

SI Technical Appendix 7.3 Night-time Assessment

1.1 Introduction

- 1.1.1 This appendix provides a night-time assessment of the Reduced Visible Aviation Lighting Strategy for the proposed development presented in **SI 2021 Chapter 15: Aviation**. It provides an overview of the Reduced Visible Aviation Lighting Strategy and proposed mitigation as well as detailed assessment including methodology, night-time viewpoint analysis and a full assessment of the likely effects of the proposed aviation warning lights which is summarised in the main **SI 2021 Chapter 7: Landscape and Visual**.

1.2 Lighting Strategy

- 1.2.1 The Reduced Visible Aviation Lighting Strategy meets the requirements of civilian and military aviation whilst minimising the effects of the aviation warning lights on the surrounding environment. It has been prepared by aviation specialists Osprey Consulting Services Ltd. and agreed with the Civil Aviation Authority (CAA). The Lighting Strategy is illustrated in **SI 2021 Figure 7.12a**.

- 1.2.2 The design of the Reduced Visible Aviation Lighting Strategy entails a number of mitigating features as follows:

- Number of lit turbines (aviation warning lights) reduced from fourteen to four (Air Navigation Order (ANO) Visible Red Lighting).

Four turbines (turbines 1, 5, 6, and 12) would be fitted with aviation warning lights positioned on the turbine nacelle (highest practical position). Mid-height tower lights (three x 32 candela for each turbine) are not required in this case, but a second 2000 candela light on the nacelles of Turbines 1, 5, 6 and 12, would be provided to act as an alternative, which would only 'switch on' in the event of failure of the main light. Therefore, the total number of lights has reduced from 56 (14 x 2000 candela and 42 x 32 candela) to 4 x 2000 candela (source brightness).

- Reduced intensity aviation warning lights.

The ANO 2000/200cd Lights will operate via a visibility sensor at a reduced intensity of 200cd during periods of clear visibility >5km from the proposed lit turbine positions, increasing to 2000cd during periods of poor visibility anywhere <5km from the proposed lit turbine positions. They are designed to accord with CAA SARG Policy Statement (g)¹ "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."

Meteorological observations from Kinloss suggest that poor visibility is likely to occur for approximately 15% of the time and so the reduced intensity of 200cd represents a more 'typical' or 'realistic' experience of the proposed development that would be experienced approximately 85% of the time. The assessment however has also taken account of the 'worst case' scenario (light intensity emitted from a 2000cd light source), which is likely to occur approximately 15% of the time when visibility is <5km from the lit turbines.

¹ CAA, Safety and Airspace Regulation Group (SARG) dated 1/6/2017, 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*.

- Directional lighting with a focused narrow horizontal beam of light.

The design of aviation warning lights will be specified to limit the light emission to a narrow horizontal beam and a tight spectrum which is required by CAA specification. This is defined as an angle of between 0° (horizontal) to $+3^\circ$. This beam of light extends out in all directions (360°). Below this range (i.e. below 0°) the intensity of any 'over spill' light quickly reduces so there is potentially a further reduction of light intensity for those visual receptors located in areas located 'below' the horizontal beam (below 0°). This reduction in light intensity is illustrated by the light intensity ZTV shown in **SI 2021 Figures 7.12c (i) and 7.12c (ii)**.

- 1.2.3 The reduced intensity aviation warning lights are automated products (fitted with visibility sensors, GPS / timers and / or light sensor combinations) that are designed to automatically control the light intensity 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 and Delta. The CEL MI-2KR aviation warning light has been used as a 'candidate' light for this assessment.
- 1.2.4 Mitigation associated with a narrow horizontal beam of light is illustrated in **Plate 1** and in more detail in **SI 2021 Figures 7.12c (ii)** and emitting a focused or narrow horizontal beam of light at between 0° (horizontal) and $+3^\circ$ in all directions (360°) from the light position. The light intensity within the beam (0° to $+3^\circ$) is at least 2000 / 200 cd. A small amount of over spill light is unavoidably emitted outwith this beam and has a lower intensity than the horizontal or direct beam.

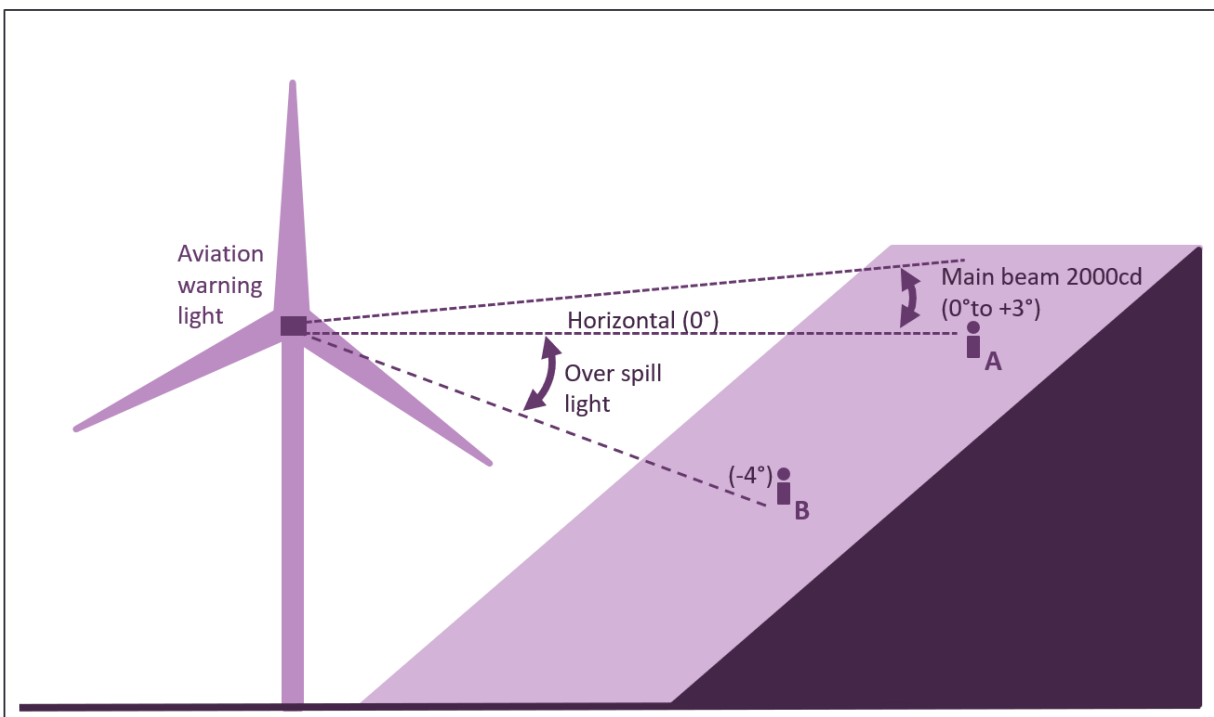


Plate 1: Diagram of aviation warning light operating with a focused and narrow horizontal beam (not to scale)

- 1.2.5 A person ('A') standing on a hillside for example, would be level with the horizontal beam of light and would view the light intensity as either 200 cd (when the light sensors detect that visibility in all directions from the lit turbines is more than 5km) or as 2000 cd (when the light sensors detect that the visibility is less than 5km from the lit turbines). Looking at **SI 2021 Figure 7.12c (i)**, for example, the effect could be replicated by a person located on the Tap O' Noth. Due to the elevation, the person's line of sight would become level with the direct beam emitted from the aviation warning lights (0° to $+3^\circ$ or 2000 / 200 cd). In reality however, this would require walkers to be on the hillside at night with torches which is which is less likely in comparison to walkers accessing the hill during the daytime.

- 1.2.6 A person ('B') positioned lower down the hillside or in a valley (for example Wester Tillathrowie), would not be 'in line' with the horizontal beam, rather they would be at a lower level than the turbine hub (the example shown in the diagram is at an angle of -4°) and would not view the direct beam of 2000 / 200 cd light. Rather they would view 'over spill' light which is of a lower intensity ($\leq 175-75\text{cd}$ / $\leq 18-8\text{cd}$ according to whether the visibility is greater or less than 5km). As a comparison, an average car brake light is approximately 80cd.
- 1.2.7 **Table 7.3.1** (also shown on the key of **SI 2021 Figures 7.12c (i)-(ii)**) indicates the range or spectrum of light intensity according to the angle of light projected from the light source. It ranges from the maximum light intensity within the horizontal or direct beam to the lower intensity over spill light outside the direct beam. This spectrum is based on Table 6-3 of the ICAO Annex 14 to the Chicago Convention, Volume 1.

Table 7.3.1 Intensity of turbine light (nacelle) shown in candelas (cd)

Angle of light	Light intensity: 2000 cd	Light intensity: 200cd
+3° to 0° (horizontal beam)	2000 cd	200 cd
0° to -1°	2000 cd to 750 cd	200 cd to 75 cd
-1° to -2°	800 cd to 265 cd	80 cd to 27 cd
-2° to -3°	265 cd to 200 cd	27 cd to 20 cd
-3° to -4°	200 cd to 175 cd	20 cd to 18 cd
Below -4°	Below 175 - 75 cd	Below 18 to 8 cd

- 1.2.8 The light intensity ZTV illustrated in **Figure 7.12c (i)** does not take account of distance or other factors such as atmospheric conditions or partial vegetation screening.
- 1.2.9 The Reduced Visible Aviation Lighting Strategy also allows for the MOD military requirement that infra-red lighting would be fitted to the hubs / nacelles of turbines 8, 9 and 14. This is separate from the civilian ANO and relates to the MOD Low Flying Area 14. Infra-red lighting however is not visible to the naked eye (visible to aircraft only) and the effects of infra-red lighting are not considered further in this assessment.

1.3 Methodology

- 1.3.1 The night-time assessment follows similar methodology used for the assessment of landscape, visual and cumulative effects, set out in Chapter 7 of the EIA Report and as amended in **SI 2021 Appendix 7.1**. The night-time assessment is conducted during periods between dusk and dawn and assesses the baseline night-time environment against the Lighting Strategy for the proposed development.
- 1.3.2 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 of what the human eye can reasonably perceive. As with the 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. 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.

Assessment Parameters

- 1.3.3 The night-time assessment has assumed a worst-case of 2000 cd nacelle lighting combined with any reduced intensity of light emitted as overspill from the light source at an angle less than 0° or below the main horizontal beam of focused light (+3° to 0°).
- 1.3.4 The assessment is supported by visualisations (baseline photos, wirelines and photomontages) from particular viewpoints and there are two photomontages for each viewpoint illustrated in **SI 2021 Figures 7.13a-d to 7.16a-d**. The first provides an impression of the proposed aviation warning lights as they would appear assuming the 2000cd nacelle lighting scenario which takes account of any reductions in light intensity due to directional lighting, according to the light intensity ZTV illustrated in **SI 2021 Figure 7.12c(i)** but assumes visibility is <5km from the lit turbines. Meteorological records suggest that this scenario would occur for approximately 15% of the time. In reality the baseline photo has been taken during the conditions of clear visibility.
- 1.3.5 The second photomontage provides an impression of the 200cd scenario, which assumes that the light intensity has been reduced to 10% assuming visibility is >5km from the lit turbines. This scenario also assumes a reduction in light intensity as illustrated in **SI 2021 Figure 7.12c(i)** and meteorological records suggest that this scenario would occur for approximately 85% of the time.

Defining the Study Area

- 1.3.6 The Night-time Assessment Study Area is the same as the LVIA Study Area (45km from the outer turbine positions) with a focus on the central 20-10km of the LVIA Study Area measured from the lit turbines.

Zone of Theoretical Visibility Plots

- 1.3.7 The night-time assessment is supported by Zone of Theoretical Visibility (ZTV) plots that illustrate the areas of theoretical visibility of the proposed aviation warning lights (**SI 2021 Figure 7.12b**). As noted previously, **SI 2021 Figure 7.12c (i)** provides a ZTV plot of the light intensity of the proposed 2000 / 200 cd aviation warning lights.
- 1.3.8 **SI 2021 Figure 7.12d** illustrates a cumulative ZTV plot of the theoretical visibility of aviation warning lights proposed in relation to other wind farms that would require aviation warning lights. This includes the following wind farm applications:
- Garbet Hill (5 turbines are proposed to be lit);
 - Rothes III (8 turbines are proposed to be lit); and
 - Clash Gour (the CAA accepted a proposed scheme in which 3 turbines are lit).
- 1.3.9 Further aviation warning lights may be required for other wind farm development currently at the pre-planning stage, although the details are not known, and they have been excluded from this part of the assessment.
- 1.3.10 The ZTV does 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, which would otherwise preclude visibility. The ZTVs provide a starting point in the assessment process and accordingly tend towards giving a 'worst case' or greatest calculation of the theoretical visibility.

1.4 Night-time Assessment

- 1.4.1 The night-time assessment is supported by baseline observation of the existing night-time environment or darkness, field observation of other similar lit structures and night-time viewpoint analysis from selected viewpoints. These visualisations help to assess both the level of night-time visual impact for particular receptors and focus the assessment.
- 1.4.2 The night-time viewpoint analysis involves visiting the viewpoint locations during periods of twilight / night and viewing wireframes and photomontages 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. A range of viewpoints are examined in detail and analysed to determine whether a significant visual effect would occur. By arranging the viewpoints in order of distance it is possible to define a threshold or outer limit, beyond which it would be reasonable to assume that there would be no further significant effects.

Establishing the Baseline Night-time Environment or Darkness Survey

- 1.4.3 During site visits a baseline night-time environment survey or 'darkness survey' is carried out at each viewpoint location and recorded. The purpose of the darkness survey is to establish the existing light levels perceived by the landscape architects at the viewpoints and determine their sensitivity to change. The following observations are recorded:
- 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');
 - 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.
- 1.4.4 Baseline photographs for each of the Night-time Assessment viewpoints are recorded and illustrated in **SI 2021 Figures 7.13a-d to 16a-d**. **SI 2021 Figure 7.12f** illustrates a satellite image of the baseline lighting within the LVIA Study Area. The darkness survey and night-time assessment has been supported by the night-time observation of the following light sources in the landscape:
- Towns and settlements (street lighting / buildings / retail areas) such as Rhynie and Huntly;
 - Individual dwellings and farms; and
 - Vehicles using the road network.
- 1.4.5 Generally, the upland areas within 10km are generally unlit with areas of low level lighting from settlement and the road network appearing in the low lying valleys and glens. This baseline pattern is illustrated in **SI 2021 Figures 7.12f**.

Photography and Photomontage

- 1.4.6 The methodology used for viewpoint photography and photomontage accords with the NatureScot guidance *The Visual Representation of Wind Farms, Version 2.2*, February 2017, although NatureScot recognise that night-time assessment and the production of night-time photomontages is an emerging area of study. NatureScot have also provided further advice in their October 2020 guidance *General pre-application and scoping advice for onshore wind farms*. Further guidance is

provided by the Landscape Institute, September 2019, *Visual Representation of Development Proposals*, Technical Guidance Note 06/19.

- 1.4.7 The objective for night-time viewpoint photography is to represent, as far as is practical, the lighting levels as they would be perceived by the human eye. Photography which includes temporary light sources that are not typical or representative, such as passing vehicles on quiet country lanes, have been avoided.
- 1.4.8 The baseline photography is recorded during the twilight period. This corresponds with periods when people are more likely to be outside at night and allows a visible horizon which is required in order to correctly render the photomontages. **Table 7.3.2** provides a description of the periods between twilight / dawn and dusk and can be used to identify when people are most likely to be outdoors and when the aviation warning lights will be switched on. It is worth noting that the existing lights in the baseline, as well as the proposed aviation warning lights, will not be perceived as bright during civil twilight as when they are viewed later in the night, during darker periods. This is because of the eye's limits on the contrast it can detect.
- 1.4.9 Where existing lights are shown in the photographs, they can appear blurred in comparison to those seen by the naked eye in the field when the photographs were captured. The term used in photography to describe this effect is 'Bokeh' which describes the way the lens renders out-of-focus points of light.

Table 7.3.2 Annual Operation of the Aviation Warning Lights in Rhynie

Periods between Sunset and Sunrise Times at Rhynie	Spring Equinox 20 March 2021	Summer Solstice 20 June 2021	Autumn Equinox 22 Sept 2021	Winter Solstice 21 Dec 2021
Astronomical twilight begins (full darkness ends)	03:58	N/A	04:43	06:21
Nautical twilight begins (First light) There is some lightening of the sky which may be pale or reddish at the eastern edge. At the mid-point of nautical twilight, trees and buildings can be seen sharply against the sky, but it's still dark on the ground - it would be easy to step into a hole, and pedestrians would be carrying torches / head torches. Cyclists would need lights.	04:47	N/A	05:32	07:08
Dawn - Civil twilight begins (~1 hour before sunrise) 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 are near traffic, especially on an overcast day.	05:33	03:02	06:18	08:00
Aviation warning lights switch off ~30m before sunrise.				
Sunrise (Sun disk passes above the horizon)	06:10	04:10	06:55	08:47
Daytime	-	-	-	-
Sunset (Sun disk passes below the horizon)	18:27	22:15	19:12	15:31
Aviation warning lights switch on ~30m after sunset, subject to visibility				

Periods between Sunset and Sunrise Times at Rhynie	Spring Equinox 20 March 2021	Summer Solstice 20 June 2021	Autumn Equinox 22 Sept 2021	Winter Solstice 21 Dec 2021
Dusk - Civil twilight ends (~1hour after sunset) 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.	19:03	23:23	19:49	16:18
Nautical twilight ends (Nightfall) 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.	19:49	N/A	20:35	17:10
Astronomical twilight ends (full darkness starts)	20:38	N/A	21:24	18:57

Night-time Photomontage: Rendering of Aviation Warning Lights

- 1.4.10 NatureScot recognise that the illustration of technically accurate lighting proposals is difficult to achieve and that the photomontages rely on professional judgement and an 'artistic impression' due to the limitations in being able to model light intensity over distance in variable atmospheric conditions of light / darkness. Nevertheless, the photomontages are considered useful when combined with objective data illustrated in the ZTV plots and wireline figures.
- 1.4.11 The rendering or visual representation of the proposed aviation warning lights has been achieved using Adobe Photoshop and a comparative study of photography of actual turbine lighting in similar lighting conditions and viewing distances, based on other lighting sources in the Study Area as noted in the Baseline Night-time Environment or Darkness Survey. Information and night-time observation has also been conducted from the following lit structures in other parts of Scotland including:
- Two Enercon turbines are noted to be lit at Upper Wheedlemont Farm, west of Rhynie;
 - Black Hill Transmitters, near Salsburgh, North Lanarkshire:

There are three transmitter towers, approximately 300m in height, each with 6-7 regularly spaced lights, required at 2000 cd. They have no mitigation and are prominent at approximately 6-7km distance.
 - Crossdykes Wind Farm in Dumfries and Galloway:

There are ten turbines, each fitted with twin nacelle lights required at 2000 cd and three tower lights. They have no mitigation and are prominent at approximately 6-7km distance.
- 1.4.12 In order to consistently replicate the aviation light intensity in the photomontages, the same illustration techniques used in the EIA Report have been replicated.

1.5 Consultation

- 1.5.1 **SI 2021 Chapter 6** describes the scoping and consultation to date. Consultation related to the effects of aviation warning lights on views and visual amenity was received by Aberdeenshire Council and NatureScot.

- 1.5.2 In summary, Aberdeenshire Council removed a reason for objection related to aviation lighting on the basis of the applicant proposing a reduced lighting arrangement which was subsequently agreed by the CAA (email dated 23rd December 2020). Aberdeenshire Council also acknowledged the limited likelihood of receptors being present on the hills / hill summits at night. During the summer months and using the summer solstice as an example, hill walkers would need to be on the hills at 22:45 in order to see the aviation warning lights. During the winter months and using the winter solstice as an example, hill walkers would need to be on the hills at 16:00, in both cases the walkers would require torches themselves, during the period of nautical twilight (nightfall) and beyond.
- 1.5.3 In response to the Application NatureScot advised (letter dated 30th April 2020) that *"There are potential significant adverse effects on the dark rural skies due to the proposed aviation lighting."* A range of mitigation measures were advised which have been employed in the proposed Lighting Strategy. NatureScot also considered that the rendering of aviation warning lights was 'underestimated' in Viewpoint N11. The revised photomontage has been re-rendered to take account of this whilst also illustrating the mitigation proposed as part of the Lighting Strategy.

Night-time Viewpoint Selection

- 1.5.4 Night-time viewpoint selection has sought to present the proposed development as experienced by a range of receptor groups, from a spread of different directions, and over varying distances. It is to be noted that the viewpoint selection has also been based on where people are most likely to be at night to experience these views. In total four night-time viewpoints have been illustrated. This list of the Night-time Assessment viewpoints is set out in **Table 7.3.3**.

Table 7.3.3 Night-time Viewpoint Selection

Viewpoint Selection	Comments
N1. Minor road near Tillathrowie (SI 2021 Figure 7.13a-d)	Viewpoint to the northeast of the proposed development from a minor road in the valley near Tillathrowie.
N9. Minor road off B9117 near Miltown of Rothiemay (SI 2021 Figure 7.14a-d)	Viewpoint to the northeast of the proposed development from a minor road in the Strath Isla area.
N11. Battle Hill, Huntly (SI 2021 Figure 7.15a-d)	Viewpoint to the northeast of the proposed development located close to Huntly.
N12. Coreen Hills, Old Military Road (SI 2021 Figure 7.16a-d)	Viewpoint to the southeast of the proposed development located at an elevation position in the Coreen Hills.

1.6 Night-time Viewpoint Analysis

- 1.6.1 Analysis of the number of aviation warning lights theoretically visible from each viewpoint in accordance with the NatureScot advice on the scope of landscape and visual assessment for turbine lighting (*General Pre-application and Scoping Advice for Onshore Wind Farms, Annex 2 – NatureScot, October 2020*) is provided in **Table 7.3.4**.
- 1.6.2 Allowing for the proposed Lighting Strategy and mitigation, which includes directional and reduced intensity lighting there would be No Significant visual effects affecting any of the assessment viewpoints.
- 1.6.3 A summary of the night-time viewpoint analysis is provided in **Table 7.3.5**. This includes details of which turbine appears brightest to an observer at each viewpoint, based on an analysis of the light attenuation through the air in typical visibility. The median visibility expected for the site should be

similar to the measured data seen at Kinloss, where it is 40km. This accords with available satellite data for the region as well. The calculation also takes account of the emergent vertical intensity profile of the light expected as shown for each viewpoint by **SI 2021 Figure 7.12c(i)**. Each viewpoint is analysed further in **Table 7.3.7**, which includes a darkness survey describing the baseline night-time environment. Other cumulative wind farm applications within the 45km study area that require aviation warning lights (turbines $\geq 150\text{m}$ to blade tip height) are illustrated in the wirelines where visible.

Table 7.3.4 Summary of Night-time Viewpoint Analysis

Viewpoint No. and Title	Turbine 1	Turbine 2	Turbine 3	Turbine 4	Turbine 5	Turbine 6	Turbine 7	Turbine 8	Turbine 9	Turbine 10	Turbine 11	Turbine 12	Turbine 13	Turbine 14	Total
N1. Minor road near Tillathrowie	✓	Not Lit	Not Lit	Not Lit	X	✓ (behind 12)	Not Lit	Not Lit	Not Lit	Not Lit	Not Lit	✓	Not Lit	Not Lit	3
N9. Minor road off B9117 near Miltown of Rothiemay	✓	Not Lit	Not Lit	Not Lit	X	✓	Not Lit	Not Lit	Not Lit	Not Lit	Not Lit	X	Not Lit	Not Lit	2
N11. Battle Hill, Huntly	X	Not Lit	Not Lit	Not Lit	✓	X	Not Lit	Not Lit	Not Lit	Not Lit	Not Lit	X	Not Lit	Not Lit	1
N12. Coreen Hills, Old Military Road	X	Not Lit	Not Lit	Not Lit	✓	X	Not Lit	Not Lit	Not Lit	Not Lit	Not Lit	✓	Not Lit	Not Lit	2

Table 7.3.5 Summary of Night-time Viewpoint Analysis

Viewpoint Selection	Sensitivity	Distance to nearest visible lit turbine	*No. of visible nacelle lights:	Distance to Brightest Turbine	Brightest Turbine	2000cd Intensity		200cd Intensity	
						Magnitude	Level of Effect	Magnitude	Level of Effect
N1. Minor road near Tillathrowie	High to Medium	3.7km	3	3.7km	T6	Slight	Moderate to Moderate / Minor	Negligible	Moderate / Minor to Minor
N9. Minor road off B9117 near Miltown of Rothiemay	High to Medium	19.7km	2	19.7km	T6	Negligible	Moderate / Minor to Minor	Negligible to Zero	Minor
N11. Battle Hill, Huntly	High to Medium	11km	1	12.5km	T5	Negligible	Moderate / Minor to Minor	Negligible	Moderate / Minor to Minor
N12. Coreen Hills, Old Military Road	High to Medium	13.5km	2	14.0km	T6	Slight - Negligible	Moderate / Minor	Negligible	Moderate / Minor to Minor

Note: Significant effects are shown in bold (no significant effects are recorded). For cumulative night-time effects, refer to **Table 7A.7**

*Number of visible aviation warning lights counted on the photomontage.

1.7 Night-time Assessment

- 1.7.1 The LVIA within the main **SI 2021 Chapter 7 Landscape and Visual** includes a summary of the likely effects of the aviation warning lights on landscape and visual receptors. A full assessment is provided here.

Night-time Landscape Effects: During Operation

- 1.7.2 The landscape character of the area within 10km of the proposed development is illustrated in **SI 2021 Figure. 7.5**.
- 1.7.3 The 'host' *Outlying Hills and Ridges* LCT (formerly the *Moorland Plateaux* LCT and *Grampian Outliers* LCA) of Clashindarroch Forest is generally a dark and 'unlit' area of forestry and the existing Clashindarroch Wind Farm. However, any attempt to undertake a night-time assessment of landscape character has to recognise that the period within which the characteristics of the landscape can be experienced are 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 when any discernment of the landscape or 'nightscape' would be limited to the shapes of hills, buildings and vegetation, subject to the availability of moonlight. Many of the key characteristics discerned in daylight, including the colour, texture, pattern and detail of the landscape would simply not be visible. The four directional and reduced intensity aviation warning lights, proposed on the nacelles of turbines 1, 5, 6, and 12 would not be sufficient in number or intensity to become a new key characteristic or element of the landscape unit or otherwise affect the perceived darkness of this forested upland area of landscape character.
- 1.7.4 This is due to a number of factors, not least the limited number of aviation warning lights (four in total) and the difficulty in perceiving landscape character during night-time conditions, in a forested context that would tend to obscure or partly obscure natural light sources such as moon light. Even allowing for clearings and open areas, much of this landscape unit is at a lower elevation than the aviation warning lights on the turbine hubs and the line of sight between this area and aviation warning lights would be less than the horizontal angle of the focused light beam (0° to $+3^{\circ}$) reducing considerably the light intensity within much of this area (**SI 2021 Figure 7.12c**). Typically, the light intensity would be reduced to $\leq 800 / 265\text{cd}$ during periods of poor visibility ($< 5\text{km}$), appearing as less than $\leq 80 / 8\text{cd}$ during periods of good visibility ($> 5\text{km}$). Meteorological observations suggest that good visibility ($> 5\text{km}$) this is likely to occur for approximately 85% of the time.
- 1.7.5 The ridge of hills to the west of the proposed development, running between Muckle Black Hill, Red Hill, Grumack Hill, Daugh of Corinacy, Black Hill and Mount of Haddoch (the 'Red Hill - Black Hill ridgeline'), are unforested and border the western edge of the *Outlying Hills and Ridges* LCT in Aberdeenshire and the *Open Upland* LCT in Moray. Due to their higher elevation the light intensity would vary between $\leq 2000 / 1500\text{cd}$ during periods of poor visibility ($< 5\text{km}$), appearing as less than $\leq 200 / 150\text{cd}$ during periods of good visibility ($> 5\text{km}$). Meteorological observations suggest that good visibility is likely to occur for approximately 15% of the time. Combined with the limited number of four lights limited to viewing in one direction, the proposed aviation warning lights would not be sufficient in number or intensity to affect the landscape character of this area.
- 1.7.6 The aviation warning lights are automated to 'switch on' 30 minutes after sunset (sun disk passes below the horizon) and remain 'switched on' through the night, 'switching off' 30 minutes prior to sunrise (sun disk passes above the horizon). Consequently, the aviation warning lights would not adversely affect periods of sunrise or sunset but would affect periods of twilight and night. There is a limited, short period of time during this period when the landscape character can be perceived, with

increased emphasis on the horizon and the landform prior to increased or total darkness in the absence of moonlight.

- 1.7.7 During periods of twilight the landscape and the turbines themselves would still be visible in the fading or reduced light and the aviation warning lights would appear faint (because the sky would not be completely dark). During the night (between dusk and dawn when the sky is at its darkest) the lights would appear most visible but the landscape character itself would not be visible although the horizon may be discernible with moonlight (increasing in full moon conditions) and the shapes of objects may also just be visible. The area would appear as an unlit or partially lit area with occasional lights from residential properties / farms and occasional traffic on minor roads and in clear / cloud free conditions 'starry nights' would be experienced. Within 500m -1km light reflecting from the turbine blades as they pass the light source may be visible as a pale reflected light, appearing close to the hub and subject to wind direction. It is worth noting that there is no mention of night-time characteristics in relation to either of these landscape units.
- 1.7.8 The sensitivity of this landscape is assessed as High to Medium, drawing from the daytime assessment. The area is dark or unlit and thus of high to medium susceptible to the introduction of aviation warning lights while the value of the night-time landscape character in this area is undesignated and judged as medium. The magnitude of change would range between Slight to Negligible within 2-3km of the lit turbines and the level of effect on the landscape character would range between **Moderate / Minor and Minor** and Not Significant, reducing further with increased distance. The nature of these effects would be long-term (reversible), direct and negative. These limited and non-significant effects would occur for a limited period (approximately 15% of the time) as a result of the proposed aviation warning lights, operating at maximum intensity in conditions of restricted visibility of <5km. It may be noted that there are no people within this part of the landscape significantly affected by the proposed development.
- 1.7.9 Beyond approximately 2-3km the effects of the lighting would be perceived as visual effects, viewing in one direction, rather than affecting the wider landscape character, and the effect on the perception of darkness would be Not Significant. In addition, the level of perceived light would dissipate with increased distance and the light brilliance or luminosity would reduce further.

Cumulative Effects of Reduced Intensity Aviation Warning Lights

- 1.7.10 The Garbet Hill application is located approximately 6km to the northwest of the proposed development, beyond the Deveron Valley and the ridge at Craig Watch and within the *Open Upland* LCT. Five of the proposed turbines at Garbet Hill would be lit. The Garbet Hill LVIA reports that the effect on the landscape character would range between "*Substantial / Moderate and Significant (between 0.5-2km to the south, southwest and west of the lit turbines [due to the rising topography in these directions]) to Moderate / Slight and Not Significant (within 1-2km to the northeast and east, and within 0.5km to the west and southwest of the lit turbines).*"
- 1.7.11 The cumulative ZTV in **SI 2021 Figure 7.12d** reveals that there are very limited areas where both Garbet Hill and the proposed development would be visible concurrently or sequentially (along roads) and there is therefore limited opportunity for cumulative effects. Although both schemes would be visible in opposing directions from the top of the Red Hill – Black Hill ridgeline and neither the additional or combined magnitude of change would exceed Slight to Negligible and the level of effect on the landscape character would range between **Moderate / Minor and Minor** and Not Significant, reducing further with increased distance. The nature of these effects would be long-term (reversible), direct and negative to neutral. These effects would occur for a limited period (approximately 15% of the time) as a result of the proposed aviation warning lights, operating at maximum intensity in conditions of restricted visibility of <5km. It may be noted that there are no people within this part of the landscape significantly affected by the proposed development.

- 1.7.12 Similarly, there are limited locations where the proposed development and the lit turbines at Clash Gour and Rothes III would be visible. Both Clash Gour and Rothes III are located at beyond 30km and 25km distance respectively and where visible would be perceived as distant visual effects, viewed in one direction from limited locations, such that there would not be capably of affecting the night-time landscape character of either the *Outlying Hills and Ridges* LCT or the adjacent *Open Upland* LCT.

Indirect Effects on the Surrounding Landscape Character

- 1.7.13 There would be no Significant effects on other areas of landscape character including the *Upland Valleys* LCT and the *Farmed and Wooded River Valleys of the Deveron Valley*, the *Farmed and Rolling Ridges and Hills* LCT around Tillathrowie or the *Farmed Moorland Edge* LCT and *Farmed Basin* LCT of Aberdeenshire. This is due to either the lack of theoretical visibility from within these areas (as indicated in **SI 2021 Figures 7.5** and **7.12c**) and the reduced light intensity that would be experienced in locations such as Tillathrowie within the *Farmed and Rolling Ridges and Hills* LCT (formerly the *Agricultural Heartlands* LCT / *Northern Rolling Lowlands* LCA).
- 1.7.14 In terms of the cumulative assessment the proposed development would be unlikely to contribute significantly to cumulative effects.

Indirect Effects on Landscape Designations

- 1.7.15 Comparison of **SI 2021 Figures 7.4b** and **7.12c** reveals that there would be no theoretical visibility of the proposed aviation warning lights from within any landscape designations within 10km (including the Deveron Valley Special Landscape Area (SLA) in Aberdeenshire or the Ben Rinnes SLA in Moray). Consequently, there would be no effect on landscape designations.

Indirect Effects on the Cairngorms Dark Sky Park

- 1.7.16 **SI 2021 Figure 7.12e** illustrates the extent of the Cairngorms Dark Sky Park, and the light intensity ZTV for the proposed development. There would be limited theoretical visibility of the proposed aviation warning lights at >16km distance, overlapping with the northern edges of the Ladder Hills and the south-eastern boundary of the Cairngorms Dark Sky Park. Judging from the viewpoint assessment, views and any night-time visual effects perceived from this part of the Dark Sky Park would not be significant and few people if any are likely to experience these views from this remote area at night. Within the Cairngorms Dark Sky Park, Dark Sky Discovery Sites (Blairfindy Moor, The Carrachs, and Fields of Hope) are recommended locations from which to view the night sky. None of the Dark Sky Discovery Sites would have theoretical visibility of the proposed aviation warning lights. Consequently, there would be no effect on the Dark Sky Discovery Sites within the Cairngorms Dark Sky Park.

Night-time Landscape Effects: during Construction and Decommissioning

- 1.7.17 During the construction and decommissioning periods some limited health and safety lighting would be required at the Site entrance office and temporary construction compounds and there would also be lights from vehicles moving around the Site during periods of darkened daylight hours such as heavy rain / dark skies. Cranes (up to 2 have been assumed) may also carry unmitigated safety and aviation warning lights and the effects on the night-time landscape character would be localised and limited, such that there would be no effects on landscape receptors including landscape character, designations and the Cairngorms Dark Sky Park.

Night-time Visual Effects: During Operation

- 1.7.18 The night-time viewpoint assessment concludes that there would be no significant visual effects within 20km of the proposed development with the magnitude of change ranging between Slight at Tillathrowie (3.7km distance) to Negligible within the wider study area. The level of effect ranges from **Moderate to Moderate / Minor** and Not Significant in the Tillathrowie area to **Moderate / Minor to Minor** and Not Significant within the wider study area. Drawing from the viewpoint assessment the night-time visual assessment is focused on those receptors within 5km where people are most likely to be located. This includes settlements, residential properties and roads. Hill walkers are unlikely to be present on the core paths and at hill summits and would themselves require torches and tourist and visitor attractions are likely to be closed to the public during the hours of darkness.

Visual Effects on Settlements

- 1.7.19 The night-time assessment has focused on those settlements and residential properties within 5km. The sensitivity of these settlements has been assessed as High as a precaution, drawing from the previous EIA Report, although the susceptibility of receptors at night and the value of the night-time views may generally be considered as less than during the day, particularly when considering the darkest / latest periods of the night.
- 1.7.20 The settlement at Milltown of Rothiemay at 19.7km distance has been re-assessed as part of the viewpoint analysis (Viewpoint 9) which has confirmed that there would be no significant effects. Residential properties in the vicinity of Viewpoint 8: Minor Road near Course, southeast of A97 were identified in the EIA Report as potentially significantly affected. Further analysis reveals that the views towards the proposed development from properties in the vicinity of Viewpoint 8 are screened by intervening buildings and or vegetation, whilst the main concentration of houses further south are at a lower elevation. In addition, the viewpoint analysis indicates that at approximately 17km distance there would be no significant effects.

Table 7.3.6 Visual Effects on views from Settlements

Settlement / Groups of Residential Properties	Assessment
Tillathrowie	<p>Scattered properties to the northeast of the proposed development, within 5km comprise an area referred to in this assessment as 'Tillathrowie' although it does not possess community facilities and places (village hall, park, school etc.) that would otherwise identify it as a 'settlement'. All of the properties in this area were included in the Residential Visual Amenity Assessment (RVAA) contained within the EIA Report and Viewpoint N1: Minor road near Tillathrowie (SI 2021 Figure 7.13a-d) is representative of the views from receptors in this area which includes local roads. The maximum light intensity at Viewpoint N1 would be ≤ 265-200cd, occurring during periods of poor visibility (<5km) which is likely to occur approximately 15% of the time). More typically the light intensity would be reduced to ≤ 27-20cd coinciding with periods when the visibility is >5km in all directions (likely to be approximately 85% of the time). The magnitude of change for this viewpoint would be Slight to Negligible and the effect of the aviation warning lights would be Moderate to Moderate / Minor at 2000cd reducing to Moderate / Minor to Minor at 200cd and not significant. The nature of these effects would be long-term (reversible), direct and negative to neutral.</p> <p>The RVAA identified three properties where the daytime views would be significantly affected, although none would be adversely affected in terms of residential visual amenity. Each of these are considered further as follows:</p> <ul style="list-style-type: none"> G2: Wester Tillathrowie and Forestry Holdings <p>Located at 2.6km distance the property would theoretically view one aviation warning light with a light intensity of ≤ 175-75cd during periods of poor visibility (<5km), but more typically reduced to ≤ 18-8cd</p>

Settlement / Groups of Residential Properties Assessment

during periods when the visibility is >5km in all directions. The magnitude would be Negligible and the level of effect **Moderate / Minor** and not significant.

- G3: 8 and 9 Forestry Holdings

Located at 3km distance the property would theoretically view up to two aviation warning lights with a light intensity of $\leq 200-175\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 20-18\text{cd}$ during periods when the visibility is >5km in all directions. The magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

- G4: Bogairdy House, Bogairdy Heights and Mill of Bogairdy

Located at 4.8km distance the property would theoretically view up to three to four aviation warning lights with a light intensity of $\leq 265-200\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 27-20\text{cd}$ during periods when the visibility is >5km in all directions. Taking account of the property orientation and some partial vegetation screening from a shelterbelt, the magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

- P1: Glenburn

Located at 2.8km distance the property would theoretically view up to two aviation warning lights with a light intensity of $\leq 175-75\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 18-8\text{cd}$ during periods when the visibility is >5km in all directions. Views of the aviation warning lights may be 'funnelled' or framed by garden vegetation and as a consequence the magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

- P5: Easter Tillathrowie

Located at 3.2km distance the property would theoretically view up to three aviation warning lights with a light intensity of $\leq 175-75\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 18-8\text{cd}$ during periods when the visibility is >5km in all directions. The magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

- P7: The Schoolhouse

Located at 3.8km distance the property would theoretically view up to three to four aviation warning lights with a light intensity of $\leq 265-200\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 27-20\text{cd}$ during periods when the visibility is >5km in all directions. Taking account of the property orientation and seasonal vegetation / garden screening the magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

- P11: Whitestones

Located at 3.7km distance the property would theoretically view up to three to four aviation warning light with a light intensity of $\leq 265-200\text{cd}$ during periods of poor visibility (<5km), but more typically reduced to $\leq 27-20\text{cd}$ during periods when the visibility is >5km in all directions. The magnitude would be Slight to Negligible and the level of effect **Moderate to Moderate / Minor** and not significant.

The aviation warning lights are automated to 'switch on' 30 minutes after sunset (sun disk passes below the horizon) and remain 'switched on' through the night, 'switching off' 30 minutes prior to sunrise (sun disk passes above the horizon). Consequently, the aviation warning lights would not adversely affect periods of sunrise or sunset but would affect periods of twilight and night. During the summer months, for example during the summer solstice, the lights would be switched on at 22.45 and most residents and road users would be indoors at this time. Conversely, during the winter months the aviation warning lights would come on at 16.00 and switch off at 08.17 in the morning on the winter solstice for example. It is 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 lights incidentally to the main activity.

There would be no cumulative visibility of other wind farms with aviation warning lights and consequentially no cumulative effects of other wind farms with aviation warning lights.

Haugh of Glass

This settlement is located 5km to the north of the proposed development and there would be no visibility of the proposed aviation warning lights from this settlement which is located within the Deveron Valley. Consequently, there would be no effect on the views from Haugh of Glass.

Visual Effects on Views from Transport Routes

- 1.7.21 'A' class roads within 5km are limited to the A941 which is not overlapped by the light intensity ZTV (**SI 2021 Figure 7.12c (i)**) and there would be no views of the aviation warning lights from this road between Rhynie and Dufftown. There are no 'B' class roads within 5km of the proposed development. Consequentially there would be no night-time visual effects on the views from roads within 5km.
- 1.7.22 Local roads overlapped by the light intensity ZTV are limited to the Tillathrowie area and the visual effects would be similar to those described under the settlement assessment (Moderate to Moderate / Minor at 2000cd reducing to Moderate / Minor to Minor at 200cd) and not significant. The nature of these effects would be long-term (reversible), direct and negative to neutral.

1.8 Summary of Night-time Assessment

- 1.8.1 No significant landscape, visual or cumulative effects are predicted as a result of the proposed aviation warning lights.
- 1.8.2 This includes the landscape character areas of *Outlying Hills and Ridges* LCT (formerly the *Moorland Plateaux* LCT and *Grampian Outliers* LCA), *Open Upland* LCT, or the *Upland Valleys* LCT and the *Farmed and Wooded River Valleys* of the Deveron Valley, the *Farmed and Rolling Ridges and Hills* LCT around Tillathrowie or the *Farmed Moorland Edge* LCT and *Farmed Basin* LCT of Aberdeenshire; designated landscapes and the Cairngorms Dark Sky Park and associated Dark Sky Discovery Sites.
- 1.8.3 Visual receptors included scattered settlement and local roads at Tillathrowie, Haugh of Glass and the A941, the latter two of which are not overlapped by the ZTV and would have no view of the proposed aviation warning lights.
- 1.8.4 Viewpoint N1: Minor road near Tillathrowie (**SI 2021 Figure 7.13a-d**) is representative of the views from receptors in the Tillathrowie area. The maximum light intensity at Viewpoint N1 would be ≤ 265 -200cd, occurring during periods of poor visibility (< 5 km which is likely to occur approximately 15% of the time). More typically the light intensity would be reduced to ≤ 27 -20cd coinciding with periods when the visibility is > 5 km in all directions (likely to be approximately 85% of the time). The magnitude of change for this viewpoint would be Slight to Negligible and the effect of the aviation warning lights would be **Moderate to Moderate / Minor** at 2000cd reducing to **Moderate / Minor to Minor** at 200cd and not significant. The nature of these effects would be long-term (reversible), direct and negative to neutral.
- 1.8.5 Most people including hill walkers in the area, during the summer months, are unlikely to experience the aviation warning lights. For example, during the summer solstice the aviation warning lights would switch on at 22.45 and switch off at 04.00 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 the lights would come on at 16.17 and switch off at 08.17 in the morning. It is 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.
- 1.8.6 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.

1.9 Night-time Viewpoint Analysis

Table 7.3.7 Night-time Viewpoint Analysis

SI 2021 Figure 7.13a-d	N1. Minor road near Tillathrowie		
Description	<p>This viewpoint is located 3.7km northeast of the nearest proposed turbine, on the layby to the south side of the minor road, just beyond the western boundary of The School House at an elevation of 267m AOD. It is representative of views experienced by local residents and road users in the Tillathrowie area.</p> <p>The baseline photography illustrates the night-time context at this location. There are few sources of artificial light, limited to occasional lights from residential properties and vehicles on the minor road network. Whilst these are not apparent in the photograph, they are visible in the field. Overall, this represents a dark location at night.</p>		
Sensitivity	<p>The susceptibility of the local residents is considered to be High and that of local road users as Medium. The view is likely to be highly valued by residents and although undesignated it is reasonably scenic and assessed as High to Medium, reducing later into the night.</p> <p>The sensitivity of this viewpoint is therefore assessed as <i>High to Medium</i>, reducing later into the night to <i>Medium</i>.</p>		
Magnitude of Change (proposed development only)	<p>Whilst in Operation:</p> <p>Up to three aviation warning lights would be visible, appearing just above the horizon at 3.7km distance.</p> <p><u>2000cd Lighting:</u> During periods of poor visibility (<5km in all directions from each lit turbine) the aviation warning lights would appear as overspill and the direct horizontal beam of full 2000cd light would not be visible from this location. The visible light intensity from this location would range from ≤265-200cd.</p> <p>The brightest nacelle light is calculated to be T6 at 3.7km.</p> <p>Meteorological records suggest that this scenario would occur for approximately 15% of the time. In reality the baseline photo has been taken during the conditions of clear visibility</p> <p>The magnitude of change would be <i>Slight</i>.</p> <p><u>200cd Lighting:</u> During periods of clear visibility (>5km in all directions from each lit turbine) the visible light intensity would range from ≤27cd to 20cd.</p> <p>Meteorological records suggest that this scenario would occur for approximately 85% of the time.</p> <p>The magnitude of change would be <i>Negligible</i>.</p> <p>Whilst Under Construction and Decommissioning:</p> <p>There would be some partial views of the cranes and turbines during construction.</p> <p>Not assessed.</p>		
Assessment		2000cd Lighting	200cd Lighting
	Sensitivity	High to Medium	High to Medium
	Magnitude	Slight	Negligible
	Level of Effect	Moderate to Moderate / Minor and Not Significant	Moderate / Minor to Minor and Not Significant
	Type of Effect	Long term, direct and negative.	Long term, direct and negative to neutral.
Cumulative Assessment (Scenario 1): Existing + Consented wind farms and the Proposed Development			
Cumulative Magnitude	<p>There are no other existing or consented wind farms with lit turbines visible.</p> <p>The magnitude of change would be <i>Zero</i>.</p>		
Cumulative Assessment (Scenario 2): Existing + Consented + Application wind farms and the Proposed Development			
Cumulative Magnitude	<p>There are no other wind farm applications with aviation warning lights that would be visible from this location.</p> <p>The magnitude of change would be <i>Zero</i>.</p>		

SI 2021 Figure 7.14a-d	N9. Minor road off B9117 near Miltown of Rothiemay		
Description	<p>This viewpoint is located 19.7km northeast of the nearest proposed turbine, on a minor road off the B9117, south of the property at South Retanach at an elevation of 140m AOD. It is representative of views experienced by local residents and road users in this area.</p> <p>The baseline photography illustrates the night-time context at this Location and there are few sources of artificial light in the direction of the proposed development, limited to occasional lights from residential properties and vehicles on the local road network to the west. Further to the north (to the right of the photograph) occasional street-lights are visible as well as the aviation warning lights on the wind turbines at Myreton Crossroads. Overall this represents a dark location at night.</p>		
Sensitivity	<p>The susceptibility of the local residents is considered to be High and that of local road users as Medium. The view is likely to be highly valued by residents and it is located within the Deveron Valley SLA in Moray and assessed as High to Medium, reducing later into the night. The sensitivity of this viewpoint is therefore assessed as <i>High to Medium</i>, reducing later into the night to <i>Medium</i>.</p>		
Magnitude of Change (proposed development only)	<p>Whilst in Operation:</p> <p>Up to two aviation warning lights would be visible, appearing just above the horizon at 19.7km distance.</p> <p><u>2000cd Lighting:</u> During periods of poor visibility (<5km in all directions from each lit turbine) the visible light intensity from this location would range from ≤2000-750cd.</p> <p>The brightest nacelle light is calculated to be T6 at 19.7km.</p> <p>Meteorological records suggest that this scenario would occur for approximately 15% of the time. In reality the baseline photo has been taken during the conditions of clear visibility.</p> <p>The magnitude of change would be <i>Negligible</i>.</p> <p><u>200cd Lighting:</u> During periods of clear visibility (>5km in all directions from each lit turbine) the visible light intensity would range from ≤200cd to 75cd.</p> <p>Meteorological records suggest that this scenario would occur for approximately 85% of the time.</p> <p>The magnitude of change would be <i>Negligible to Zero</i>.</p> <p>Whilst Under Construction and Decommissioning:</p> <p>There would be some partial views of the cranes and turbines during construction. - Not assessed.</p>		
Assessment		2000cd Lighting	200cd Lighting
	Sensitivity	High to Medium	High to Medium
	Magnitude	Negligible	Negligible to Zero
	Level of Effect	Moderate / Minor to Minor and Not Significant	Minor and Not Significant
	Type of Effect	Long term, direct and negative to neutral.	Long term, direct and negative to neutral.
Cumulative Assessment (Scenario 1): Existing + Consented wind farms and the Proposed Development			
Cumulative Magnitude	<p>Aviation warning lights from Myreton Crossroads at 9.2km distance to the northwest (subject to screening from intervening vegetation). No lighting mitigation is assumed.</p> <p>The magnitude of change would be <i>Slight to Negligible</i>.</p>		
Cumulative Assessment: (Scenario 2)		2000cd Lighting	200cd Lighting
	Additional effect:	Moderate / Minor and Not Significant	Minor and Not Significant
	Combined effect:	Moderate to Moderate / Minor and Not Significant	Minor and Not Significant
Type of Effect	Long term (reversible), direct, cumulative, and negative.		
Cumulative Assessment (Scenario 2): Existing + Consented + Application wind farms and the Proposed Development			
Cumulative Magnitude	<p>Five aviation warning lights on the Garbet application would be visible at 21km distance to the southwest and lighting mitigation (reduced intensity lighting) is proposed. The magnitude of change would be <i>Negligible</i>.</p>		
Cumulative Assessment: (Scenario 2)	Effect	2000cd Lighting	200cd Lighting
	Additional:	Moderate / Minor and Not Significant	Minor and Not Significant
	Combined:	Moderate to Moderate / Minor and Not Significant	Minor and Not Significant
Type of Effect	Long term (reversible), direct, cumulative, and negative.		

SI 2021 Figure 7.15a-d	N11. Battle Hill, Huntly		
Description	<p>This viewpoint is located 11.0km northeast of the nearest proposed turbine, on the south western edge of Battle Hill at an elevation of 143m AOD. It is representative of views that would be obtained by walkers and/or visitors to the hill, and potentially residents on the eastern edge of Huntly.</p> <p>The baseline photography illustrates the night-time context at this location. There are several baseline sources of artificial light in the direction of the proposed development, predominately associated with the settlement and street-lighting along the A97 (Aberdeen Road) to the left side of the photography. In the wider landscape there are also lights associated with dispersed properties and farms, notably those seen on the southeast slopes of Clashmach Hill. The foreground lights will tend to limit the viewers ability to perceive the proposed lights.</p>		
Sensitivity	<p>The susceptibility of hill walkers and local residents is considered to be High. The viewpoint is located within the Deveron Valley SLA in Aberdeenshire and is also likely to be highly valued by residents although the value is likely to reduce later into the night. The value is consequentially assessed as High to Medium, reducing later into the night.</p> <p>The sensitivity of this viewpoint is therefore assessed as <i>High</i>, reducing later into the night to <i>Medium</i>.</p>		
Magnitude of Change (Proposed Development only)	<p>Whilst in Operation:</p> <p>One aviation warning light would be visible, appearing just above the horizon at 11.0km distance. It is reasonable to assume that there would be fewer hill walkers at this location at night.</p> <p><u>2000cd Lighting:</u> During periods of poor visibility (<5km in all directions from each lit turbine) the aviation warning lights would appear as overspill and the direct horizontal beam of full 2000cd light would not be visible from this location. The visible light intensity from this location would range from ≤ 265-200cd.</p> <p>The brightest light is calculated to be T5 at 12.5km and would be viewed beyond multiple other light sources. Meteorological records suggest that this scenario would occur for approximately 15% of the time. In reality the baseline photo has been taken during the conditions of clear visibility.</p> <p>The magnitude of change would be <i>Negligible</i>.</p> <p><u>200cd Lighting:</u> During periods of clear visibility (>5km in all directions from each lit turbine) the visible light intensity would range from ≤ 27cd to 20cd.</p> <p>Meteorological records suggest that this scenario would occur for approximately 85% of the time. The magnitude of change would be <i>Negligible</i>.</p> <p>Whilst Under Construction and Decommissioning:</p> <p>There would be some partial views of the cranes and turbines during construction.</p> <p>Not assessed.</p>		
Assessment		2000cd Lighting	200cd Lighting
	Sensitivity	High to Medium	High to Medium
	Magnitude	Negligible	Negligible
	Level of Effect	Moderate / Minor to Minor and Not Significant	Moderate / Minor to Minor and Not Significant
	Type of Effect	Long term, direct and negative to neutral.	Long term, direct and negative to neutral.
Cumulative Assessment (Scenario 1): Existing + Consented wind farms and the Proposed Development			
Cumulative Magnitude	<p>There are no other existing or consented wind farms with lit turbines visible.</p> <p>The magnitude of change would be <i>Zero</i>.</p>		
Cumulative Assessment (Scenario 2): Existing + Consented + Application wind farms and the Proposed Development			
Cumulative Magnitude	<p>There are no other wind farm applications with aviation warning lights that would be visible from this location.</p> <p>The magnitude of change would be <i>Zero</i>.</p>		

SI 2021 Figure 7.16a-d	N12. Coreen Hills, Old Military Road		
Description	<p>This viewpoint is located 13.5km southeast of the nearest proposed turbine, at the Ordnance Survey viewpoint at a layby on the Old Military Road (also known as Suie Road) on the northern edge of the Correen Hills at an elevation of 381m AOD. It is representative of views experienced by road users and hillwalkers / visitors to the viewpoint.</p> <p>The baseline photography illustrates a small number of isolated sources of artificial light in the direction of the proposed development, predominately associated with local settlement within the Insch Basin, to the north. The most obvious lights are those associated with Clatt and Kennethmont. There are also occasional lights from dispersed properties / farms and vehicles on the local road network. The two wind turbines at Upper Wheellemont Farm have aviation lights on the nacelles and these are located to the west of the viewpoint. The visibility of these turbines is limited at this specific viewpoint, but they are more visible at locations further north along the road.</p>		
Sensitivity	<p>The susceptibility of the hill walkers and visitors is considered to be High, whilst the road users (drivers is assessed as Medium. The viewpoint is located within the Bennachie SLA in Aberdeenshire and is consequentially assessed as High to Medium, reducing into the night. The sensitivity of this viewpoint is therefore assessed as <i>High</i>, reducing into the night to <i>Medium</i>.</p>		
Magnitude of Change (Proposed Development only)	<p>Whilst in Operation:</p> <p>Up to two aviation warning lights would be visible, appearing just above the horizon at 3.7km distance. It is reasonable to assume that there would be few visitors to the viewpoint at night.</p> <p>2000cd Lighting: During periods of poor visibility (<5km in all directions from each lit turbine) the visible light intensity from this location would range from ≤ 2000-750cd.</p> <p>The brightest nacelle light is calculated to be T6 at 14km.</p> <p>Meteorological records suggest that this scenario would occur for approximately 15% of the time. In reality the baseline photo has been taken during the conditions of clear visibility</p> <p>The magnitude of change would be <i>Slight - Negligible</i>.</p> <p>200cd Lighting: During periods of clear visibility (>5km in all directions from each lit turbine) the visible light intensity would range from ≤ 200cd to 75cd.</p> <p>Meteorological records suggest that this scenario would occur for approximately 85% of the time.</p> <p>The magnitude of change would be <i>Negligible</i>.</p> <p>Whilst Under Construction and Decommissioning:</p> <p>There would be some partial views of the cranes and turbines during construction.</p> <p>Not assessed.</p>		
Assessment		200cd Lighting	2000cd Lighting
	Sensitivity	High to Medium	High to Medium
	Magnitude	Slight - Negligible	Negligible
	Level of Effect	Moderate / Minor and Not Significant	Moderate / Minor to Minor and Not Significant
	Type of Effect	Long term, direct and negative.	Long term, direct and negative to neutral.
Cumulative Assessment (Scenario 1): Existing + Consented wind farms and the Proposed Development			
Cumulative Magnitude	<p>One nacelle light from the Upper Wheellemont Farm turbines is visible (to the left of the photograph) at 7.6km distance. No lighting mitigation is assumed.</p> <p>The magnitude of change would be <i>Negligible</i>.</p>		
Cumulative Assessment: (Scenario 1)		200cd Lighting	2000cd Lighting
	Additional effect:	Moderate to Minor and Not Significant	Moderate / Minor to Minor and Not Significant
	Combined effect:	Moderate to Minor and Not Significant	Moderate / Minor to Minor and Not Significant
Cumulative Assessment (Scenario 2): Existing + Consented + Application wind farms and the Proposed Development			
Cumulative Magnitude	<p>There are no other wind farm applications with aviation warning lights that would be visible from this location.</p> <p>The magnitude of change would be <i>Zero</i>.</p>		