would be theoretically visible and the number of lights visible;
 - **Figures 7M.6a/b Lighting Intensity Zone of Theoretical Visibility (ZTV)** provide an indication of the variable light intensity likely to be perceived as a result of angle intensity mitigation (see **Section 2**). **Figure 7M.6a** presents the light intensity ZTV overlapped with landscape designations across the 27 km Study Area, whilst **Figure 7M.6b** focusses on a 10 km buffer from the proposed turbines; and
 - **Figure 7M.7 Cumulative Night-time Zone of Theoretical Visibility (ZTV) - Calon y Gwynt with Llyn Lort** provides a cumulative ZTV which includes the Proposed Development and the Llyn Lort Wind Farm.
- 1.2.9 A review of potential other visible aviation warning lights within the Study Area indicated the following:
- All existing and consented schemes within the LVIA Study Area are at or below a height of 150 m to blade tip and would therefore not be lit;
 - An application for the Llyn Lort scheme was submitted to PEDW in July 2025, with revisions to Volume III: Supporting Technical Appendices submitted in February 2026. PEDW's Assessment of Environmental Statement³, dated 23 March 2026, formally requested further information under Regulation 24 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (as amended). As a consequence, the application has not yet been validated and whilst the applications documents have not been uploaded to the PEDW Casework Portal,

³ Planning & Environment Decisions Wales (23/03/2026) *Assessment of Environmental Statement*. (Online). Available at: <https://planningcasework.service.gov.wales/case/CAS-02362-P3S4H4> (Accessed 05 May 2026)

they are available on the Developer's website⁴, including the Aviation Lighting and Mitigation Technical Appendix⁵. The Llyn Lort Wind Farm has therefore been included in **Figure 7M.7** and the cumulative assessment; and

- The Developer website⁶ for the Banc Du and Rhiwlas Wind Farms confirm that applications were made to PEDW for both schemes at the end of December 2025. At the time of this assessment, both applications were still subject to validation and had not yet been accepted by PEDW. As a consequence, no details of the proposed aviation lighting schemes were available for inclusion in a cumulative ZTV for the Draft ES. The Scoping scheme at Laundrymaid has also not been included in accordance with the overarching scope of the cumulative assessment set out in **Chapter 7 Landscape and Visual**. The cumulative night-time context will be updated as part of the Final ES.

CONSULTATION AND NIGHT-TIME VIEWPOINT SELECTION

- 1.2.10 The night-time viewpoint selection has been agreed through consultation during the EIA Scoping process and is consistent with the 20 day-time viewpoints. As such they represent a range of receptor groups, viewing from different directions over varying distances. Many of the viewpoints are located where people are most likely to be present at night, for example in settlements / residential properties or on roads.
- 1.2.11 In total three night-time viewpoints were selected for illustration as photomontages and more detailed assessment which is set out in **Annex 7M.2** and summarised in **Table 7M-1**. The location of the night-time viewpoints is illustrated in **Figure 7M.4** and the photomontages are presented in **Figures 7M.8 to 7M.10**.

⁴ Available at: <https://bute.energy/llyn-lort/overview/the-project/project-documentation/> (Accessed 05 May 2026)

⁵ Wind Power Aviation Consultants Ltd (March 2025). Wind Farm Aviation Lighting and Mitigation Technical Appendix for Llyn Lort Wind Farm V2.0. (Online). Available at: <https://bute.energy/wp-content/uploads/2025-06-12-Environmental-Statement-Vol-III-Appendix-3.1-Aviation-Lighting-and-Mitigation-Report-with-CAA-Approval-Letter.pdf> (Accessed 05 May 2026)

⁶ Available at: <https://bute.energy/banc-du/overview/faqs/> and <https://bute.energy/rhiwlas/rhiwlas-energy-park-overview/faqs/> (Accessed 05 May 2026)

Table 7M-1 - Night-time Viewpoint Selection

Viewpoint Selection	Distance (km)*	Comments
N1: A470, Clatter	2.9 km	Representative viewpoint from the A470 demonstrating the view experienced by a range of receptors.
N4: A470, east of Talerddig	6.3 km	Representative viewpoint from the A470 demonstrating the view experienced by a range of receptors.
N8: Minor Road, east of New Mills	9.9 km	Representative viewpoint from the minor road network in the eastern LVIA Study Area demonstrating the view experienced by a range of receptors.

Note: *Distance to nearest proposed turbine within the Proposed Development.

PHOTOGRAPHY AND PHOTOMONTAGE PRODUCTION

- 1.2.12 The methodology used for viewpoint photography and photomontage production accords with the NatureScot guidance *Visual Representation of Wind Farms*⁷. Further guidance is provided by the Landscape Institute's Technical Guidance Note, *Visual Representation of Development Proposals*⁸. The baseline photography is recorded to corresponds with periods when the turbines would be lit and people are more likely to be outside at night, whilst also providing a visible horizon which is required in order to correctly render the photomontages and assess any effect on landscape character.
- 1.2.13 To accord with the *Guidance on Aviation Lighting Impact Assessment*¹, the photomontage visualisations illustrate the maximum case lighting intensity scenario (e.g. 200cd where dimming of aviation lights proposed as embedded mitigation, and 2000cd only where this mitigation is not proposed). Therefore, in this case the photomontages for the three viewpoints show the reduced number of aviation warning lights, illustrated at 200cd only. The images do not attempt to show angle intensity mitigation and consequently may, in some cases of lower elevation relative to the aviation warning lights, over-estimate the light intensity.
- 1.2.14 The photomontages are considered useful when combined with objective data illustrated in the ZTV plots and wireline figures. However, whilst the aim is to provide a reasonably realistic image of the Proposed Development, the *Guidance on Aviation Lighting Impact Assessment*¹ recognises the limitations of both night-time photography and photomontages. These limitations include multiple variables of distance, partial screening, atmospheric conditions, time of night and darkness for example. Therefore, the photomontage production has relied on professional judgement and an 'artistic impression' and has drawn from our experience, noting previous consultee comments and comparison of previous photomontages with other lit onshore wind turbines and site survey for prolonged periods at night.

⁷ Scottish Natural Heritage (now NatureScot) (2017) *Visual representation of wind farms: Guidance. Version 2.2*. (Online). Available at: <https://www.nature.scot/doc/visual-representation-wind-farms-guidance> (Accessed March 2026)

⁸ Landscape Institute (2019) *Technical Guidance Note 06/19 Visual Representation of Development Proposals*. (Online). Available at: <https://www.landscapeinstitute.org/visualisation/> (Accessed March 2026)

2 STEP 1: DEFINING THE LIGHTING PROPOSAL

2.1 OVERVIEW

- 2.1.1 The proposed Aviation Lighting Strategy (issued for approval to the Civil Aviation Authority (CAA)) is illustrated in **Figure 7M.1**. It meets the mandatory requirements of civilian and military aviation whilst minimising the effects of the aviation warning lights on the surrounding environment, including the Eryri National Park.
- 2.1.2 The Aviation Lighting Strategy is summarised as follows:
- Reduced number of aviation warning lights to four turbines (T1, T5, T7 and T10) with no proposed mid-tower lights;
 - Dimming of lights to 10% of peak intensity during periods of clear visibility (>5 km from the wind farm); and
 - Angle intensity mitigation.

2.2 AVIATION LIGHTING REQUIREMENTS

- 2.2.1 The requirements for turbine lighting are dictated by CAA policy and the Ministry for Defence (MOD) to ensure aviation safety in accordance with Article 222 of the Air Navigation Order 2016⁹.
- 2.2.2 It should be noted that aviation warning lights provided for onshore wind farms are different from other lights and should not be compared to lights on offshore turbines, buildings or masts as the specification and mitigation employed is likely to be different. Further guidance is provided in the CAA policy statement *Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level*¹⁰ which interprets the regulations in relation to wind turbines and the need for aviation warning lights.
- 2.2.3 The CAA policy statement advises that steady medium intensity, 2000 candela (cd) red, aviation warning lights are fitted as close as possible to the top of all fixed structures which have a total height of ≥150 meters above ground level as follows:
- *“(a) The person in charge of the wind turbine generator must ensure that it is fitted with a medium intensity (2000 candela) red light, positioned as close as practicable to the top of the fixed structure. A second light serving as an alternative should be provided in case of failure of the operating light;*
 - *(b) The lights required by paragraph (a) must be so fitted to show when displayed in all directions without interruption;*
 - *(c) Additionally, at least three (to provide 360 degree coverage) low-intensity Type B6 lights (32 candela) lights should be provided at an intermediate level of half the nacelle height;*
 - *(d) Subject to sub-paragraphs (e) and (f), the person in charge of a wind turbine generator must ensure that any light required to be fitted by this article is displayed;*

⁹ Parliament of the United Kingdom (2016). *Statutory Instrument 2016 No. 765 Civil Aviation. The Air Navigation Order 2016*. (Online). Available at: <https://www.legislation.gov.uk/uksi/2016/765/contents> (Accessed May 2026)

¹⁰ Civil Aviation Authority (2017). *Policy Statement Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level*. (Online). Available at: <https://www.caa.co.uk/publication/download/16178> (Accessed May 2026)

- (e) *Lights should be operated by an acceptable control device (e.g., photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX. The control device should turn the lights off when the illuminance rises to a level of 500 LUX or more;*
- (f) *In the event of the failure of any light which is required by this policy statement to be displayed, the person in charge of a wind turbine generator must repair or replace the light as soon as practicable. For any outage that is expected to be or is greater than 12 hours, the operator shall request a NOTAM to be issued by informing the NOTAM section (operating 24 hours) of the UK Aeronautical Information Service (AIS) by telephoning +44(0) 1489 61 2488 / 2489 as soon as possible. This NOTAM is to specifically state (with justification) if the repair/replacement of the light will exceed 72 hours. AIS will copy the details of the NOTAM to the operator and to the CAA; and*
- (g) *If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.”¹⁰*

2.2.4 The ANO also requires aviation warning lighting are fitted to cranes, which would be relevant to the construction and decommissioning periods.

2.2.5 *“Away from the immediate vicinity of an aerodrome and where the maximum crane height is less than 150 meters aviation warning lighting is not a legal requirement. However, given the likelihood that such cranes will be amongst the tallest structures in any given location the CAA recommends that, in order to ensure that the crane operator fulfils his duty of care towards others, the crane user (contractor) considers using aviation warning lighting in line with the following: - Cranes that are between 90 meters and 150 meters (approximately 300 – 500 feet) high being equipped with medium intensity steady red lighting positioned at the highest point and both ends of the jib, such that the lighting will provide an indication of the height of the crane and the radius of the crane jib. Such lighting, which should be displayed at night, should be positioned so that when displayed it is visible from all directions. - Cranes that are 60 meters to 90 meters (approximately 200 – 300 feet) high being equipped with low intensity steady (generically 32 candela) red lighting positioned as close as possible to the highest point and, for tower cranes, to the top of the fixed structure. Such lighting, which should be displayed at night, should be positioned so that when displayed it is visible from all directions.”⁹*

2.3 EMBEDDED MITIGATION

2.3.1 All of the mitigation measures included within the Aviation Lighting Strategy (issued for approval to the CAA) have been embedded into the Proposed Development and as such is termed ‘embedded mitigation’ as follows:

- Reduced number of aviation warning lights:
 - The number of lights is proposed on four turbines (T1, T5, T7, and T10) and the requirement for intermediate level 32 cd lights has been removed;
 - A second medium intensity, steady red (2000 cd) light on the turbine nacelles will act as an alternate in the event of a failure of the main light (note that both lights would not be lit at the same time); and

- All turbines would be fitted with Infra-Red to the MoD Obstruction Lighting Guidance specification¹¹.
- Dimming of aviation warning lights to 10%:
 - The proposed lights would dim to 10% of the peak light intensity (2000 cd reducing to 200 cd) during periods of clear visibility (>5 km from the wind farm), increasing to 2000 cd when the visibility sensors detect poor visibility (<5 km from the wind farm);
 - The lights are designed to accord with CAA SARG Policy Statement (g)¹² *“If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.”*; and
 - Appendix 3 of the *Guidance on Aviation Lighting Impact Assessment*¹, advises that the frequency of dimming will typically occur *“90% to 95% of the time”*.
- Angle intensity mitigation (also described as ‘vertical directional intensity mitigation’):
 - The design of aviation warning lights must also comply with the International Civil Aviation Organisation (ICAO)¹³ specification as set out in Annex 14 Table 6-3. This limits the 2000 / 200 cd light emission to a narrow ‘beam spread’ with a vertical angle of between 0° to +5° and creating a ‘horizontal beam of light’ that extends out in all (360°) directions. This form of mitigation can be very effective for those receptors located in valleys or low-lying areas relative to the elevation of the aviation warning lights as illustrated in **Plate 7M-1** and explained further below; and
 - This reduction in light intensity is illustrated by **Figures 7M.6a/b**.

2.3.2 The aviation warning lights proposed as part of the Lighting Strategy are automated products (operating with visibility sensors, GPS / timers and / or light sensor combinations) that are designed to automatically control the light intensity between 2000 / 200 cd according to the meteorological conditions. These lights can also be operated remotely ‘on’ / ‘off’, ‘emergency flash’, ‘maintenance off’ and ‘test on’ for example. There are a range of manufacturers such as CEL, Luxsolar, Quantec, and Delta.

¹¹ Royal Air Force (2020). *MoD Obstruction Lighting Guidance*. (Online). Available at: <https://www.contarnex.com/infrared-obstruction-lighting/MOD%20Obstruction%20Lighting%20Guidance%202020.pdf>

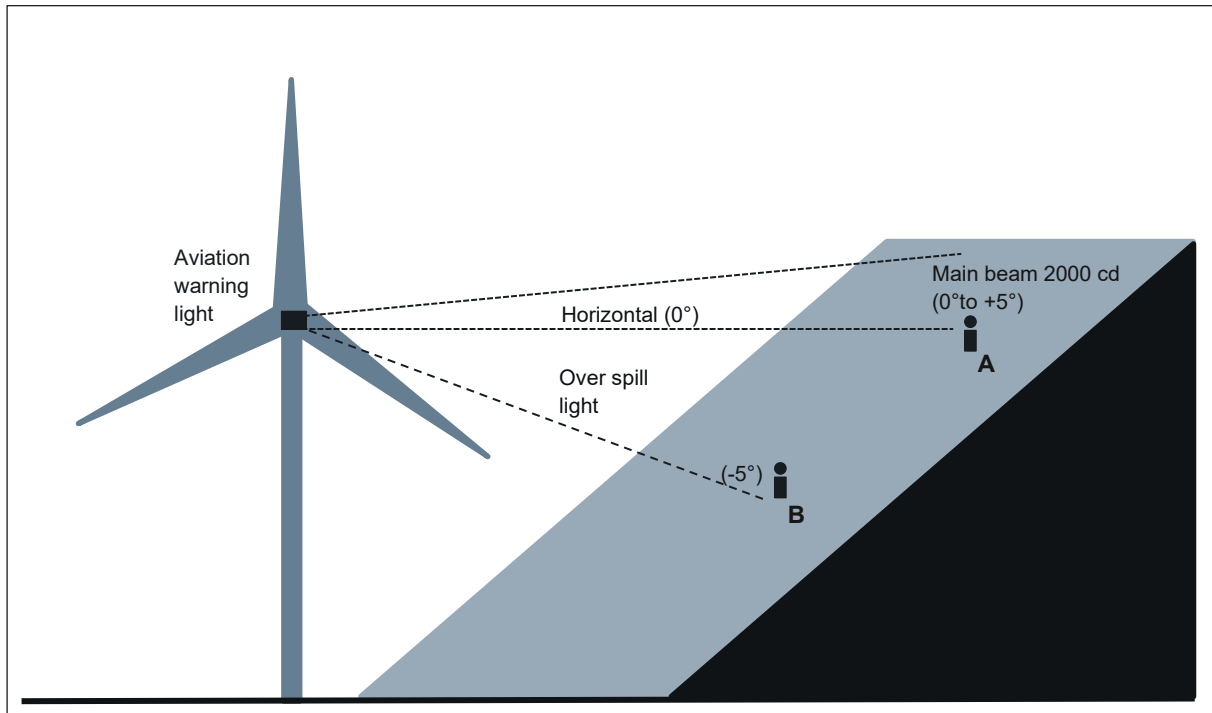
¹² CAA, Safety and Airspace Regulation Group (SARG) (June 2017). *Policy Statement Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level*. (Online). Available at: <https://www.caa.co.uk/publication/download/16178>

¹³ International Civil Aviation Organisation (2022). *Annex 14 to the Convention on International Civil Aviation. Aerodromes. Volume I Aerodrome Design and Operations Ninth Edition*.

ANGLE INTENSITY MITIGATION

2.3.3 Angle intensity mitigation is further illustrated in **Plate7M-1**.

Plate7M-1 - Diagram of aviation warning light operating with a narrow horizontal beam (not to scale)



2.3.4 The diagram shows an aviation warning light positioned on the turbine hub or nacelle and emitting a focused or narrow horizontal beam of light at between 0° (horizontal) and +5° in all directions (360°) from the light position. The light intensity within the beam (0° to +5°) is 2000 / 200 cd¹⁴. A small amount of over spill light is unavoidably emitted outside of this beam and has a lower intensity than the horizontal or 'direct beam' of light. The reduced angle intensity mitigation for angles below 0° (e.g. 0° to -5°) is set out in **Table 7M-2**.

2.3.5 Person 'A' standing on a hillside, for example, Maen Du (with a summit of 671 m AOD), would be within +5° of the horizontal beam of light emanating from some of the lit turbines, subject to their ground elevation and hub height. Person 'A' would therefore see the full intensity of the lights at either 2,000 cd (when the light sensors detect that visibility from the lit turbines is < 5 km) or 200 cd (when the light sensors detect that the visibility in all directions is >5km from the lit turbines). **Figures 7M.6a** indicates that the light intensity at the summit of Maen Du Foel Goch would range between 2206 to 1968cd (when the light sensors detect that visibility from the lit turbines is <5 km)

¹⁴ Appendix 3, paragraph 9 of the *Guidance on Aviation Lighting Impact Assessment* advises "In reality, 2000 cd branded lights are actually brighter in the middle of the beam (at +1 degree) than 2000 cd, as it is difficult to meet the average intensity requirement without exceeding it at some point in the beam spread. A modern light may for example be 2500 cd in the centre of the beam, and some older lights may be even brighter. For the sake of relative simplicity, however, and noting that there is also a degree of inaccuracy inherent when illustrating lighting, '2000 cd' is referred to as the worst case (or 200 cd where dimming is proposed)."

reducing to 221 to 197cd (when the light sensors detect that the visibility in all directions is >5 km from the lit turbines).

- 2.3.6 Person 'B' located lower down in the landscape, for example at Viewpoints N1 and N4 on the A470 (**Figures 7M.8a-d** and **7M.9a-d** respectively) would be below the horizontal beam of light (less than -5° at Viewpoint N1 and between -3° to -2° at Viewpoint N4) which would appear at a reduced intensity (over-spill light). **Figures 7M.6a/b** indicates that the light intensity along this section of the A470 would range between 394 to 38cd (when the light sensors detect that visibility from the lit turbines is <5 km) to as little as 39 to 4cd (when the light sensors detect that the visibility in all directions is >5 km from the lit turbines).
- 2.3.7 People located outside of the ZTV (in the 'non-coloured' areas of the ZTV) shown in **Figures 7M.6a/b**, would have no view of the aviation warning lights.
- 2.3.8 Table 4 of Appendix 3 of the *Guidance on Aviation Lighting Impact Assessment*¹, provides an example of the range of light intensity according to the angle of light projected from the light source. It ranges from maximum light intensity within the horizontal beam (+3° to 0°) to the lower intensity or 'over spill' light outside the horizontal beam, based on light specification CEL MI-2KR. This model has since been superseded, and equivalent or improved lights would be specified post consent as part of a planning condition.
- 2.3.9 By way of comparison, **Table 7M-2** sets out the specification for the angle intensity mitigation for the more recently available CEL-WT-MIC, which has been agreed with the Applicant and Lighting Consultant as an appropriate candidate light. This light has therefore been used as the basis for this night-time LVIA of the aviation warning lights.

Table 7M-2 - Intensity of turbine light shown in candelas (cd)

Angle of Light	Example light specification based on NS Guidance ¹ : CEL MI-2KR		Angle of Light	Example light specification: CEL-WT-MIC	
	2000 cd	Light intensity:		2000 cd	200 cd
Above 5°	N/A	N/A	Above 5°	147 to 34	15 to 3
4° to 5°	N/A	N/A	4° to 5°	247 to 134	25 to 13
3° to 4°	N/A	N/A	3° to 4°	481 to 237	48 to 24
0° to 3°	2500 / 2200	250 / 220	2° to 3°	1160 to 481	116 to 48
			1° to 2°	2119 to 1170	212 to 117
			0° to 1°	2206 to 1968	221 to 197
-1° to 0°	2200 to 980	220 to 98	-1° to 0°	2036 to 987	204 to 99
-2° to -1°	980 to 420	98 to 42	-2° to -1°	996 to 383	100 to 38
-3° to -2°	420 to 220	42 to 22	-3° to -2°	394 to 199	39 to 20
-4° to -3°	220 to 170	22 to 17	-4° to -3°	199 to 131	20 to 13

Angle of Light	Example light specification based on NS Guidance ¹ : CEL MI-2KR		Angle of Light	Example light specification: CEL-WT-MIC	
	2000 cd	Light intensity:		2000 cd	200 cd
-5° to -4°	Below 170	Below 17	-5° to -4°	131 to 92	13 to 9
Below -5°	N/A	N/A	Below -5°	94 to 38	9 to 4

FURTHER MITIGATION MEASURES FOR AVIATION LIGHTING

- 2.3.10 Other alternative forms of mitigation include the use of various forms of aircraft detection lighting systems (ADLS). However, although used in Europe and elsewhere, it is not currently permitted in the UK.

2.4 ANNUAL AND NIGHT-TIME OPERATION OF AVIATION WARNING LIGHTS

- 2.4.1 The aviation warning lights will operate automatically via a light sensor or timer and will generally 'switch on' 30minutes after sunset (when the disc of the sun has passed below the horizon) and 'switch off' 30minutes before sunrise. **Table 7M-3** sets out the annual and night-time operation of the aviation lights between dusk and dawn, which can be used to compare periods when people are most likely to be outdoors and coinciding with when the aviation lights would be switched on.
- 2.4.2 During the summer months, most people, including hill walkers are unlikely to experience the aviation warning lights. For example, during the summer solstice 2027, the aviation warning lights would switch on at 22.11 and switch off at 04.20 in the morning. Local residents and local road users are more likely to experience the aviation warning lights during the winter months. For example, during the winter solstice 2027 the lights would come on at 16.31 and switch off at 7:52 in the morning. It is also reasonable to expect that most people would be commuting or indoors during these periods of colder weather, during the twilight and night, and would experience the aviation warning lights incidentally to their main activity.

Table 7M-3 - Annual and Night-time Operation of Aviation Warning Lights

Time periods between Sunset and Sunrise in Clatter ¹⁵	Spring Equinox 20 Mar 27	Summer Solstice 21 June 27	Autumn Equinox 23 Sept 27	Winter Solstice 21 Dec 27
Astronomical twilight begins (full darkness ends)	04:18	N/A	05:05	06:14
Nautical twilight begins (First light)	05:00	02:36	05:47	06:56
There is some lightening of the sky which may be pale or reddish at the eastern edge. Trees and buildings can be seen sharply against the sky, but it's still very dim on the ground - it would be easy to step into a hole, and pedestrians would be carrying torches / head torches. Cyclists would need lights.				

¹⁵ Available at: <https://www.thetimeandplace.info/uk/clatter-powys> (Accessed May 2026)

Time periods between Sunset and Sunrise in Clatter15	Spring Equinox 20 Mar 27	Summer Solstice 21 June 27	Autumn Equinox 23 Sept 27	Winter Solstice 21 Dec 27
Dawn - Civil twilight begins (~1hour before sunrise)	05:41	04:00	06:28	07:41
At the start of civil twilight, the sky tends to be light blue and colours of objects are easier to detect. By the midpoint, you can read a newspaper outside under open sky. Pedestrians no longer need torches but would wear reflectors or bright clothing if they're near traffic, especially on an overcast day.				
Aviation warning lights switch off ~30m before sunrise.				
Sunrise (Sun disk passes above the horizon)	06:15	04:50	07:02	08:22
Daytime	-	-	-	-
Sunset (Sun disk passes below the horizon)	18:27	21:41	19:10	16:01
Aviation warning lights switch on ~30m after sunset, subject to visibility				
Dusk - Civil twilight ends (~1hour after sunset)	19:01	22:31	19:44	16:43
Reverse of the morning progression. Sky starts out pale but dusky, often pinkish. Streetlights come on. Good visibility for exercising outside, but towards the end of this period pedestrians may wear reflectors if near vehicle traffic.				
Nautical twilight ends (Nightfall)	19:41	23:54	20:24	17:27
Reverse of the morning progression. The brightest planets become visible, all but the most vibrant colours are muted to shades of grey. Walkers would need head torches, particularly in trees. By the end of nautical twilight, it is night for most purposes.				
Astronomical twilight ends (full darkness starts)	20:23	N/A	21:06	18:09
Midnight (darkest skies)	-	-	-	-

3 STEP 2: UNDERSTANDING THE BASELINE

3.1 OVERVIEW

- 3.1.1 The night-time assessment or 'darkness survey' is supported by baseline observation of the existing night-time environment or 'darkness' whilst on site and observation of existing lights / lit structures visible at night from the viewpoint locations and associated landscape and visual receptors. The night-time assessment is also supported by baseline photography, wirelines, and photomontages from selected viewpoints. These visualisations help to assess both the level of night-time visual impact for receptors and focus the assessment.

3.2 PERCEPTION OF AVIATION WARNING LIGHTS AT NIGHT

- 3.2.1 The night-time assessment involves visiting the viewpoint locations during periods of twilight and viewing visualisations prepared for each viewpoint location. The fieldwork is conducted in periods of fine weather with clear skies and considers seasonal changes such as reduced leaf cover or hedgerow maintenance. The *Guidance on Aviation Lighting Impact Assessment*¹ provides advice on several factors that can affect perception of the aviation warning lights, and the following have been considered as part of this observation process:

DARKNESS ADAPTATION

- 3.2.2 It can take several minutes for the observer's eyes to become fully adaptive to the dark and able to pick out landscape features and other existing light sources in the baseline when conducting the fieldwork. For this reason, all observations of the baseline viewpoints were recorded from a safe stationary position with torches / car lights switched off. Consequently, receptors such as drivers and residents in settlements are generally not able to fully perceive the landscape and / or other light sources at night and have a lower susceptibility. People walking at night in an unlit or rural area with few distant or no lights (such as dog walkers or star gazers and occasional hill / night walkers) tend to be more adapted to the darkness as they spend time at that location and would have a higher susceptibility.

WEATHER CONDITIONS / MOON SEQUENCE AND TIME OF NIGHT

- 3.2.3 The weather conditions, and whether there is a full moon and the time of night and season all affect level of darkness and the degree to which the observer is able to perceive the baseline landscape and other light sources at night. Observations and photography is typically conducted during clear weather conditions and during a period corresponding with the operation of the aviation warning lights as noted in **Table 7M-3**.
- 3.2.4 Night walking during the summer solstice in clear weather and with full moon conditions (between approximately 11pm and 3am) allows the walker to experience the night sky in near twilight conditions, whilst the during the opposite (winter solstice in poor weather with no moon), the night conditions will be very dark.

PRACTICAL HEALTH AND SAFETY CONSIDERATION AND NUMBERS OF PEOPLE

- 3.2.5 Observation of / and evidence of typical numbers of people at the viewpoint locations at night and factors such as the condition of the path / ground underfoot, relative safety, access and public promotion / use of the viewpoint at night provides an indication of the likely use and presence of people viewing the night-sky at that location.

DISTANCE

- 3.2.6 Intervening distance between the light source and the viewer has an attenuating effect on the observer's ability to perceive light. There is also an increased potential atmospheric particles and unseen, seasonably bare branches of trees / woodland to obscure / reduce light intensity from some locations.

OTHER LIGHT SOURCES

- 3.2.7 Other light sources present in the baseline will tend to reduce the night-time visual effect of the proposed aviation warning lights as the landscape / view may be characterised as lit or unlit, and the intensity of existing lights may detract from the aviation warning lights or influence the observer darkness adaptation.
- 3.2.8 The following site observations of other existing light sources are considered during the darkness survey:
- Areas of darkness with no artificial light;
 - Direct artificial lighting (where the light source is directly visible from the viewpoint);
 - Indirect artificial lighting (where the light source is not visible but the light emanating from the light source is visible as in the case of 'sky glow'¹⁶);
 - Static lighting, for example emanating from a residential property or streetlight; and
 - Mobile or transient lighting, for example associated with moving vehicles, trains, or aircraft.
- 3.2.9 Baseline photographs at each of the Night-time Assessment viewpoints are recorded for each of the night-time visualisations.
- 3.2.10 **Figures 7M.2 Baseline Satellite Image and 7M.3 Tranquillity and Place – Dark Skies in Annex 7M.1** provide a baseline of the night-time satellite imagery within the Study Area, indicating the broad areas of visible light. Most of the existing light sources are located within the larger settlements of Llanidloes, Newtown and Welshpool, with smaller occurrences of light present within the dispersed smaller villages and very limited light sources present in the south-west of the Study Area. The site area and immediate surroundings are largely unlit and dark. The existing Mynydd Clogau and Tirgwynt wind farms are not lit with aviation warning lights on the nacelles.
- 3.2.11 As indicated on **Figure 7M.6a**, the Eryri National Park is recognised as an International Dark Skies Reserve. A number of Core Areas have also been identified within the Dark Skies Reserve, with Core Area 3 coinciding with the 27 km Study Area.

¹⁶ Note: due to the horizontal direction of aviation warning lights, they do not contribute to light pollution phenomenon such as 'sky glow' or reflection from low cloud bases, rather they appear as points of light.

3.3 BASELINE RECEPTORS

- 3.3.1 A complete list of baseline landscape and visual receptors, included in the LVIA are listed in **Chapter 7: Landscape and Visual**.
- 3.3.2 In accordance with the Scoping Report, an assessment of the night-time effects on landscape receptors has been scoped out of the Night-time Assessment, with the exception of the effects on the Special Qualities of the Eryri National Park and proposed Glyndŵr National Park, as far as these relate to 'dark skies'. The period within which the characteristics of the landscape can be experienced at night are typically limited between the periods of dusk and dawn (during civil twilight) and may only occur for half an hour before the onset of nautical twilight and then astronomical twilight. This period is extended during the summer solstice in clear weather, and with full moon conditions (between approximately 11pm and 3am) allowing the landscape or 'nightscape' to be experienced in near twilight conditions. However, whilst the shapes of hills, buildings and vegetation can be made out, many of the key characteristics discerned in daylight, including the colour, texture, pattern, depth / distance and detail of the landscape are muted or simply not be visible. In this sense, the baseline landscape character at night has a reduced relevance.
- 3.3.3 Visual receptors included in the assessment have also been reconsidered in terms of their sensitivity to the aviation warning lights, as opposed to the Proposed Development under daytime conditions. The assessment includes views from settlement, transport and recreational routes, and recreation / tourist / visitor locations where an appreciation of the night sky / landscape at night is a key component of the activities of people at that location.

4 STEP 3: ASSESSING THE EFFECTS OF THE AVIATION LIGHTING

- 4.1.1 This part of the Night-time Assessment comprises ZTV and Viewpoint analysis in **Sections 4.2** and **4.3** respectively, with **Section 4.4** setting out the night-time assessment of visual effects.

4.2 NIGHT-TIME ZTV ANALYSIS

- 4.2.1 The Night-time Assessment is supported by ZTV plots that illustrate the areas from where in theory, the aviation warning lights would be visible as follows:

- **Figure 7M.4: Nacelle Lights Zone of Theoretical Visibility (ZTV) with Night-time Viewpoints**
 - Provides a hub height ZTV of the four lit turbines within the 27 km Study Area. It indicates where the lit turbines would be theoretically visible (subject to the screening of landform, buildings and vegetation) but not the light intensity. It indicates that within 5 km, all four of the lit turbines would be visible from a moderate proportion of landscape, concentrated across the largely unsettled uplands, with only one or two lights visible within the valley to the south of the Site, through which the settled A470 is routed. A similar pattern of visibility can be observed between 5-10 km from the proposed turbines, with visibility largely absent from areas of landscape to the north of the Site. At distances beyond 10km, there would be fragmented visibility across upper slopes and elevated ridgelines, with visibility absent from within the settled valleys.
- **Figure 7M.6a/b: Lighting Intensity Zone of Theoretical Visibility (ZTV)**
 - **Figure 7M.6a** provides a light intensity ZTV for both the 2000cd and 200cd scenarios across the 27 km Study Area, overlaid with designated landscapes. **Figure 7M.6b** provides a detailed figure of the light intensity ZTV within 10 km of the proposed turbines. Both figures indicate where the lit turbines would be theoretically visible (subject to the screening of landform, buildings and vegetation) and the light intensity. The areas of lowest light intensity correspond with the landscape within the Site at the base of the turbines and the low-lying valleys immediately surrounding the Proposed Development. These areas coincide with the closest receptors including the settlements of Clatter and Carno, a proportion of the individual residential properties included in the RVAA and the A470. Conversely, hill summits (the closest being to the west and southwest beyond 6 km) would experience the greatest light intensity.
- **Figure 7M.7: Cumulative Night-time Zone of Theoretical Visibility (ZTV) - Calon y Gwynt with Llyn Lort**
 - Provides a cumulative ZTV for other lit turbines associated with existing, consented wind farms and other wind farm applications the Study Area. As set out in **Section 1.2**, there is only one other wind farm with proposed aviation warning lights – the scheme at Llyn Lort. The night-time cumulative context will be reviewed and if necessary, updated as part of the Final ES.

- 4.2.2 The ZTVs do not take account of the screening effects of buildings, localised landform, and vegetation. As a result, there may be roads, tracks, and footpaths within the Study Area which, although shown as falling within the ZTV, are screened or filtered by built form and vegetation. It is

also important to note that the light intensity ZTVs do not take account of distance or other factors such as atmospheric conditions, cloud obscuration or partial vegetation screening.

4.3 NIGHT-TIME VIEWPOINT ANALYSIS

4.3.1 Analysis of the number of aviation warning lights theoretically visible from each viewpoint is provided in **Table 7M-4**.

Table 7M-4 - Summary of Night-time Viewpoint Analysis

Viewpoint No. and Title	Lit turbines			
	T1	T5	T7	T10
N1. A470, Clatter	-	ü	-	-
2. A470, Carno	-	ü	-	-
3. Cefn Coch	ü	ü	ü	ü
N4. A470, east of Talerddig	-	ü	ü	ü
5. Severn Way, south of Bwlch-y-Ffridd	ü	ü	-	-
6. B4569, west Caersws	-	ü	ü	-
7. Glyndŵr's Way, north of Moelddolwn	-	ü	ü	ü
N8. Minor road, east of New Mills	ü	ü	ü	ü
9. Llanidloes Road, Newtown	ü	ü	ü	ü
10. Sustrans NCR 81 and Severn Way, northeast of Llanidloes	ü	ü	ü	ü
11. Glyndŵr's Way, north of Llanbrynmair	ü	ü	ü	ü
12. Cambrian Way, west of Bont Dolgadfan	ü	ü	ü	ü
13. B4395, north of Llangadfan*	ü	ü	ü	ü
14. Sustrans NCR 8, west of Dylife	ü	ü	ü	ü
15. Y Golfa, west of Welshpool	ü	ü	ü	ü
16. Glyndŵr's Way, Meifod	ü	-	-	-
17. Offa's Dyke National Trail, northeast of Montgomery	ü	-	-	ü
18. Black Mountain, Shropshire Hills National Landscape**	ü	ü	ü	-
19. Cambrian Way, Pumlumon Fawr	ü	ü	ü	ü
20. Maen Du, Eryri (Snowdonia) National Park***	ü	ü	ü	ü

* The viewpoint is located on the boundary of the proposed Glyndŵr National Park.

** The viewpoint is located within the Shropshire Hills National Landscape.

*** The viewpoint is located within the Eryri National Park.

4.3.2 More detailed analysis of the viewpoints is provided in **Table 7M-5** (assessed at 200cd). Each of the three night-time viewpoints are analysed further in **Annex 7M.2**, which includes a darkness survey describing the baseline night-time environment, as observed during the field survey. The remaining viewpoints have been subject to desk-based assessment only.

4.3.3 Allowing for the embedded mitigation (excepting angle intensity mitigation) and the influence of existing lights, the viewpoint analysis has determined that none of the viewpoints would be significantly affected by the proposed aviation warning lights. This includes the three illustrated night-time viewpoints (N1, N4 and N8). Allowing for the mitigating effects of angle intensity mitigation, the visibility of the lights would reduce further when viewed from low lying receptors as indicated in **Figure 7M.6a/b** although this would not provide mitigation for elevated receptors for example hill walkers.

The greatest effects at night are likely to be experienced by recreational users at elevated locations and hill summits. Wild camping on open access land in Wales is prohibited under Schedule 2 of the Countryside and Rights of Way Act 2000¹⁷, whilst recreational users including hill walkers are less likely to be present on the hills at night for practical and safety reasons. Whilst this receptor group has been afforded higher value particularly those within the Eryri National Park International Dark Sky Reserve, their susceptibility has been reduced due to practical access difficulties at night (risks of trips and falls) and the very low or negligible numbers of people likely to visit these locations at night. The Guidance on Aviation Lighting Impact Assessment advises, in relation to this type of receptor, there is a *“Balance to be struck between higher sensitivity and the relatively lower numbers of people undertaking formal or informal recreation outdoors at night”*.

¹⁷ Countryside and Rights Of Way Act 2000. (Online). Available at: <https://www.legislation.gov.uk/ukpga/2000/37/contents>

Table 7M-5 - Summary of Night-time Viewpoint Analysis (200cd)

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
N1. A470, Clatter	2.9 km (T5)	Medium-Low (residents) Low (road users)	Zero	No View	See Annex 7M.2 No aviation warning lights would be visible.
2. A470, Carno	3.4 km (T5)	Medium-Low (residents) Low (road users)	Very Low	Negligible and Not Significant (all receptors)	The night-time sensitivity has been assessed as Medium-Low for residential receptors and Low for road users, due to the Medium value (as assigned in Appendix 7K) and the primary receptors being residents in a settlement and road users, both of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. Although the area is rural and therefore relatively dark, residents at dwellings and road users would themselves be a source of light and the viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Viewed from the A470, up to one aviation warning light (T5) would theoretically be visible although in reality, this would be screened by intervening vegetation. The angle intensity mitigation would reduce the lights to between 9-4cd.

¹⁸ The *Guidance on Aviation Lighting Impact Assessment* advises that the value is “judged the same as for the day-time assessment unless specific factors suggest otherwise – for example identification as a Dark Sky Park which would increase value at night; or where factors that contribute to value during daytime are irrelevant or imperceptible at night – which may reduce value at night”. The susceptibility of visual receptors “differs at night reflecting the different activities people undertake during the hours of darkness” with Table 1 of the Guidance assigning a Low susceptibility to aviation lighting to people within lit towns and villages and people driving/travelling though the landscape at night and a High susceptibility to people undertaking informal and organised recreation in dark rural areas/ star gazing where the main focus is the landscape/night sky.

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
3. Cefn Coch	5.6 km (T10)	Medium-Low (residents) Low (road users)	Low	Minor to Negligible and Not Significant (residents) Negligible and Not Significant (road users)	The night-time sensitivity has been assessed as Medium-Low for residential receptors and Low for road users, due to the Medium value (as assigned in Appendix 7K) and the primary receptors being residents in a settlement and road users, both of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. Although the area is rural and therefore relatively dark, residents at dwellings and road users would themselves be a source of light and the viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible above the landform/horizon with the aviation warning light on T7 visible just behind the tower of the lit T10. Other existing lights would be visible, including occasional transient vehicular lights and static lights within the Cefn Coch static caravan site, at the adjacent Cefn Coch Inn and at scattered farmsteads and properties within the intervening dark landscape. The angle intensity mitigation would reduce the lights to between 39-20cd.
N4. A470, east of Talerddig	6.3 km (T7)	Medium-Low (residents) Low (road users)	Low	Minor to Negligible and Not Significant (residents) Negligible and Not Significant (road users)	See Annex 7M.2 The night-time sensitivity has been assessed as Medium-Low for residential receptors and Low for road users, due to the Medium value (as assigned in Appendix 7K) and the primary receptors being residents in a settlement and road users, both of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. Although the area is rural and therefore relatively dark, residents at dwellings and road users would themselves be a source of light and the viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location.

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					Up to three lit turbines would theoretically be visible appearing above the landform / horizon as points of light against the sky, although in reality, the aviation warning light on T10 would be screened by intervening deciduous hedgerow trees during the summer months and partially screened during the winter months. Allowing for the angle intensity mitigation, the intensity of these lights would reduce to between 39-20cd.
5. Severn Way, south of Bwlch-y-Ffridd	6.2 km (T1)	Medium (recreational receptors) Low (road users)	Low	Minor and Not Significant (walkers) Negligible and Not Significant (road users)	The night-time sensitivity has been assessed as Medium for recreational receptors and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users on the Severn Way judged to be Medium at night (although walkers are likely to be low in number and wearing head torches), and road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Two aviation warning lights (T1 and T5) would be visible above the horizon and beyond a relatively dark intervening landscape within which lights associated with the mid-ground farmstead and distant hillside farms are likely to be visible. The angle intensity mitigation would reduce the lights to between 39-20cd.
6. B4569, west Caersws	6.1 km (T1)	Medium (recreational receptors) Medium – Low (residents) Low (road users)	Low-Very Low	Negligible and Not Significant (all receptors)	The night-time sensitivity has been assessed as Medium for recreational receptors travelling along a section of National Cycle Route (NCR) 81 and the Severn Way long distance walking route, Medium-Low for residents and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users on the Severn Way and NCR 81 judged to be Medium at night (although walkers and cyclists are likely to be low in number and wearing head torches

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					or using bike lights), with residents and road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Up to two aviation warning lights would theoretically be visible in a dark to partially lit landscape, with lights visible from residential properties along Carno Road on the northern edge of Caersws. In reality, the aviation warning light on T7 would be screened by intervening deciduous trees during the summer months and partially screened during the winter months. The angle intensity mitigation would reduce the lights to between 20-13cd.
7. Glyndŵr's Way, north of Moelddolwn	9.2 km (T10)	Medium (recreational users)	Low	Minor and Not Significant	Recreational users travelling along the Glyndŵr Way are assessed as being of Medium sensitivity at night (Medium value as assigned in Appendix 7K and medium susceptibility), although walkers are likely to be very low in numbers and wearing head torches. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Up to three aviation warning lights would be visible above the horizon beyond a predominantly dark landscape which features only occasional lights associated with scattered residential properties and farmsteads. The angle intensity mitigation would reduce the lights to between 100-38cd.
N8. Minor road, east of New Mills	9.9 km (T1)	Low (road users)	Low	Negligible	See Annex 7M.2 The night-time sensitivity has been assessed as Low for road users, due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location.

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					All four lit turbines would be visible as regularly spaced points of light extending across approximately 11° of the horizontal FoV and appearing above the landform / horizon. Turbine rotation of T9 may cause the light on the nacelle of T7 to appear intermittently (turning 'on' / 'off') due to a prevailing south westerly wind direction. The angle intensity mitigation would reduce the lights to between 100-38cd.
9. Llanidloes Road, Newtown	10.3 km (T1)	Medium-Low (residents) Low (road users)	Low-Very Low	Negligible and Not Significant (all receptors)	The night-time sensitivity has been assessed as Medium-Low for residential receptors and Low for road users, due to the Medium value (as assigned in Appendix 7K) and the primary receptors being residents in a settlement and road users, both of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. Residents at dwellings on the western edge of Newtown and road users would themselves be a source of light and the viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Up to four aviation warning lights would theoretically be visible beyond a partially lit landscape, with lights at Glanhafren Hall and a number of residential properties visible in the mid-distance. In reality, the aviation warning light on T10 would be screened by intervening vegetation during both the summer and winter months. The angle intensity mitigation would reduce the intensity of the remaining three lights to between 39-20cd.
10. Sustrans NCR 81 and Severn Way, northeast of Llanidloes	11.3 km (T5)	Medium (recreational receptors) Low (road users)	Low	Minor and Not Significant (recreational receptors)	The night-time sensitivity has been assessed as Medium for recreational receptors and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users on the Severn Way and NCR 81 judged to be Medium at night (with walkers and cyclists likely to be low in number and wearing head torches or using bike

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
				Negligible and Not Significant (road users)	lights), and road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i> ¹ . The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible above the horizon and beyond a relatively dark intervening landscape within which lights associated with the mid-ground property, farmstead and distant hillside farms are likely to be visible. The angle intensity mitigation would reduce the lights to between 100-38cd.
11. Glyndŵr's Way, north of Llanbrynmair	12.2 km (T7)	Medium (recreational users)	Low	Minor and Not Significant	Recreational users travelling along the Glyndŵr Way are assessed as being of Medium sensitivity at night (Medium value as assigned in Appendix 7K and medium susceptibility), with walkers likely to be very low in numbers and wearing head torches. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible above the horizon and beyond a relatively dark intervening landscape within which lights associated with scattered hillside farms and properties are likely to be visible. A greater cluster of light sources is likely to be visible within the village of Llanbrynmair, located within the valley towards to the right side of the view. The angle intensity mitigation would have limited effect at this elevated location.
12. Cambrian Way, west of Bont Dolgadfan	13.9 km (T7)	Medium (recreational users)	Low	Minor and Not Significant	Recreational users travelling along the Cambrian Way are assessed as being of Medium sensitivity at night (Medium value as assigned in Appendix 7K and medium susceptibility). This section of the long-distance footpath is likely to be difficult to navigate at night, with walkers likely to be very low in numbers and wearing head torches. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location.

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					All four aviation warning lights would be visible as distant points of light above the horizon and beyond a dark intervening landscape which features few other light sources. The angle intensity mitigation would have limited effect at this elevated location.
13. B4395, north of Llangadfan*	13.7 km (T10)	Medium (recreational receptors) Medium – Low (residents) Low (road users)	Low	Minor and Not Significant (recreational receptors) Minor to Negligible and Not Significant (residents) Negligible and Not Significant (road users)	The night-time sensitivity has been assessed as Medium for recreational receptors travelling along a section of the Glyndŵr Way National Trail, Medium-Low for residents and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users judged to be Medium at night (although walkers are likely to be low in number and wearing head torches), with residents and road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Three aviation warning lights (T5, T7 and T10) would be visible above the horizon and beyond a predominantly dark landscape, which is likely to feature only occasional static lights associated with scattered properties and farmsteads and periodic transient lights from vehicles travelling along the B4395 in the foreground of the view. The angle intensity mitigation would reduce the lights to between 100-38cd.
14. Sustrans NCR 8, west of Dylife	15.4 km (T5)	Medium (recreational receptors) Low (road users)	Low	Minor and Not Significant (recreational receptors)	The night-time sensitivity has been assessed as Medium for recreational receptors and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users on NCR 8 judged to be Medium at night (with cyclists likely to be low in number and using lights), and road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact</i>

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
				Negligible and Not Significant (road users)	<i>Assessment¹</i>. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible as distant points of light above the horizon and beyond a dark intervening landscape which features few other light sources with the exception of periodic transient lights from vehicles travelling along the minor road on which the viewpoint is located. The angle intensity mitigation would have limited effect at this elevated location.
15. Y Golfa, west of Welshpool	19.3 km (T1)	Medium (recreational receptors)	Low-Very Low	Negligible and Not Significant	The night-time sensitivity has been assessed as Medium for recreational receptors walking along the Glyndŵr Way due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational receptors judged to be Medium at night (with walkers likely to be very low in number and using torches). Welshpool Golf Club would be closed after dark. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible as distant points of light above the horizon and in the context of existing light sources within the small settlement of Castle Caereinion and scattered farmsteads and residential properties on the hillsides between the viewpoint and Proposed Development. Vehicular lights on the various roads would occasionally be visible subject to screening from landform and vegetation. The angle intensity mitigation would have limited effect at this elevated location.
16. Glyndŵr's Way, Meifod	20.3 km (T10)	Medium (recreational receptors)	Very Low	Negligible and Not Significant	The night-time sensitivity has been assessed as Medium for recreational receptors travelling along a section of the Glyndŵr Way National Trail and Low for road users. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational users judged to be Medium at night

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
		Low (road users)			(although walkers are likely to be low in number and wearing head torches), with road users judged to be of Low susceptibility in accordance with the <i>Guidance on Aviation Lighting Impact Assessment</i>¹. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. One aviation warning light (T1) would be visible to the south-west appearing above the horizon at distance and beyond a partially lit landscape with lights likely to be visible from the large farmstead and properties along the A495 towards the right side of the view, and scattered residential properties and farms on the hillsides in the middle distance. The angle intensity mitigation would reduce the lights to between 100-38cd.
17. Offa's Dyke National Trail, northeast of Montgomery	22.1 km (T1)	Medium (recreational receptors)	Very Low	Negligible and Not Significant	The night-time sensitivity has been assessed as Medium for recreational receptors travelling along a section of the Glyndŵr Way National Trail. This is due to the Medium value of the view (as assigned in Appendix 7K), with the susceptibility of recreational receptors judged to be Medium at night (although walkers are likely to be very low in number and wearing head torches). The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Two aviation warning lights (T1 and T10) would theoretically be visible although in reality, the hubs of both turbines would be screened by intervening vegetation. The angle intensity mitigation would reduce the lights to between 100-38cd.
18. Black Mountain, Shropshire Hills National Landscape**	22.5 km (T1)	Medium (road users)	Zero	No View	The night-time sensitivity has been assessed as Medium due to be High value of the view (as assigned in Appendix 7K as a consequence of its location within the Shropshire Hills National Landscape), with the susceptibility of road users judged to be Low at night (in accordance with the <i>Guidance on Aviation Lighting</i>

Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					<i>Impact Assessment</i>¹⁾. The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. Three aviation warning lights (T1, T5 and T7) would theoretically be visible although in reality, screening from coniferous woodland would screen views of the nacelles of all three turbines. The angle intensity mitigation would have limited effect at this elevated location.
19. Cambrian Way, Pumlumon Fawr	23.1 km (T5)	High-Medium	Very Low	Minor to Negligible and Not Significant	This viewpoint is located at the trigonometry point on the summit of Pumlumon Fawr on the Cambrian Way long-distance footpath. The night-time sensitivity has been assessed as High-Medium due to be High value of the view (as assigned in Appendix 7K as a consequence of its location within Special Landscape Area (SLA) 48- South Ceredigion uplands), with the susceptibility of recreational receptors judged to be Medium at night (although recognising that the summit would be difficult to navigate at night and the walkers would themselves have torches/head torches). The viewpoint is not located within a Dark Sky Park or at a promoted night sky viewpoint location. All four aviation warning lights would be visible in the far distance in clear conditions in the context of other scattered light sources visible from the summit. The angle intensity mitigation would have limited effect at this elevated location.
20. Maen Du, Eryri (Snowdonia) National Park	23.8km (T7)	High	Very Low	Minor and Not Significant	The night-time sensitivity has been assessed as High due to be High value of the view (as assigned in Appendix 7K as a consequence of its location within the Eryri National Park), with the susceptibility of recreational receptors judged to be High at night as a consequence of this viewpoint being located within the Eryri National Park International Dark Sky Reserve. It is however recognised that the summit would be extremely challenging to

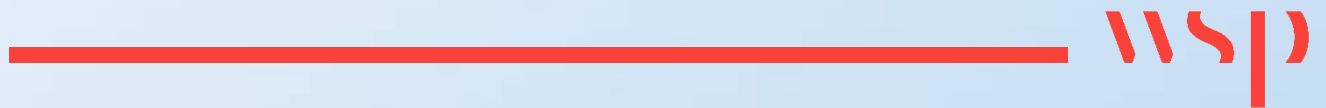
Viewpoint No. and Title	Distance to nearest lit turbine (km)	Sensitivity ¹⁸	200cd Intensity		Comments
			Magnitude	Level of Effect	
					navigate at night and the walkers would themselves have torches/head torches. All four aviation warning lights would be visible in the far distance in clear conditions, located just above (T1 and T10) or just below (T5 and T7) the distant horizon and in the context of other scattered light sources visible from the summit. The angle intensity mitigation would have limited effect at this elevated location.

4.4 NIGHT-TIME VISUAL EFFECTS

- 4.4.1 The night-time visual assessment considers the likely effects of the proposed aviation warning lights on the views and visual amenity experienced by people in the landscape between the periods of dusk and dawn. Drawing from the night-time viewpoint analysis in **Table 7M-5** and detailed assessment in **Annex 7M.2** which identifies no significant effects, there is no further assessment on the visual receptors assessed in **Chapter 7: Landscape and Visual** as none of them would be significantly affected by the proposed aviation warning lights.
- 4.4.2 Locations including settlements, roads, recreational routes and hill summits have visibility of varying levels of artificial light present in most of these locations and / or associated with the activity of travelling through the landscape such that the visual effects are unlikely to be significant.
- 4.4.3 The greatest visual effects at night are likely to be experienced by recreational users at elevated locations and hill summits. Whilst recreational users including hill walkers are less likely to be present on the hills at night for practical and safety reasons, occasional walkers may traverse the hill slopes and visit summits to view the night sky. They have been afforded higher value and susceptibility, particularly those at Viewpoint 20 within the Eryri National Park International Dark Sky Reserve. However, none of the summits are a promoted night sky viewpoint location and practical access at night would be extremely challenging, with a high risk of trips and falls and consequently, the numbers of people likely to visit these locations at night would be very low or negligible. The *Guidance on Aviation Lighting Impact Assessment*¹ advises in relation to this type of receptor, there is a “*Balance to be struck between higher sensitivity and the relatively lower numbers of people undertaking formal or informal recreation outdoors at night.*”
- 4.4.4 In summary, there would be no significant night-time effects on the views experienced by people within this area at night, including those who may be star-gazing and appreciating the night sky. The aviation warning lights would however be visible and may be considered noticeable from some locations. Mitigating factors however include the context and presence of other existing artificial light sources within which the lights would be viewed and the embedded mitigation, as well as factors of intervening distance and whole or partial screening from landform, vegetation and / or buildings.
- 4.4.5 During the summer months, most people, including hill walkers are unlikely to experience the aviation warning lights. For example, during the summer solstice 2027, the aviation warning lights would switch on at 22.11 and switch off at 04.20 in the morning. Local residents and local road users are more likely to experience the aviation warning lights during the winter months when, for example during the winter solstice 2027, the lights would come on at 16.31 and switch off at 7:52 in the morning. It is also reasonable to expect that most people would be commuting or indoors during these periods of colder weather, during the twilight and night, and would experience the aviation warning lights incidentally to their main activity.
- 4.4.6 Operation of the aviation warning lights would have no adverse effect on periods of sunrise (when the sun disk passes above the horizon and the period just after this) and sunset (the period just before the sun disk passes below the horizon) as the operation is programmed to switch off 30 mins before sunrise and switch on 30 mins after sunset, respectively.

Annex 7M.1

NIGHT-TIME FIGURES





ANNEX 7M.1: NIGHT-TIME FIGURES

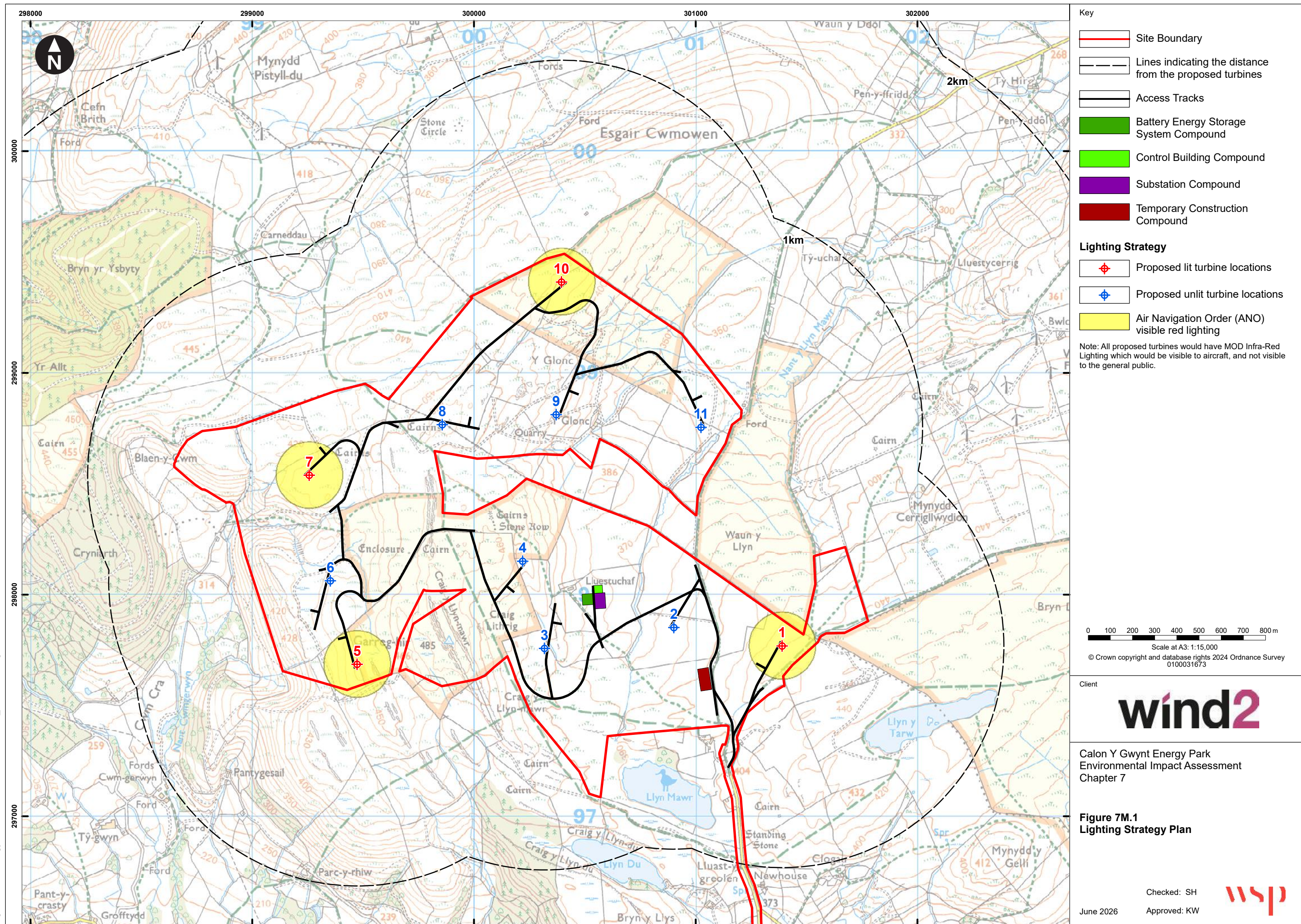


Figure 7M.1 Strategy 62282400-WSPE-FG-SA-00006_R4

