Appendix 6.2: Aviation Lighting

Creachan Wind Farm

Environmental Impact Assessment Report
Volume 4: Appendices

Appendix 6.2: Aviation Lighting

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Delivering a better world

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1. Introduction

In the interest of aviation safety wind turbines and other structures measuring 150 m or greater in height are required to include visible lighting. The Proposed Development includes four turbines with a maximum blade tip height of up to 180 m and nine with a maximum blade tip height of up to 200m and therefore, visible aviation lighting will be required. As a result, parts of the Proposed Development may be visible within hours of darkness from certain inhabited and frequented locations, leading to the potential for landscape and visual effects.

In addition to the visible aviation lighting, and in line with Ministry of Defence requirements, infra-red lighting will also be positioned on the turbine hubs. However, this type of infra-red lighting will not be visible to the naked eye and therefore is not considered as part of the Landscape and Visual Impact Assessment (LVIA).

An overview of the approach to the assessment of landscape and visual effects related to lighting is included in **Chapter 6: Landscape and Visual**, with more details provided below in **Section 4**.

This appendix is intended to provide supporting information to aide understanding of the landscape and visual assessment with relation to aviation lighting. It provides background information related to the requirements for aviation lighting and an overview of the approach taken for the Proposed Development. It then provides a summary table indicating which of the lights, if any, will be visible from each of the identified viewpoint locations followed by an assessment of potential effects, including cumulative. Details of the scope of the assessment are provided in **Section 5**.

Details of the daytime assessment of landscape and visual effects are provided in **Appendix 6.5: Landscape Assessment** and **Appendix 6.6: Visual Assessment**, with an overview and summary of findings presented in **Chapter 6: Landscape and Visual.** Detailed technical information on aviation lighting is provided in **Chapter 12: Aviation Safeguarding**.

A series of figures have been produced to support the LVIA and are provided in **Volume 2**. Those of most relevance to aviation lighting and hours of darkness include:

- Figure 6.9 Aviation Lighting Zone of Theoretical Visibility (ZTV);
- Figure 6.10 Aviation Lighting Intensity ZTV; and
- Figure 6.16 to 6.18 Cumulative Aviation Lighting ZTVs.

Hours of darkness visualisations (shown at 200 candela (cd)) have been prepared from three viewpoint locations as agreed with NatureScot (NS) and The Highland Council (THC) and are provided in **Volume 3: Visualisations**.

2. Statutory Requirements and Guidance

The statutory requirement for lighting of structures, or potential on-route obstacles, of 150 m or greater in height in the UK is defined in Article 222 of the Air Navigation Order (ANO) (The Civil Aviation Authority, 2016). This sets out the necessity for medium intensity steady red lights to be positioned as close as possible to the top of the structure and also the potential requirement for additional lighting at intermediate levels between the top lights and ground level.

The Civil Aviation Authority (CAA) Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level (The Civil Aviation Authority, 2017) provides additional guidance and clarifies the required intensity and positioning of the lighting as follows:

- Medium intensity (2000 cd) steady red aviation warning light positioned on the nacelle of the turbine; and
- At least three low intensity (32 cd) intermediate lights positioned on the turbine tower at half the nacelle height to provide 360-degree coverage.

The CAA policy statement also allows lighting to operate at a lower intensity (a minimum of 10% of the specified peak intensity) when the horizontal meteorological visibility in all directions from the hub height of the turbines is more than 5 km. This means that the medium intensity (2000 cd) lights are permitted to be reduce to 200 cd in good atmospheric conditions, such as when there is no low cloud cover, mist or fog, or rain or snow at or around the hub height of each turbine.

The International Civil Aviation Organization (ICAO) provides further information in relation to aviation obstruction lighting in Annex 14 to the Convention on International Civil Aviation (The International Civil Aviation Organization). This sets out the minimum intensity of lights at different vertical angles relative to the lighting horizontal plane (i.e. the nacelle level for the Proposed Development). For the medium intensity (2000 cd) aviation lights the minimum requirements are:

- 1500 cd at a vertical angle of zero degrees (when the viewer is at the same level as the light); and
- 750 cd at a vertical angle of -1 degrees (when the viewer is 1 degree below the level of the light)

The above minimum figures are based on the lights when operating at peak intensity (2000 cd mode). When atmospheric conditions allow the lights to be operated on the lower intensity mode (200 cd) these minimums will also reduce to 10% (i.e. 75 cd at -1 degrees). There are no specified minimum intensities for vertical angles lower than -1 degrees, allowing some flexibility in design.

The NatureScot Guidance on Aviation Lighting Impact Assessment (NatureScot, 2024) provides guidance on the assessment and illustration of effects on the landscape and visual resource from visible aviation lighting located on onshore wind turbines.

3. Proposed Aviation Lighting

The following provides an overview of the approach to aviation lighting for the Proposed Development. Further detail, including more technical information on lighting is provided in **Chapter 12: Aviation Safeguarding**.

The approach to aviation lighting for the Proposed Development has been to follow the requirements set out in the ANO and by the CAA to ensure aviation safety, while also seeking to reduce potential environmental effects. The design process has considered a number of potential mitigation measures to reduce landscape and visual effects of lighting, including:

- Turbine layout;
- Reduction of the number of lights; and
- Light unit design and controls.
-

3.1 Turbine Layout

The potential for landscape and visual effects of aviation lighting was considered as part of the turbine layout design process. This largely involved seeking to reduce the visibility of turbine hubs from within the Dornoch Firth NSA and Rhiddoroch - Beinn Dearg - Ben Wyvis WLA and from settlement and scattered residential receptors. This included the lowland to the south-east of the Development Site such as Strath Rusdale. Key measures that have been embedded in the design of the Proposed Development include: reduction in the heights of turbines; and positioning the proposed turbines to avoid more elevated parts of the Development Site.

The aviation lighting and lighting intensity ZTVs (**Figure 6.9 and Figure 6.10**) demonstrate that theoretical visibility of the aviation lighting will be limited within the detailed 20 km study area. This will include the localised landscape surrounding the Main Development Area (MDA) (largely within approximately 10 km of the MDA), the lowland and part of the upland landscape to the north of the Dornoch Firth and pockets of the upland landscape associated with the more elevated parts of the landscape, including the summits of Ben Wyvis and Beinn a Chaisteil. The majority of settlement, roads and transport routes where people are most likely to be in hours of darkness are outside the extent of the ZTV and therefore will not be subject to visual effects from the aviation lighting included as part of the Proposed Development. The majority of the Dornoch Firth NSA and Rhiddoroch - Beinn Dearg - Ben Wyvis WLA are also outside the extent of the aviation lighting ZTV, limiting potential for hours of darkness effects.

3.2 Reduction in the Number of Lights

The CAA has indicated that it may not always be necessary to light all of the turbines within a wind farm. Where this approach is possible the lighting design will involve lighting of a selection of the turbines, focused on those along the perimeter and / or those at a higher elevation.

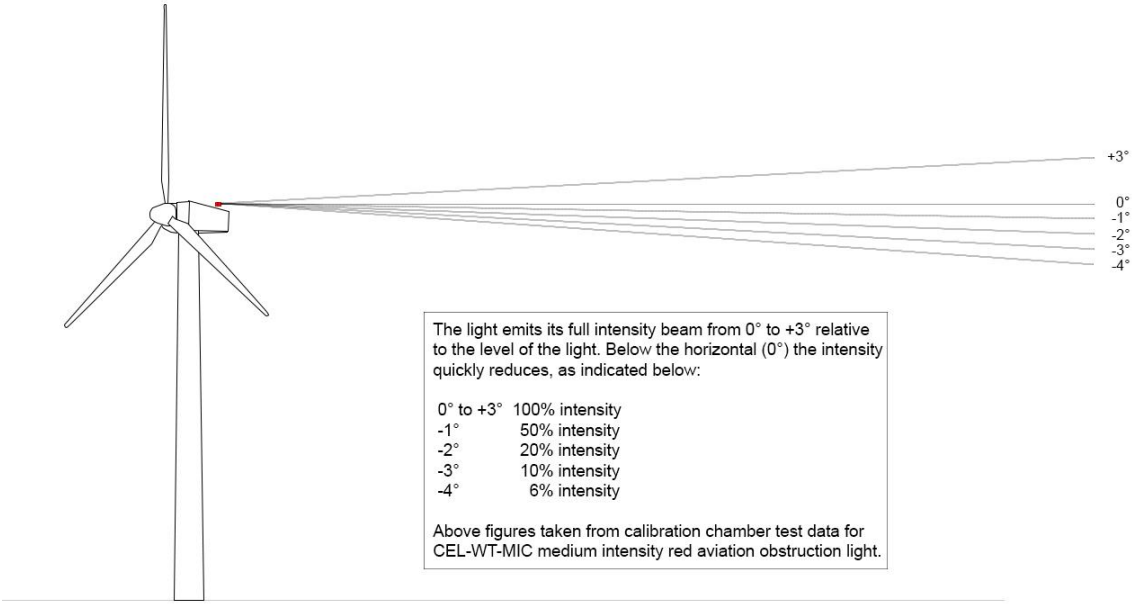
Through consultation and agreement with the CAA, the embedded mitigation measures relating to the aviation lighting design for the Proposed Development include:

- Aviation lighting limited to five turbines (T5, T6, T9, T12 and T13);
- Reduction from 2000 cd to 200 cd in good conditions (when meteorological visibilities greater than 5 km); and
- No mid mast lights.

3.3 Light Unit Design and Controls

In addition to reducing the number of aviation lights required and reducing the extent of their theoretical visibility through layout design, consideration has been made as to the design of the aviation lighting unit itself. Aviation lighting manufacturers are now producing lights with tightly controlled focusing. It is anticipated that the Proposed Development will use a lighting unit that is designed to produce a narrow, focused beam of light, with the greatest intensity between 0 and 3 degrees relative to the level of the light. This will help to avoid skyglow effects experienced with other types of lighting, such as older types of street lighting, and also reduces downward light spill. The result of this is that the light intensity quickly reduces at lower vertical angles relative to the position of the lights. The following diagram provides an illustration of the typical reduction in intensity at different angles based on a focused medium intensity aviation light (CEL-WT-MIC²) produced by a leading manufacturer.

Diagram 1 Illustration of the typical reduction in intensity at different angles



The Proposed Development is located within the upland landscape to the west of the Dornoch Firth. The surrounding landscape and visual receptors vary between those to the west of the Proposed Development, at a relatively higher level associated with the mountains and hills, and those receptors on the surrounding lowland, which represents the majority of the visual receptors and locations where people are more likely to frequent in hours of darkness. The lighting intensity ZTV (**Figure 6.10**) indicates that from many locations within the detailed 20 km study area where the lighting will be visible, the apparent intensity of the lights will be much reduced. To provide an example, at Viewpoint 2: Strath Rusdale, the vertical angle from the proposed aviation lighting will be approximately three degrees below the horizontal (i.e. -3°), resulting in a reduced lighting intensity of approximately 220 cd, when operating at peak intensity and 22 cd in the lower intensity mode. These values do not take into account the distance and atmospheric filtering between the light and the viewpoint location, and therefore in reality the intensity of lighting experienced at that location will be further reduced. Furthermore, Viewpoint 2 is located approximately 7.8 km from the nearest lit turbine and as such the lights will generally be seen only during good weather conditions when they are in the lower intensity setting.

The proposed lighting will be fitted with sensors to monitor the surrounding atmospheric conditions. When good conditions (visibility greater than 5 km in all directions) are present the lighting will automatically switch to a lower intensity mode, 10% of the peak intensity, in line with CAA policy guidance. This will mean that in periods of good visibility the intensity of the lighting, and therefore potential landscape and visual effects, will be reduced. In poor atmospheric conditions, when visibility is less than 5 km from the hub of a turbine, the lighting will be in the higher intensity mode. However, in this scenario the lighting will often be at least partially obscured, particularly from locations greater than 5 km.

4. Assessment Methodology

The assessment of hours of darkness landscape and visual effects resulting from the proposed aviation lighting follows the same key steps as that of daylight hours assessment (see **Appendix 6.1**), considering the value and susceptibility, sensitivity and magnitude, leading to an overall judgement of the level and significance of effects. However, it is important to note that the hours of darkness sensitivity of the receptors are likely to vary from that experienced during daylight hours. The assessment methodology also takes into account relevant NatureScot guidance on Aviation Lighting Impact Assessment (NatureScot, 2024).

Many of the factors such as scale, distance, duration and extent remain relevant, although in the hours of darkness assessment is focused solely on the visible aviation lighting rather than the wind turbines which will be less apparent.

4.1 Landscape Character - Sensitivity

For landscape receptors, as for daylight hours, landscape value is addressed by reference to international, national, regional, and local designations, although this extends to designation or recognition for dark sky qualities during hours of darkness. It is considered that various physical attributes of the landscape contribute less to the landscape value during hours of darkness as they will not be apparent. Therefore, the factors that are most important in determining landscape value, as referenced from the list of factors within the published Landscape Institute's Technical Guidance Note 02/21 (Landscape Institute, 2021), are considered to be the following:

- *"Recreational - Landscape offering recreational opportunities where experience of landscape is important";*
- *"Perceptual (scenic) - Landscape that appeals to the senses, primarily the visual sense"*; and
- *Perceptual (wildness and tranquillity) - Landscape with a strong perceptual value notably wildness, tranquillity and/or dark skies".*

Landscape susceptibility, which relates to the ability of a particular landscape to accommodate the Proposed Development, is considered to differ during hours of darkness. The following baseline characteristic considerations are regarded as being the most important:

- Scale – a measure of how well a proposed development will relate to the overall scale of the landscape, landform and/or landscape features;
- Landform – the extent to which a proposed development will relate to and/or integrate with the existing landform and topographic features;
- Openness/enclosure – the level of which the openness or enclosure of a landscape will influence the ability of a landscape to accommodate a proposed development;

- Development context – the level to which existing similar development within a landscape influences the ability to accommodate a proposed development; and
- Perceptual qualities (remoteness, tranquillity, dark skies etc.) – extent to which existing perceptual qualities will influence the ability of the landscape to accommodate the proposed development.

Table 1 below sets out the considerations in relation to landscape sensitivity during hours of darkness.

Table 1: Sensitivity of Landscape Receptors During Hours of Darkness

	Higher Sensitivity Indicators	Lower Sensitivity Indicators
Value	A nationally designated landscape and/or a landscape with recognised dark sky qualities, very high recreational opportunities, and with very strong perceptual aspects.	An undesignated landscape and/or landscape containing limited or no dark sky qualities, influence from existing light sources and limited recreational opportunities.
Susceptibility	Attributes that make up the character of the landscape which offer very limited or no opportunities to accommodate change of the type proposed without fundamentally altering key characteristics.	Attributes that make up the character of the landscape which are tolerant of extensive change of the type proposed without fundamentally altering the existing characteristics.

4.2 Visual Amenity – Sensitivity

Certain aspects which contribute to daylight hours value of the view, such as the composition and its scenic quality, are generally less relevant to hours of darkness when the detail and features within the view are less apparent. The popularity of a viewpoint during the daylight hours may also be very different to hours of darkness. Value of the view within hours of darkness therefore focuses on provision of facilities and/or recognition specific to hours of darkness enjoyment, for example through identification as a dark sky discovery site.

Visual susceptibility, which is largely a function of the activity of the receptors and the extent to which their attention is focused on the view, is also likely to vary between daylight hours and hours of darkness conditions. In some cases, for example residents in their home, susceptibility will remain broadly similar between daylight hours and hours of darkness. Those undertaking activities which require darkness, such as stargazing will be of higher susceptibility. Whereas, for other types of receptors, such as those travelling by road or ferry, views within hours of darkness are likely to be less important than in daylight hours conditions, reducing the susceptibility to change. **Table 2** below sets out the considerations in relation to visual sensitivity during hours of darkness.

Table 2: Sensitivity of Visual Receptors During Hours of Darkness

	Higher Sensitivity Indicators	Lower Sensitivity Indicators
Value	Views from recognised and/or promoted dark sky viewing locations, such as a Dark Sky Discovery Site*.	View at hours of darkness heavily influenced or defined by existing light sources with little or no appreciation of the hours of darkness sky.
Susceptibility	Receptors at locations where the hours of darkness view is of primary importance, such as those stargazing at Dark Sky Discovery Sites.	Receptors for which the hours of darkness view is irrelevant and entirely unrelated to the purpose of being at that location and / or the existing view is influenced to a high degree by lighting.

* Dark Sky Discovery Sites are "*a nationwide network of places that provide great views and which are accessible to everyone. They have been nominated by local groups and organisations as their top local spot to see the stars*" (Dark Sky Discovery, 2025).

4.3 Magnitude of Effect

In relation to magnitude of effect, many of the factors such as distance, duration and extent remain relevant, although, in the hours of darkness, assessment is focused solely on the aviation lighting rather than the wind turbines which will be less apparent. The degree of contrast or integration also remains relevant. However, it is evaluated in relation to the level and nature of existing light sources present within the view or perceptible, rather than other features which may contribute to the composition of the view or perception of landscape character during the daylight hours but are not readily apparent or perceptible within hours of darkness.

Weather can also have a strong influence on the impression of change resulting from aviation lighting. In addition, the time of year influences the likelihood of experiencing dark skies and hence lighting effects, with fewer hours of darkness and hence aviation lighting, in summer.

The proposed lighting will be fitted with sensors to monitor the surrounding atmospheric conditions. When fair conditions (visibility greater than 5 km in all directions) are present the lighting will automatically switch to a lower intensity mode, 10% of the peak intensity, in line with CAA policy guidance.

It is also important to note that appreciation of hours of darkness views, and particularly those relating to dark skies, is greatest in fair weather conditions with the absence of clouds. In these conditions the proposed aviation lighting will operate within the lower intensity mode, reducing the impression of change. This will be similar for views of sunset, although in these conditions contrast of the aviation lighting with the background will also be reduced, further limiting the impression of change.

5. Scope of Aviation Lighting Assessment

This assessment focuses on potential significant landscape and visual effects resulting from the aviation lighting on the proposed wind turbines. The assessment takes a targeted approach focused on landscape receptors and viewpoints within the detailed 20 km study area and based on the following scope agreed in consultation with NS and THC:

- Appraisal of landscape receptors with the potential for hours of darkness significant effects, when considering their key characteristics related to dark skies and including potential for cumulative effects;
- Detailed assessment (including cumulative) for three 'hours of darkness' viewpoints (Viewpoints 2, 7 and 10); and
- Appraisal of remaining viewpoints within 20 km of the Proposed Development with potential for hours of darkness significant effects.

The cumulative assessment follows the same approach and three scenario as in the main assessment, with further details provided in **Appendix 6.1: Landscape and Visual Methodology**

The assessment on hours of darkness for the Dornoch Firth National Scenic Area (NSA) and Rhiddoroch - Beinn Dearg - Ben Wyvis Wild Land Area (WLA) is contained within **Appendix 6.3: National Scenic Area Special Landscape Quality Assessment** and **Appendix 6.4: Wild Land Assessment** respectively.

A range of factors, including distance, atmospheric conditions, intensity of lights and the vertical angle of the view influence the potential effects of visible lights. As set out in **Chapter 6: Landscape and Visual**, the hours of darkness assessment is undertaken on the basis of excellent visibility conditions and the aviation lighting operating at 200cd, taking account of the identified embedded mitigation relating to intensity modes. This approach is in line with that recommended by NatureScot guidance (NatureScot, 2024).

This assessment focuses on potential effects during the operation stage of the Proposed Development when the wind turbines will be in place and aviation lighting operational. Any effects from lighting during construction (and decommissioning) will be temporary in nature and of a short duration and as such will not be significant and therefore have not been considered further in this assessment.

6. Baseline of Receptors

6.1 Landscape Receptors

The landscape designations included within the assessment are set out as follows in **Table 3** with key characteristics highlighted relating to perceptual qualities, dark skies and intervisibility and hours of darkness value, susceptibility and sensitivity. The locations of the landscape designations are shown on **Figure 6.3a** and **Figure 6.3b**. Although Novar GDL is located within the detailed 20 km study area, it is outside the extent of the ZTV and has therefore been excluded from further assessment.

Table 3: Landscape Designations in relation to Aviation Lighting

Landscape Receptor	Relevant key characteristics to landscape designation hours of darkness assessment	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
Ardross Castle GDL	• Designed landscape with scenic features; • The principal designed vista is eastwards from the castle, although with open panoramic views to the west and south available from the castle terrace; and • Existing localised influence of lights from settlement within and adjacent to GDL.	Many of the characteristics contributing to the value of the GDL will be less perceptible during hours of darkness. Some scenic qualities associated with views will remain. The hours of darkness value is considered to reduce to **high**.	The susceptibility will reduce to **medium** as many factors will be less apparent during hours of darkness and the wooded nature of the GDL will provide some containment during hours of darkness.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.
Skibo Castle GDL	• Designed landscape with scenic features; • Views from Skibo Castle are described to the south across the parks and the Firth to the hills beyond as well as views across the Ross-shire hills to the west; and • Existing influence of lights from settlement and development within the GDL and from traffic on adjacent/ nearby roads.	Many of the characteristics contributing to the value of the GDL will be less perceptible during hours of darkness. Some scenic qualities associated with views will remain. The hours of darkness value is considered to reduce to **high**.	The susceptibility will reduce to **medium** as many factors will be less apparent during hours of darkness and the wooded nature of the GDL will provide some containment during hours of darkness.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.
Fannichs, Beinn Dearg and	• "*The wide extent of the mountain ranges, limited access routes, rough ground and uninhabited*	The SLA will continue to comprise a locally strong sense of wildness and	The susceptibility will remain at **high** during	Taking into account value judgements and susceptibility to

Landscape Receptor	Relevant key characteristics to landscape designation hours of darkness assessment	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
Glencalvie SLA	*character combine to create a great sense of wildness within an expansive, mountain vastness;* • *The dominant characteristic over most of the area is open, heather and grassland slopes interspersed with areas of scree, boulders and rocky outcrops;* • *Creates a strongly defined character significantly different from the overriding landscape character of the area; and* • *Small areas of clear human habitation, vast areas where there is none".*	tranquillity with limited human influence. The hours of darkness value is considered to remain at **very high**.	hours of darkness as the most important factors are still largely relevant.	change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.
Ben Wyvis SLA	• *"Ben Wyvis stands in an isolated position, forming a dominant 'whaleback'-shaped landmark in the landscape, especially when viewed from the south; and* • *Existing plantations appear incongruous in the surrounding landscape, especially when seen from the mountain top, due to their contrast of colour, shape, line and texture. Collectively, these seem to almost encircle the mountain".*	The SLA will continue to comprise perceptual qualities with limited direct human influence during hours of darkness. The hours of darkness value is considered to remain at **very high**.	The susceptibility will remain at **medium** during hours of darkness due to existing influence from a range of external light sources.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.

▪

The LCTs included within the hours of darkness appraisal are set out in **Table 4** with key characteristics highlighted relating to perceptual qualities, dark skies and intervisibility and hours of darkness value, susceptibility and sensitivity. The locations of the LCTs are shown on **Figure 6.4a** and **Figure 6.4b**.

As within the main assessment, the scope of which is detailed within **Chapter 6: Landscape and Visual**, the following LCTs have been scoped out due to very little or no intervisibility with the Proposed Development and specifically the proposed aviation lighting:

- LCT 140: Sandy Beaches and Dunes;
- LCT 331: Rounded Rocky Hills - Ross & Cromarty;
- LCT 343: Coastal Shelf;
- LCT 345: Farmed and Forested Slopes - Ross & Cromarty; and
- LCT 347: Open Steep Farmed Slopes.

Table 4: Landscape Receptors in relation to Aviation Lighting

Landscape Receptor	Relevant key characteristics to LCT hours of darkness appraisal	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
LCT 329: Rounded Mountain Massif	• *"Limited settlement, few footpaths or other structures, and little evidence of historic or current land use";* • *"Far reaching views from upper reaches to the mountains, plains and firths in adjacent areas"; and* • *"Wild character over much of the area".*	The LCT will continue to comprise a local strong sense of wildness and tranquillity although with some influence from existing light sources. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **high**.	The susceptibility will remain at **medium** during hours of darkness as the most important factors are still relevant.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.
LCT 330: Rounded Hills and Moorland Slopes - Ross & Cromarty	• *"Man-made structures of pylons, wind farms and reservoirs occur as occasional features within a large scale landscape"; and* • *"Large, remote interior areas of vast scale with wildness characteristics".*	The LCT will continue to exhibit local aspects of wildness and tranquillity although with some influence from existing light sources. The hours of darkness value of this LCT in the detailed 20	The susceptibility will remain at **medium** during hours of darkness as the most important factors are still relevant, although with some	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **medium**.

Landscape Receptor	Relevant key characteristics to LCT hours of darkness appraisal	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
		km study area is considered to remain at **medium** as some of the man-made structures may not be as perceptible during hours of darkness.	alteration from existing light sources.	
LCT 135: Rounded Hills - Caithness & Sutherland	• "*Scarcely settled with a largely uninhabited interior and widely scattered crofts and farms on lower slopes adjoining straths and farmed landscapes;* • *Wind farms located in more accessible and generally lower rolling hills, either close to extensive forestry or the high voltage transmission line aligned broadly parallel to the south-east Sutherland coast;* • *Views into the interior of the hills very restricted; and* • *Strong sense of wild character can be experienced within the more remote and little modified parts of this landscape".*	The LCT will continue to exhibit local wildness characteristics with the scenic quality somewhat reduced due to detracting elements. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain **medium**.	The susceptibility will remain at **medium** during hours of darkness as the most important factors are still relevant, although with some alteration from existing light sources.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **medium**.
LCT 139: Rugged Mountain Massif - Caithness & Sutherland	• *"Largely uninhabited and difficult to access. The small number of settlements and roads which do exist tend to be located at the edges of this character type and at the intersection of a strath or loch;* • *Limited visibility within the glens which lie between or at the foot of these mountains, due to their steepness of slope and immense size;* • *Extensive views of the surrounding landscape and*	The LCT will retain a locally strong wild character and with scenic qualities. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **very high**.	The susceptibility will remain at **high** during hours of darkness as the most important factors are still relevant.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.

Landscape Receptor	Relevant key characteristics to LCT hours of darkness appraisal	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	an exhilarating experience of openness and exposure from mountain ridges and summits; and • *Natural unmodified character of the high mountains, with their remoteness, ruggedness, and difficulty of access, creating a strong wild character."*			
LCT 142: Strath - Caithness & Sutherland	• "*Settlement generally denser within the lower reaches of many straths, especially at bridging points, on the coast and close to major roads;* • *Focus in views from roads provided by a number of estate shooting lodges, and clustered, predominantly 19th Century, often estate style buildings. Narrow roads, commonly aligned along the edge of the floodplain, from which views are strongly channelled by the side slopes;* • *Rounded Hills often forming prominent edges to the straths with shapely well-defined hills, providing a distinctive skyline and scenic backdrop; and* • *Highly scenic backdrop of mountains often revealed in some of the upper reaches of these straths".*	The scenic qualities and sense of identity of the LCT will be less perceptible during hours of darkness. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **medium**.	The susceptibility will reduce to **medium** as many of the key characteristics will be less perceptible during hours of darkness, including the relationship between the scenic landscape backdrop and the LCT.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **medium**.
LCT 145: Farmed and Forested Slopes with Crofting	• *"Density of housing increasing close to the larger settlements;* • *Semi-enclosed character of this well-wooded landscape with occasional views; and* • *Attractive views from small roads high up the slopes, giving views to the Rounded*	The LCT will remain to have some scenic quality but with limited dark sky attributes. The hours of darkness value of this LCT in the detailed 20	The susceptibility will reduce to **medium** during hours of darkness with factors less apparent or altered by	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of

Landscape Receptor	Relevant key characteristics to LCT hours of darkness appraisal	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	Hills – Caithness & Sutherland and glimpses of the Dornoch Firth".	km study area is considered to remain at **medium**.	existing light sources.	darkness is considered to be **medium**.
LCT 146: Coastal Farmland & Woodlands	• "*Dispersed farms throughout the area and occasional clusters of crofts…; and* • *High visibility from the east coast railway and coastal trunk roads, as well as the network of other roads which cross this area".*	The LCT will remain to have some scenic quality but with limited dark sky attributes. The hours of darkness value of this LCT in the detailed 20 km study area is considered to reduce to **medium**.	The susceptibility will reduce to **medium** during hours of darkness with factors less apparent or altered by existing light sources.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **medium**.
LCT 328: Rugged Mountain Massif - Ross & Cromarty	• *"Little settlement, few roads or other structures, and little evidence of historic or current land use; and* • *Wild character derived from the natural, rugged and remote landscape."*	The LCT is considered to retain local wildness, scenic and tranquillity values. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **very high**.	The susceptibility will remain at **high** during hours of darkness as the most important factors are still relevant.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **high**.
LCT 339: Inland Strath	• "*Contrast with surrounding exposed, uninhabited, upland moorland and hills, and the more intensely farmed or settled areas beyond the lower end of the strath; and* • *Confined views which direct attention towards the foreground details on the surrounding slopes and enclosing skyline".*	The LCT will retain perceptual attributes relating to tranquillity and with some local dark sky qualities. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **medium**.	The susceptibility will reduce to **medium** during hours of darkness as the relationship with the surrounding landscape is less pronounced during hours of darkness.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **medium**.

Landscape Receptor	Relevant key characteristics to LCT hours of darkness appraisal	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
LCT 341: Forest Edge Farming	• "*Tree cover creates enclosed or intermittent distant views and helps to screen structures such as pylons and masts; and* • *Far reaching views to the south and east from high ground or open areas, often framed and enhanced by foreground trees*"	The LCT will continue to exhibit scenic quality but with limited or no dark sky attributes. The hours of darkness value of this LCT in the detailed 20 km study area is considered to reduce to **low**.	The susceptibility will reduce to **low** during hours of darkness due to influence of existing light sources.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **low**.
LCT 346: Open Farmed Slopes	• "*Scattered settlement patterns and network of minor roads running along contour lines, with few groupings in villages or towns; and* • *Ever present views which are open, expansive and outward looking".*	The LCT will retain some scenic quality but with limited or no dark sky attributes. The hours of darkness value of this LCT in the detailed 20 km study area is considered to remain at **low**.	The susceptibility will reduce to **low** during hours of darkness due to influence of existing light sources.	Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character during hours of darkness is considered to be **low**.

Due to similarities between key characteristics between LCTs and potential intervisibility with aviation lighting, the following LCTs are grouped in the hours of darkness assessment:

- LCT 329: Rounded Mountain Massif and LCT 330: Rounded Hills and Moorland Slopes - Ross & Cromarty, and LCT 135: Rounded Hills - Caithness & Sutherland. The landscape sensitivity during hours of darkness for these LCTs will be **medium to high**;
- LCT 139: Rugged Mountain Massif - Caithness & Sutherland, and LCT 328: Rugged Mountain Massif - Ross & Cromarty. The landscape sensitivity during hours of darkness for these LCTs will be **high**;
- LCT 145: Farmed and Forested Slopes with Crofting and LCT 146: Coastal Farmland & Woodlands. The landscape sensitivity during hours of darkness for these LCTs will be **medium**; and
- LCT 341: Forest Edge Farming and LCT 346: Open Farmed Slopes. The landscape sensitivity during hours of darkness for these LCTs will be **low**.

The remaining LCTs are assessed individually.

6.2 Visual Receptors

The assessment includes three 'hours of darkness' viewpoints (Viewpoints 2, 7 and 10) and an appraisal of the remaining viewpoints with the potential for hours of darkness significant effects within 20 km of the Proposed Development. This approach has been agreed with NS and THC.

There will be no visibility of the aviation lighting from Viewpoint 5 and 12 due to screening by intervening topography and as such they have not be considered further in this assessment.

The viewpoints are shown on **Figures 6.6a, 6.6b, 6.7a and 6.7b**. The visual receptors included within the assessment and appraisal are set out as follows in **Table 5** with a baseline description and hours of darkness value, susceptibility and sensitivity.

Table 5: Visual Receptors in Relation to Aviation Lighting

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
Scoped into hours of darkness viewpoint assessment				
Viewpoint 2	This viewpoint is located within the residential area of Strath Rusdale. There are relatively open views from this location along the strath with views more restricted to the north-east and south-west by the wider upland and hills. Within hours of darkness, the view is generally dark with low levels of lighting from small windows in several residential properties and occasional vehicle lights along the unnamed road in the strath at a low elevation. The cumulative baseline comprises no additional aviation lighting of cumulative schemes in Scenarios 1 and 2. For Scenario 3, the aviation lights of Ceislein Wind Farm will be visible.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	The viewpoint is representative of residential receptors which lowers the hours of darkness susceptibility to **medium** due to baseline lighting in residential properties.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 7	This viewpoint is located to the east of Bonar Bridge, within the Dornoch Firth NSA and at an elevated part of the settlement. There are relatively open views which are focused on the Dornoch Firth to the south and are enclosed by the wider upland and hills. Within hours of darkness, the view is influenced by	Due to the existing light sources in the view, there is little appreciation of hours of darkness views. The	The viewpoint is representative of residential receptors which lowers the hours of darkness susceptibility	Taking into account value judgements and susceptibility to change, overall

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	various lighting sources from nearby residential properties and vehicle lights along the road network including the A949. The cumulative baseline comprises no additional aviation lighting of cumulative schemes in Scenarios 1, 2 and 3.	value of the hours of darkness viewpoint is considered to be **low**.	to **medium** due to baseline lighting in residential properties.	sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 10	This viewpoint is located along the B9163 on the Black Isle. There are relatively open views across to the uplands and mountains in the background of the view and partially screened views across the Cromarty Firth to the adjacent lowland. Within hours of darkness, the view is influenced by various lighting sources from residential properties, street lighting, the road network, including in close proximity along the B9163 and from lighting on structures within the Cromarty Firth. The cumulative baseline comprises visible aviation lighting from Strathrory for each scenario, Carn Fearna for scenarios 2 and 3 (although largely screened by intervening vegetation), and Ceislein Wind Farm for Scenario 3.	Due to the existing light sources in the view, there is little appreciation of hours of darkness views. The value of the hours of darkness viewpoint is considered to be **low**.	The viewpoint is representative of residential receptors which lowers the hours of darkness susceptibility to **medium** due to baseline lighting in residential properties.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **low**.
Scoped into hours of darkness viewpoint appraisal				
Viewpoint 1	This viewpoint is located on the hill summit of Carn Chuinneag. From the summit and elevated mountainous areas, receptors typically experience long-distance panoramic views that are primarily focused on the surrounding landscape with minimal screening. Within hours of darkness, the view will be dark with no artificial lighting within the immediate area. Skyglow and distant light sources, including those from existing wind farms, will be visible on the horizon. Due to the inaccessibility and remoteness of the viewpoint location,	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	The viewpoint is representative of recreational receptors therefore if present during hours of darkness, the focus is considered to be to appreciate hours of	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	there are likely to be few recreational receptors during the hours of darkness.		darkness views. The susceptibility of the hours of darkness viewpoint is considered to be **high**.	darkness is considered to be **medium**.
Viewpoint 3	This viewpoint is located on an unnamed road on the edge of Ardross Castle GDL. There are relatively open views towards the strath landscape in the background to the north-west. Within hours of darkness, the view will have limited sources of artificial lighting, limited to scattered residential properties and vehicles on minor roads.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium.**	The viewpoint is representative of residential receptors which lowers the hours of darkness susceptibility to **medium** due to baseline lighting in residential properties.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 4	This viewpoint is located at the Cnoc Fyrish monument. There are wide panoramic open views in all directions. Within hours of darkness, there will be no light sources in the immediate area. However, skyglow and a range of light sources will be present and have a strong influence on views particularly to the south and east.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium.**	The viewpoint is representative of recreational receptors therefore if present during hours of darkness, the focus is considered to be to appreciate hours of darkness views. The susceptibility of the hours of darkness viewpoint is	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
			considered to be **high**.	
Viewpoint 6	This viewpoint is located on the hill summit of Beinn a' Chaisteil. From the summit and elevated uplands, receptors typically experience far reaching panoramic views that are primarily focused on the surrounding landscape with minimal screening. Within hours of darkness, the view will be dark with no artificial lighting within the immediate area. Skyglow and distant light sources, including those from existing wind farms, will be visible in the background of the view. Due to the inaccessibility and remoteness of the viewpoint location, there are likely to be few recreational receptors during the hours of darkness.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	The viewpoint is representative of recreational receptors therefore if present during hours of darkness, the focus is considered to be to appreciate hours of darkness views. The susceptibility of the hours of darkness viewpoint is considered to be **high**.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 8	The viewpoint is located along the A949 at Creich Cemetery. The views are generally open and focused along the firth with the rounded hills and distant mountain peaks enclosing the view. Within hours of darkness, the view will be generally dark with low levels of lighting from small windows in a nearby residential property, although with stronger influence from traffic on the adjacent A949. Skyglow and distant lighting will be visible at lower elevations along the opposite side of the Dornoch Firth at the settlements of Ardgay and scattered properties at Kincardine and along the A836.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	The hours of darkness view is important but not the primary focus. The susceptibility of the hours of darkness viewpoint is considered to be **medium**.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 9	The viewpoint is located on the hill summit of Ben Wyvis. From the summit and elevated uplands, receptors typically experience far reaching panoramic views	There is a good potential to appreciate the night sky	The viewpoint is representative of recreational	Taking into account value judgements

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	that are primarily focused on the surrounding landscape with minimal screening. Within hours of darkness, the view will be dark with no artificial lighting within the immediate area. Skyglow and a range of distant light sources, including those from existing wind farms, will be visible in the background of the view. Due to the inaccessibility and remoteness of the viewpoint location, there are likely to be few recreational receptors during the hours of darkness.	from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	receptors therefore if present during hours of darkness, the focus is considered to be to appreciate hours of darkness views. The susceptibility of the hours of darkness viewpoint is considered to be **high**.	and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 11	The viewpoint is located near to the hill summit on the approach to Carn Ban. The views are panoramic and far reaching to the south and east and more enclosed by landform to the north and south-west. Within hours of darkness, the view will be dark with no artificial lighting within the immediate area. Skyglow and distant light sources, including those from existing wind farms, will be visible on the horizon and within the uplands to the south. Due to the inaccessibility and remoteness of the viewpoint location, there are likely to be few recreational receptors during the hours of darkness.	There is a good potential to appreciate the night sky from this location. The value of the hours of darkness viewpoint is considered to be **medium**.	The viewpoint is representative of recreational receptors therefore if present during hours of darkness, the focus is considered to be to appreciate hours of darkness views. The susceptibility of the hours of darkness viewpoint is considered to be **high**.	Taking into account value judgements and susceptibility to change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.
Viewpoint 13	The viewpoint is located on the A949 on the boundary of Skibo Castle. The view is generally wide and open and focused across the Dornoch Firth. Within hours of darkness, the view will be generally dark with low level lighting from	There is a good potential to appreciate the night sky from this location. The value of the	The hours of darkness view is important but not the primary focus. The susceptibility	Taking into account value judgements and susceptibility to

Visual Receptor	Viewpoint baseline hours of darkness description	Hours of darkness value	Hours of darkness susceptibility	Hours of darkness sensitivity
	a nearby residential property, and greater influence from vehicle lights on the A949. Distant lighting sources associated with scattered properties and roads to the south of the firth and skyglow are likely to influence the hours of darkness views.	hours of darkness viewpoint is considered to be **medium**.	of the hours of darkness viewpoint is considered to be **medium**.	change, overall sensitivity of the visual amenity during hours of darkness is considered to be **medium**.

Due to similarities between the baseline and potential intervisibility with aviation lighting, the following viewpoints have been grouped in the appraisal:

- Viewpoints 4, 6, 9 and 11. The visual sensitivity during hours of darkness for these viewpoints will be **medium**; and
- Viewpoints 8 and 13. The visual sensitivity during hours of darkness for these viewpoints will be **medium**.

Viewpoint 1 and Viewpoint 3 are appraised separately.

7. Potential Intervisibility with Proposed Aviation Lighting

Table 6, below, provides details of the number of lights, if any, that are potentially visible from each of the landscape and visual receptors scoped into the hours of darkness assessment. The Dornoch Firth NSA and Rhiddoroch – Beinn Dearg – Ben Wyvis WLA are included but the hours of darkness assessments should be referred to in **Appendix 6.3: National Scenic Area Special Landscape Quality Assessment** and **Appendix 6.4: Wild Land Assessment** respectively. 'X' indicates that a light is theoretically visible. It should be noted that this may be further limited by intervening vegetation including forestry cover in the landscape. The stated distance for each receptor refers to the distance to the nearest turbine with a light, irrespective of its potential visibility.

Table 6: Potential Visibility of Aviation Lighting of Assessment Receptors

Receptor (and distance)	Turbine Number (and maximum tip height)				
	T5 200m	T6 200m	T9 200m	T12 180m	T13 180m
Rhiddoroch - Beinn Dearg - Ben Wyvis WLA	X	X	X	X	X

Receptor (and distance)	Turbine Number (and maximum tip height)				
	T5 200m	T6 200m	T9 200m	T12 180m	T13 180m
(turbine with aviation lighting within)					
Dornoch Firth NSA (9.15 km)	X	X	X	X	X
Ardross Castle GDL (8.93 km)	X	-	X	X	X
Skibo Castle GDL (18.66 km)	X	X	X	X	-
Fannichs, Beinn Dearg and Glencalvie SLA (1.24 km)	X	X	X	X	X
Ben Wyvis SLA (8.35 km)	X	X	X	X	X
LCT 329: Rounded Mountain Massif (turbine with aviation lighting within)	X	X	X	X	X
LCT 330: Rounded Hills and Moorland Slopes - Ross & Cromarty (turbine with aviation lighting within)	X	X	X	X	X
LCT 135: Rounded Hills - Caithness & Sutherland (2.03 km)	X	X	X	X	X
LCT 139: Rugged Mountain Massif - Caithness & Sutherland (1.33 km)	X	X	X	X	X
LCT 142: Strath - Caithness & Sutherland (7.55 km)	X	X	X	X	X
LCT 145: Farmed and Forested Slopes with Crofting (9.83 km)	X	X	X	X	X
LCT 146: Coastal Farmland & Woodlands (15.84 km)	X	X	X	X	X
LCT 328: Rugged Mountain Massif - Ross & Cromarty (13.04 km)	X	X	X	X	X
LCT 339: Inland Strath (3.46 km)	-	-	X	X	X
LCT 341: Forest Edge Farming (6.68 km)	X	X	X	X	X
LCT 346: Open Farmed Slopes (19.39 km)	X	X	X	X	X

Receptor (and distance)	Turbine Number (and maximum tip height)				
	T5 200m	T6 200m	T9 200m	T12 180m	T13 180m
Viewpoint 1: Carn Chuinneag (1.57 km)	X	X	X	X	X
Viewpoint 2: Strath Rusdale (7.77 km)	-	-	X	X	X
Viewpoint 3: Boath Road near Lealty Lodge (9.85 km)	-	-	X	X	X
Viewpoint 4: Cnoc Fyrish (13.31 km)	X	X	X	X	X
Viewpoint 6: Beinn a' Chaisteil (13.26 km)	-	X	X	X	X
Viewpoint 7: Bonar Bridge, Migdale Hospital (12.87 km)	-	-	-	X	X
Viewpoint 8: Creich Cemetery off the A949 (12.70 km)	-	-	X	-	-
Viewpoint 9: Ben Wyvis (14.43 km)	X	X	X	X	X
Viewpoint 10: B9163 near Resolis and Balblair (21.16 km)	X	X	X	X	X
Viewpoint 11: Approach to Carn Ban (16.67 km)	-	-	-	-	X
Viewpoint 13: A949 near Ospisdale (20.10 km)	X	X	X	-	-

8. Assessment of Hours of Darkness Effects

8.1 Assessment on Landscape Receptors

The landscape effects on receptors resulting from the Proposed Development aviation lighting are set out below. This also includes the consideration of cumulative effects. The assessment takes into account the embedded mitigation measures described in **Chapter 6: Landscape and Visual**.

Table 7: Assessment of Landscape Receptors in relation to Aviation Lighting

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
Ardross Castle GDL	High	Proposed Development The aviation lighting ZTV (**Figure 6.9**) indicates potential for indirect change from the southern part of the GDL during the hours of darkness. However, the extent of potential change is likely to be more limited than indicated due to screening by mature vegetation within and adjacent to the GDL.. The aviation lighting will be perceptible in some outward views from a limited part of the GDL. The lighting will not be perceptible from the central part of the GDL around the castle and will not affect the principal views to the south and east. Key characteristics including the physical attributes of the GDL will not be influenced during hours of darkness. The magnitude of effect is considered to be **very low**. Cumulative Within all three cumulative scenarios, the aviation lighting for the cumulative schemes will be theoretically visible from parts of the GDL. Screening by mature vegetation within and adjacent to the GDL is likely to reduce the extent of potential influence. In scenario 3 aviation lighting on Ceislein will be visible from the central part of the GDL around the castle and will partially affect views south. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will slightly increase the perception of external light sources from the southern part of the GDL. This will be limited in part due to the woodland cover within the GDL, with no visibility of the aviation lighting from the central part of the GDL around Ardross Castle. The addition of the Proposed Development will have a slight influence on outward views from the GDL, but the majority of other characteristics and the majority of the GDL will not be affected.	Proposed Development The significance of effect is considered to be **negligible adverse** (not significant). Cumulative The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **negligible adverse** (not significant).

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		The magnitude of effect is considered to be **very low**.	
Skibo Castle GDL	High	Proposed Development The aviation lighting ZTV (**Figure 6.9**) indicates potential for indirect change within the central and northern parts of the GDL, although this is likely to be limited by mature vegetation cover within the GDL. The aviation lighting will be visible in some far-reaching outward views from the GDL, although will be minor distant features within the surrounding large-scale landscape. Other key characteristics including the physical attributes of the GDL will not be influenced during hours of darkness. The magnitude of effect is considered to be **very low**.Cumulative Within all three cumulative scenarios, aviation lighting for cumulative schemes will be theoretically visible from much of the GDL, although this is likely to be locally limited by mature vegetation cover within the GDL. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will provide additional influence of aviation lighting in the central and northern parts of the GDL. However this will be very limited in part due to the offset distance and the woodland cover within the GDL including from the central area around the castle. There will be very small geographical areas with new visibility of aviation lighting. This will have a limited influence on outward views from the GDL in hours of darkness, experienced in the context of existing light sources and with the majority of other characteristics unaffected. The magnitude of effect is considered to be **very low**.	Proposed Development The significance of effect is considered to be **negligible adverse** (not significant). Cumulative The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **negligible adverse** (not significant).
Fannichs, Beinn Dearg and	High	Proposed Development During the hours of darkness, the aviation lighting will be theoretically visible from small geographical areas within the SLA.	Proposed Development The significance of effect is considered to

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
Glencalvie SLA		This will be removed in part, including around the Amat Forest area, due to vegetation cover within the SLA. The aviation lighting will be often be experienced in the context of existing aviation lighting on wind turbines and other light sources within the surrounding landscape. The limited geographical extent of potential influence and the existing context will lessen change on the perceptual characteristics of the SLA. There will be no change to physical attributes or the majority of perceptual attributes that contribute to the SLA. The magnitude of effect is considered to be **low**. <u>Cumulative</u> For Scenario 1, aviation lighting for cumulative schemes will be perceptible across the higher parts of the SLA, including the landscapes around and summits of Beinn Tharsuinn and Carn Ban. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will locally increase the geographical area of theoretical visibility of aviation lighting across small parts of the SLA. This will be small in comparison to the extent of perceptibility of cumulative schemes. The ZTV indicates the addition of the Proposed Development will introduce an area of new visibility of aviation lighting around the Amat Forest. However, this is likely to be limited due to vegetation cover and distance. The addition of the Proposed Development will result in a very limited and localised additional change with little influence on perceptual attributes and no change to many of the other characteristics. The magnitude of effect is considered to be **very low**. For Scenarios 2 and 3, the cumulative baseline scenario will be very similar to that at Scenario 1 with slightly more	be **minor adverse** (not significant). <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **negligible adverse** (not significant).

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		perception of cumulative schemes. This is not considered to alter the baseline sufficiently to alter the conclusions, therefore the magnitude of effect is considered to be **very low**.	
Ben Wyvis SLA	High	<u>Proposed Development</u> During the hours of darkness, the aviation lighting will be theoretically visible from small geographical areas within the SLA. This will be experienced in the context of existing influence from a range of existing light sources, including aviation lights, within the surrounding landscape. The limited geographical area experiencing potential visibility, the offset distance and this context will lessen influence on the perceptual characteristics of the SLA. There will be no change to physical attributes or the majority of perceptual attributes that contribute to the SLA. The magnitude of effect is considered to be **low**. <u>Cumulative</u> For Scenario 1, aviation lighting for cumulative schemes will be perceptible across the majority of the western part of the SLA and pockets throughout. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will locally increase the geographical area of visibility of aviation lighting across small parts of the north of the SLA. This will be small in comparison to the extent of perceptibility of cumulative schemes. The addition of the Proposed Development will include an area of new visibility around the Wyvis Forest. The addition will have a limited change on the perceptual characteristics of the SLA, with many of the characteristics not affected. The magnitude of effect is considered to be **low**. For Scenarios 2 and 3, the cumulative baseline scenario will be similar to that at	<u>Proposed Development</u> The significance of effect is considered to be **minor adverse** (not significant). <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **minor adverse** (not significant).

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		Scenario 1 with more perception of cumulative schemes. This is not considered to alter the baseline sufficiently to alter the conclusions and will add additional context of aviation lighting on the perceptual characteristics of the SLA, therefore the magnitude of effect is considered to be **low**.	
LCT 329: Rounded Mountain Massif, LCT 330: Rounded Hills and Moorland Slopes - Ross & Cromarty, and LCT 135: Rounded Hills - Caithness & Sutherland	High (for LCT 329) Medium (for LCTs 330 and 135)	<u>Proposed Development</u> During the hours of darkness, the aviation lighting will be directly located within LCTs 329 and 330 and in close proximity to part of LCT 135. The aviation lighting will have an influence on perceptual attributes and dark sky qualities within the MDA and up to approximately 5 km, although this may extend to include an area west of Kildermorie within LCT 329. Within these areas the aviation lighting will represent a locally notable change and **locally medium** magnitude of effect. Within the wider extents of these LCTs, the perception of change will be reduced due to screened from landform and/ or increased distance. Indirect change is also often limited to more elevated parts of the LCT where there is an existing influence from light sources, including aviation lighting on existing wind farms, reducing the impression of change. The overall magnitude of effect on each of these LCT will be **low**. <u>Cumulative</u> The majority of the cumulative schemes, including those with aviation light, will be located within these LCTs. Aviation lighting on cumulative schemes in Scenario 1 will typically be perceptible from higher parts and more widespread in close proximity to the cumulative schemes. This will include for LCT 329 and 330 near to Kirkan and Strathrory and for LCT 135 near to Strath Oykel. There is comparatively less influence in the western part of the detailed 20 km study	<u>Proposed Development</u> The significance of effect in the detailed 20 km study area is considered to be **locally moderate adverse (significant)** and **overall low (not significant)** for each of these LCTs. <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **locally moderate adverse (significant)** and **overall low** (not significant) for each of these LCTs.

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		area, although with pockets of visibility of light sources from higher parts. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will locally increase the geographical area of perception of aviation lighting across parts of these LCTs. The proposed aviation lighting will add a small number of lights into the landscape and result in a notable additional change within a localised area including the MDA and immediate vicinity, resulting in a **locally medium** magnitude of cumulative effect. Additional change on the wider extents of each of these LCT will be more limited resulting in an **overall low** magnitude of cumulative effect in relation to Scenario 1. In Scenarios 2 and 3 the cumulative schemes will add a small number of additional light sources into the LCTs, typically at distance from the Proposed Development. Although this has a localised influence on the baseline, the cumulative magnitude of effect resulting from the addition of the proposed aviation lighting will remain largely the same as Scenario 1: **locally medium** and **overall low**.	
LCT 139: Rugged Mountain Massif - Caithness & Sutherland, and LCT 328: Rugged Mountain Massif - Ross & Cromarty	High	<u>Proposed Development</u> The proposed aviation lighting will be screened from the majority of these LCTs due to intervening landform, as indicated by the ZTV (**Figure 6.9**) such that potential indirect change will be limited to localised elevated slopes and summits. Existing light sources are apparent and have a local influence on the majority of the elevated parts of the LCTs, limiting the sense of change. Although there may be very localised increased sense of change from a small part of LCT 139, overall the magnitude of effect on both LCTs will be **low**. <u>Cumulative</u>	<u>Proposed Development</u> The significance of effect in the detailed 20 km study area is considered to be **minor adverse (not significant)**. <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **minor adverse (not significant)**.

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		Aviation lighting on cumulative schemes in Scenario 1 will typically be perceptible from more elevated parts of these LCTs, locally influencing perceptual attributes. There is little or no perception of cumulative schemes from lower elevations. The Proposed Development will add a small number of additional light which will be perceptible from localised elevated parts of these LCTs. There is an existing influence from light sources on most of these areas and although there may be a slight increase in extent of influence this will represent an overall small additional change and **low** magnitude of cumulative effect. In Scenarios 2 and 3 the cumulative schemes will add a small number of additional light sources into the distance from these LCTs. Although this has a small influence on the baseline, the cumulative magnitude of effect resulting from the addition of the proposed aviation lighting will remain largely the same as Scenario 1: **low**.	
LCT 142: Strath - Caithness & Sutherland	Medium	<u>Proposed Development</u> The proposed aviation lighting will be screened from the vast majority of this LCT, with perception limited to relatively small and distant areas. The main extent of potential indirect change is along part of Strath Cuileannach to the north of Croick where there is potential for perception of one light. The extent of change will be limited further by woodland planting along the slopes of the strath. There are no existing light sources apparent from this part of the LCT which increases the sense of change, although this is somewhat tempered by the distance of over 8 km. Overall, taking a precautionary approach, magnitude of effect is considered to be **low**. <u>Cumulative</u>	<u>Proposed Development</u> The significance of effect in the detailed 20 km study area is considered to be **minor adverse** (not significant). <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **minor adverse** (not significant).

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		Aviation lighting for cumulative schemes in Scenario 1 will be perceptible from the northern part of the LCT 142 within the detailed 20 km study area. The addition of the aviation lighting of the Proposed Development will influence a limited but different part of the LCT and therefore locally extend perception of distant lights in the surrounding uplands. This is anticipated to result in a localised and very small additional change. Taking a precautionary approach, the magnitude of cumulative effect is considered to be **low**. In scenario 2 the cumulative schemes will have an increased influence on the northern part of the LCT 142 within the detailed 20 km study area. The Proposed Development will continue to influence a different part of the LCT and therefore slightly extend the perception of lights. Overall, the magnitude of cumulative effect will remain broadly the same as for Scenario 1: **low**. Ceislein will have no influence on this LCT and therefore the cumulative baseline and magnitude of cumulative effect will remain as for Scenario 2: **low**.	
LCT 145: Farmed and Forested Slopes with Crofting and LCT 146: Coastal Farmland & Woodlands	Medium	<u>Proposed Development</u> There is an existing context of light sources across both of these LCTs, and particularly towards the west of LCT 145 around Ardgay and Bonar Bridge. The A949 and associated traffic also have an influence on the baseline, and further limit perceptual attributes. During the hours of darkness, the aviation lighting will be perceptible from parts of the coastal and sloped farmland to the north of the Dornoch Firth. This will be reduced in part due to vegetation cover within the LCTs. The aviation lighting will add up to five lights into the distant uplands to the south at greater distance than existing light sources within and	<u>Proposed Development</u> The significance of effect in the detailed 20 km study area is considered to be **minor adverse** (not significant) for LCT 145 and **negligible adverse** (not significant) for LCT 146 <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		adjacent to these LCTs. Magnitude of effect on LCT 145 will be **low**. Slightly more limited change and a **very low** magnitude of effect is anticipated for LCT 146 due to the lower elevation and therefore greater screening by intervening landform. <u>Cumulative</u> Aviation lighting for cumulative schemes in Scenario 1 will be perceptible within the majority of LCT 146 and small parts of LCT 145 near to Upper Ardchronie and Little Creich within the detailed 20 km study area. This will be reduced in part due to vegetation cover within the LCTs. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will introduce new areas with influence of aviation lighting within LCT 145 and will increase the marginally increase the influence with other cumulative schemes in both LCT 145 and 146. Cumulative change will be limited due to a combination of the distance from the Proposed Development, the existing context of lighting within the LCTs, including from aviation lighting at wind farms, and the nature of perceptual attributes. The magnitude of cumulative effect on LCT 145 is considered to be **low** and on LCT 146 is considered to be **very low**. The cumulative baseline for Scenario 2 will include the addition of Balblair Wind Farm and Acheilidh Wind Farm, which will locally increase the perception of aviation lighting within LCT 145. This will further provide context for the addition of the Proposed Development and somewhat lessen the impression of change. Overall, magnitude of effect will remain the same as for Scenario 1. The cumulative baseline will have little difference for Scenario 3; therefore, the magnitude is considered to be comparable to Scenario 1 and 2.	is considered to be **minor adverse** (not significant) for LCT 145 and **negligible adverse** (not significant) for LCT 146.

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
LCT 339: Inland Strath	Medium	Proposed Development During the hours of darkness, the aviation lighting will be perceptible across much of the small area of the LCT along Strath Rusdale. Intervening topography of the upland ridge will limit influence to up to three lights within a small, but important part of the context at the head of the strath. The elevated position will reduce the apparent intensity of the lights, reducing their influence on perceptual attributes. However they will appear separate from the existing light sources confined to the base of the strath. Magnitude of effect will be **medium**. Cumulative The aviation lighting on cumulative schemes in scenario 1 and 2 will be screened from this LCT and therefore there will be no cumulative effects. In scenario 3, the lights on Ceislein will have a local influence on a small part of this LCT and particularly in the south, altering the baseline. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will add to and extend the influence of lighting within the surrounding uplands. Intervening landform will reduce the change to up to three lights, somewhat reducing the change. Overall, the Proposed Development will increase the influence of aviation lighting and will be within a different part of the context to Ceislein and therefore magnitude of cumulative effect will be **medium**.	Proposed Development The significance of effect in the detailed 20 km study area is considered to be **moderate adverse (significant)**. Cumulative There will be **no change** for Scenarios 1 and 2. The significance of cumulative effect for Scenario 3 is considered to be **moderate adverse (significant)**.
LCT 341: Forest Edge Farming and LCT 346: Open Farmed Slopes	Low	Proposed Development During the hours of darkness, the aviation lighting will be perceptible from a narrow band of land that extends through the LCTs to the south-east of the Proposed Development. This will be reduced in part due to vegetation cover within the LCTs. The geographical area of the LCTs experiencing such change is therefore	Proposed Development The significance of effect in the detailed 20 km study area is considered to be **negligible adverse (not significant)**.

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		limited, especially for LCT 346 with increased distance from the Proposed Development. The only key characteristic that will be affected by the aviation lighting will be the outward views from the LCT. Such views will be within the context of a range of existing lighting, including from residential properties and settlement and the road network. The remainder of key characteristics will not be affected. The magnitude of effect in the detailed 20 km study area is considered to be **very low**. <u>Cumulative</u> Aviation lighting for cumulative schemes in Scenario 1 will be perceptible in small parts of the LCTs, including near to Ardross Castle and along the northern edge of the Black Isle. This will be reduced in part due to vegetation cover within the LCTs. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will introduce limited new areas with influence of aviation lighting within LCTs. In the limited geographical areas where cumulative aviation lighting is perceptible, there will be some parts with increased influence with the addition of the Proposed Development but will remain to be limited. The magnitude of cumulative effect is considered to be **very low**. The cumulative baseline will have little difference for Scenario 2; therefore, the magnitude of cumulative effects is considered to be comparable to Scenario 1. The cumulative baseline for Scenario 3 will include the addition of Ceislein Wind Farm which will increase the perception of aviation lighting within the LCTs. This will further provide context for the addition of the Proposed Development and lessen change to the outward views. The magnitude of effect within the 20 km	<u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 in the detailed 20 km study area is considered to be **negligible adverse (not significant)**.

Landscape Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		detailed study area is considered to remain at **very low**.	

8.2 Assessment and Appraisal on Visual Receptors

The visual effects on receptors resulting from the Proposed Development aviation lighting are set out below. This includes an hours of darkness assessment and consideration of cumulative effects for the three hours of darkness viewpoints (Viewpoints 2, 7 and 10). An appraisal on receptors resulting from the Proposed Development aviation lighting is also given for the remaining viewpoints scoped into the hours of darkness receptors. The assessment and appraisal take account of the embedded mitigation measures described in **Section 3** and in **Chapter 6: Landscape and Visual**.

Table 8: Assessment and Appraisal of Visual Receptors in relation to Aviation Lighting

Visual Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
Scoped into hours of darkness viewpoint assessment			
Viewpoint 2	Medium	<u>Proposed Development</u> Aviation lighting on up to three of the proposed turbines (9, 12 and 13) will be visible from this location. Within hours of darkness, the aviation lighting will be notable within a small part of the view to the north-west within the uplands beyond the head of the strath. This will contrast with the existing night time baseline of sporadic residential light sources along the strath. The viewpoint is at a low elevation relative to the aviation lighting which will notably reduce the apparent intensity of the lights. The magnitude of effect is considered to be **medium**. Views and potential effects on nearby residential properties will often be more restricted in nature due to orientation of the property and/or screening by foreground vegetation. <u>Cumulative</u>	<u>Proposed Development</u> The significance of effect is considered to be **moderate adverse (significant)**. <u>Cumulative</u> The significance of cumulative effect for Scenarios 1 and 2 is considered to be **no change (not significant)**. The significance of cumulative effect for Scenario 3 is considered to be **moderate adverse (not significant)**.

Visual Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		The magnitude of effect for Scenarios 1 and 2 will be **none** as no cumulative schemes will comprise aviation lighting. In scenario 3, aviation lighting for Ceislein Wind Farm will be visible to the south, influence the hours of darkness baseline. The Proposed Development will add further lights into views from this location and although the altered baseline reduces the contrast and influence slightly, the magnitude of cumulative effect will be **medium**.	
Viewpoint 7	Medium	<u>Proposed Development</u> Aviation lighting on up to two of the proposed turbines (12 and 13) will be theoretically visible on the distant horizon to the south-west. The turbine hubs will largely be screened by topography and therefore visibility of the lighting is marginal and may be partially screened. The lighting will be seen within the context of a range of existing light sources within the view to the south-west and although located at higher elevation will be more distant and occupy a very small part of the expansive view, limiting the sense of change. The viewpoint is at a low elevation relative to the aviation lighting which will notably reduce the apparent intensity of the lights. The magnitude of effect is considered to be **low**. <u>Cumulative</u> There will be no visibility of aviation lighting on the cumulative schemes in each of the scenarios and as such there will be no cumulative effects.	<u>Proposed Development</u> The significance of effect is considered to be **minor adverse (not significant)**. <u>Cumulative</u> The significance of cumulative effect for Scenarios 1, 2 and 3 is considered to be **no change** (not significant).
Viewpoint 10	Low	<u>Proposed Development</u> Aviation lighting on up to five of the proposed turbines (5, 6, 9, 12 and 13) will be theoretically visible on the distant horizon to the north-west. The lighting will be seen within the context of a range of existing light sources across wide parts of the view and therefore influencing the baseline. The Proposed Development will introduce a small number of additional	<u>Proposed Development</u> The significance of effect is considered to be **negligible adverse (not significant)**. <u>Cumulative</u>

Visual Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		lights and although located at higher elevation will be more distant and occupy a very small part of the expansive view, limiting the sense of change. The magnitude of effect is considered to be **very low**. <u>Cumulative</u> Aviation lights on Strathrory are theoretically visible on the horizon to the north, although are likely to be screened by intervening vegetation. If visible the lights will add slightly to the existing baseline which includes a wide range of existing lights. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will be in a similar pattern at a similar elevation to the cumulative scheme which will continue to be not dissimilar to the existing residential lighting in the view on the rising land, which will reduce the degree of contrast. The magnitude of effect is considered to be **very low**. At Scenario 2, the aviation lighting for Carn Fearna will be theoretically visible but screened by intervening vegetation, therefore the magnitude of cumulative effect will be the same as Scenario 1: **very low**. At Scenario 3, the aviation lighting for Ceislein Wind Farm will add further lighting along the upland ridge adding to the context and influence of lighting in the cumulative baseline. The addition of the aviation lighting of the Proposed Development into this cumulative baseline will be within the context of existing lighting within different parts of the view, which will reduce the degree of contrast. The magnitude of effect is considered to be **very low**.	The significance of cumulative effect for Scenarios 1, 2 and 3 are considered to be **negligible adverse (not significant)**.
Scoped into hours of darkness viewpoint appraisal			
Viewpoint 1	Medium	The aviation lighting will be visible in the foreground and middle ground of the view to the south-east. Although there is a	The resulting effects are considered likely to be significant

Visual Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		context of distant light sources to the east and south, the proximity of the Proposed Development is such that change will be notable. Views west which contain no existing light sources will be unaffected.	adverse due to the proximity of the lighting to the receptor and limited and/or distant nature of existing lighting in the view. It should be noted that there will likely be limited receptors at this viewpoint during hours of darkness and if present, will likely carry personal safety lighting.
Viewpoint 3	Medium	Three of the aviation lightings will be theoretically visible within the uplands to the east, although one is likely to be screened by intervening vegetation. Within hours of darkness, the aviation lighting will contrast somewhat with the baseline which includes a small number of low elevation light sources associated with scattered residential properties. The proposed aviation lighting will be at higher elevation and therefore increase the influence of existing light sources, although will occupy an overall small part of the view and will be relatively distant, at just less than 10 km.	The resulting effects are considered unlikely to be significant adverse.
Viewpoints 4, 6, 9 and 11	Medium	The aviation lighting will be theoretically visible at a similar elevation in the background of views from these viewpoints near or on summits. Five lights will be visible from Viewpoint 4 (Cnoc Fyrish) and Viewpoint 9 (Ben Wyvis), with four visible from Viewpoint 6 (Beinn a'Chaisteil) and only one visible from Viewpoint 11 due to intervening topography. There will be no visibility of aviation lighting from the summit of Carn Ban to the north of Viewpoint 11 or from	The resulting effects are considered unlikely to be significant adverse. It should be noted that there will likely be limited receptors at this viewpoint during hours of darkness and if present, will likely carry personal safety lighting.

Visual Receptor	Hours of darkness sensitivity	Magnitude of Effect	Significance of Effect
		the Fyrish Monument to the south of Viewpoint 4. In each case the aviation lighting will add a small number of lights into the distant uplands and generally occupy a small part of the views available. The lighting will be within the context of sky glow and/or a range of distant light sources, including those from existing wind farms, which will lessen the degree of contrast.	
Viewpoints 8 and 13	Medium	The aviation lighting will be theoretically visible on the distant upland horizon to the north of the Dornoch Firth. This will be more limited for viewpoint 8 due to intervening topography, with just one aviation light theoretically visible. Within hours of darkness, the aviation lighting will be visible in the context of existing lighting within the views which will lessen the degree of contrast. Although the aviation lighting will appear at higher elevation than existing light sources, it will be more distant and will occupy a small part of the expansive views, reducing the impression of change.	The resulting effects are considered unlikely to be significant adverse.

9. Reference List

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