



# Technical Appendix 5.5

## Landscape and Visual Assessment of Turbine Lighting

# Table of contents

5.1	Introduction	3
5.2	Guidance	3
5.2.1	Guidelines for Landscape and Visual Impact Assessment (GLVIA3)	3
5.2.2	NatureScot Guidance	3
5.2.3	Institute of Lighting Professional’s Guidance	3
5.3	Assessment Parameters	3
5.4	Methodology	3
5.4.1	Sensitivity to Turbine Aviation Lighting	4
5.4.2	Study Area	4
5.4.3	Lighting Visualisation Methodology	4
5.4.4	Cumulative Assessment of Turbine Lights	4
5.5	Baseline lighting	4
5.6	Assessment of lighting effects	5
5.6.1	Zone of Theoretical Visibility Analysis	5
5.6.2	Viewpoint Analysis	5
5.6.3	Lighting Effects on Landscape Character	7
5.6.4	Visual Amenity	9
5.7	Summary	10
5.8	Conclusion	10

# List of Figures

Figure 5.5.1: ZTV of Turbine Nacelle and Tower Lighting  
Figure 5.5.2: Light Pollution and Local Landscape Character



## 5 APPENDIX 5.5

### 5.1 Introduction

1. This appendix assesses the effects of the turbine aviation lighting on landscape and visual receptors. The Civil Aviation Authority (CAA) require that turbines at or above 150m in height are lit as set out in Article 222 of the UK Air Navigation Order (ANO) 2016. CAA's 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' (June 2017) sets out the specific lighting requirements which are discussed in **Section 5.3**.
2. This appendix focusses on the potential impacts of turbine aviation lighting on landscape and visual receptors. It does not cover any technical information about lighting or potential mitigation strategies which are outwith the remit of a Landscape Architect. These are covered in **Appendix 13.3 Indicative Aviation Lighting Landscape and Visual Impact Mitigation Plan**.
3. Recent discussions with the Applicant and NatureScot with regard to turbine aviation lighting have informed potential options to reduce or limit lighting such as transponder activated lighting covered in **Appendix 4.2 Transponder Activated Lighting**. Whilst the options presented in **Appendix 4.2** could almost entirely remove the potential lighting effects on landscape and visual receptors in the future, this LVIA appendix considers the worst case scenario of the current lighting based on CAA guidance.

### 5.2 Guidance

4. The assessment of effects of lighting of turbines is an evolving area of LVIA, informed by the following guidance:
  - 5.2.1 **Guidelines for Landscape and Visual Impact Assessment (GLVIA3)**
5. GLVIA3 provides general guidance on assessment of lighting stating that where the visual effects of lighting may be an issue "the visual effects assessment will also need to include qualitative assessments of the effects of the predicted light levels on night-time visibility".
  - 5.2.2 **NatureScot Guidance**
6. NatureScot have recently issued updated guidance in relation to assessing impacts from turbine aviation lighting. Annex 2 of NatureScot's General Pre-application and Scoping Advice for Onshore Wind Farms Guidance (September 2020) outlines advice on the scope of assessment for turbine lighting. They recommend that the assessment of lighting should take account of the baseline darkness and any light sources, and people's likely use of an area in darkness and lowlight levels. They advise that the following should be included within a lighting assessment:
  - Clear information on positions and intensity of lighting proposed;
  - A ZTV illustrating turbine nacelle and intermediate lighting;
  - Wirelines annotated with lighting positions;
  - A table which lists how many lit turbines would be visible from each viewpoint;
  - Assessment of all viewpoints with potential visibility of lighting where effects may be significant;
  - Assessment of effects on landscape character; and
  - Night-time visualisations from a limited number of representative viewpoints.
7. NatureScot provide guidance in their 'Visual Representation of Wind Farms' (SNH, Version 2.2, February 2017) on how lighting should be presented in windfarm visualisations. Para 174-177 states "*Where an illustration of lighting is required, a basic visualisation showing the existing view alongside an approximation of how the wind farm might look at night with aviation lighting may be useful. This is only likely to be required in particular*

*situations where the wind farm is likely to be regularly viewed at night (e.g. from a settlement, transport route) or where there is a particular sensitivity to lighting (e.g. in or near a Dark Sky Park or Wild Land Area). Not all viewpoints will need to be illustrated in this way. The visualisation should use photographs taken in low light conditions, preferably when other artificial lighting (such as street lights and lights on buildings) are on, to show how the wind farm lighting will look compared to the existing baseline at night. It is only necessary to illustrate visible lighting, not infrared or other alternative lighting requirements... We have found that approximately 30 minutes after sunset provides a reasonable balance between visibility of the landform and the apparent brightness of artificial lights, as both should be visible in the image."*

#### 5.2.3 Institute of Lighting Professional's Guidance

8. The Institute of Lighting Professionals' (ILP) guidance note 'Guidance Note 1 for the reduction of obtrusive light' (ILP, updated 2020) is useful to refer to regarding their definitions of different types of 'obtrusive' light, which can be classed as a type of pollution and nuisance by law:
  - Sky Glow – brightening of the night sky.
  - Glare – uncomfortable brightness of a light source when viewed against a darker background.
  - Light Spill and Intrusion – the spilling of light beyond the boundary of the area being lit.

### 5.3 Assessment Parameters

9. CAA's policy statement (June 2017) sets out the lighting requirements of turbines over 150m. For the purposes of this appendix the relevant parameters include the following:
  - Medium Intensity (2000\* candela) red light positioned as close as practicable to the top of the fixed structure – i.e. the nacelle.
  - At least three low-intensity (32 candela) red lights (to provide 360 degree coverage) should be provided at an intermediate level of half the nacelle height.
10. Lights would be controlled to turn on when light levels fall below 500 LUX and turn off when light levels rise above 500 LUX.
11. \*Importantly, the CAA guidance states that "*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...at the top of the structure...may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.*" This allows the medium intensity light of 2000 candela to be reduced to 200 candela.
12. In discussions with NatureScot on the parameters for the Applicant's Eucharhead Proposal Landscape and Visual Impact Assessment (LVIA) it was agreed that as the baseline photography for the lighting visualisations will be in clear conditions (visibility greater than 5km) the modelling of 2000 candela lighting would not be a realistic worst case scenario and unhelpfully exaggerate potential effects. This LVIA follows the approach taken for Eucharhead and includes visualisations based on the reduced intensity 200 candela lighting.

### 5.4 Methodology

13. The approach for assessment of landscape and visual effects from the turbine aviation lighting is based on the methodology set out in **Appendix 5.1 LVIA Methodology** and informed by the above parameters. The methodology includes the approach to determining the sensitivity for landscape and visual receptors to lighting, taking into account there are different factors to consider at night. It is summarised below for ease of reading.

#### 5.4.1 Sensitivity to Turbine Aviation Lighting

14. The assessment terminology and criteria used to assess the effects on receptors from turbine aviation lighting are the same as presented above for the main assessment, however the approach to determining the sensitivity of receptors has to consider different aspects which are set out below.

##### 5.4.1.1 Landscape Character Sensitivity to Lighting

15. The sensitivity of a landscape receptor at night reflects its susceptibility to the change and any values related to the absence of light. The susceptibility of a landscape character area to the introduction of new lighting is primarily determined by the existing level of darkness. This can be informed by field survey, light pollution mapping and night-time satellite and aerial imagery. How a landscape at night is valued relates to qualities that can be appreciated at night such as the darkness (including Dark Sky Park designations) or tranquillity.
16. Valued landscapes (including national and local landscape designations) would generally be considered to have the same value as for daytime assessment. Susceptibility of the valued landscapes would be determined by consideration of each of the special qualities to impacts from aviation lighting.

##### 5.4.1.2 Visual Receptors Sensitivity to Lighting

17. The sensitivity of a visual receptor at night reflects their susceptibility to the change and any values which may be associated with the specific view at night.
18. Most views at night do not have any formal recognition and would have a low value unless specifically promoted for viewing at night. Specific promotion would include stargazing in dark skies areas or features that are illuminated for viewing at night.
19. Susceptibility of visual receptors to turbine aviation lighting would vary depending on the activity and purpose. It would be highest for those deliberately visiting a location for the dark skies. Susceptibility would be lower for residents in urban areas where there is a high level of light pollution, or road users where the focus on the road required at night and light from the vehicles would reduce attention on the wider view.
20. A guide to levels of value and susceptibility for visual receptors is as follows:
- High Sensitivity (High Value and High Susceptibility): Visitors to Dark Sky Park (Core Areas)
  - High-Medium Sensitivity (Medium Value and High Susceptibility): Visitors to promoted Dark Sky viewpoints, visitor centres or observatories that lie outwith Dark Sky Park Core Area.
  - High-Medium to Medium Sensitivity (High to Medium Value and Medium Susceptibility); Visitors to nationally or locally promoted landmarks or features that are illuminated at night.
  - Medium Sensitivity (Low Value and High Susceptibility): Residents of particularly dark areas (rural locations with no street lighting for example), people engaged in night time activities such as wild camping and wildlife watching.
  - Medium-Low Sensitivity (Low Value and Medium Susceptibility): Residents in urban areas, or semi-urban/rural areas where they are influenced by street lighting, users of cycleways and railways.
  - Low Sensitivity (Low value and Low Susceptibility): Drivers on unlit local roads.
  - Low-Negligible Sensitivity (Negligible Value and Low Susceptibility): Users of main roads and people at their place of work.

#### 5.4.2 Study Area

21. The assessment considers the landscape and visual receptors as set out in **Chapter 5: Landscape and Visual Impact Assessment (LVIA)**, focussing on those within an approximate 10km radius where the lighting would likely be most noticeable, including those receptors that would be more sensitive to lighting, such as the designated landscapes and local residents within more rural areas. Whilst lighting would likely be visible beyond 10km, based on the assessment in **Chapter 5: LVIA**, the Proposed Development would generally appear across a small horizontal extent of views at this distance and the turbine aviation lighting would be discernible but not prominent and unlikely to create significant effects.

22. Three viewpoints from the list of viewpoints for **Chapter 5: LVIA** were chosen to illustrate the potential visibility of the turbine aviation lighting and aid the assessment. These include, based on NatureScot's request, a view at Hart Fell within the Talla-Hart Fell Wild Land Area (Viewpoint 15).

23. Field survey within the Study Area was undertaken at dusk and darkness to understand the baseline lighting situation and inform the assessment.

#### 5.4.3 Lighting Visualisation Methodology

24. A professional photographer, experienced in windfarm photography for EIA undertook the photography at the agreed viewpoint locations at dusk or dawn, taking into account NatureScot's advice of 30 minutes before sunset or after sunrise to enable the baseline lighting to be seen as well as the visibility of the landform and turbines.
25. Visibility of lighting is dependent on a range of factors, not just atmospheric conditions, including the intensity of lighting and the height and angle of the viewer in relation to the light source. In addition, lighting products also can vary in brightness under the same technical specifications. Therefore, to accurately portray proposed turbine aviation lighting on visualisations is acknowledged as particularly tricky with so many factors involved. It is also very difficult to capture existing lighting in photography that emulates what is seen by the naked eye. In photography of landscapes which include lights at various distances and balanced with the natural dusk or dawn lighting levels, the photography can exaggerate the brightness of existing lighting by appearing slightly larger and more blurred. This is taken into consideration in the modelling of lighting on the photomontages.
26. The turbine aviation lighting represented in the viewpoint visualisations has been calibrated from existing turbine lighting at equivalent levels and distances. This has involved field surveys to locations where there is visible turbine aviation lighting on the Middleton and Neilston wind turbines in East Renfrewshire, and Cathkin Braes turbine in Glasgow. This gave an understanding of the varying visibility and brightness of the lighting at dusk and darkness, and how this compares when captured by photography.
27. In order to understand how many lights are visible and from where, NatureScot have specifically requested the potential visibility of the lighting sources (nacelle and tower) for each viewpoint is recorded in a table and that all wirelines illustrate the location of nacelle and tower lighting (in addition to the selected night time visualisations). The tower lights are shown, where visible, as small black circles on the 53.5 degree wirelines (**EIA Report Figures 5.11-5.31**).
28. The assessment is also supported by a Zone of Theoretical Visibility (ZTV) plan (**Figure 5.5.1**) which illustrates the potential extent of visibility of the nacelle lighting and the tower lighting. This does not take into consideration diminishing effects of distance on lighting or any other technical lighting factors that may limit the brightness and visibility.

#### 5.4.4 Cumulative Assessment of Turbine Lights

29. There are no windfarms with turbine aviation lighting currently operating within the Study Area for the Proposed Development. However, it is acknowledged that proposals for several sites at the edges of the 30 km Study Area (including Faw Side, Eucharhead, Fell, and Trostan Loch Windfarms) will require lighting as they are over 150 m in height. At approximately 30km from the Proposed Development and based on the cumulative analysis in **Appendix 5.6: Cumulative Context**, the potential for significant cumulative lighting effects would be limited, so no further detailed cumulative assessment is made in this appendix.

## 5.5 Baseline lighting

30. It is first important to understand the existing light levels across the Study Area and where there would be most potential for landscape and visuals effects from the proposed turbine aviation lighting. The existing baseline lighting levels within a 15km radius of the Proposed Development is illustrated on **Figure 5.5.2: Light Pollution and Landscape Character**. An overview of the light pollution within the wider context of the Study Area is presented on **Plate 5.1.1**. This is based on Open Source data of Light Pollution across the UK.



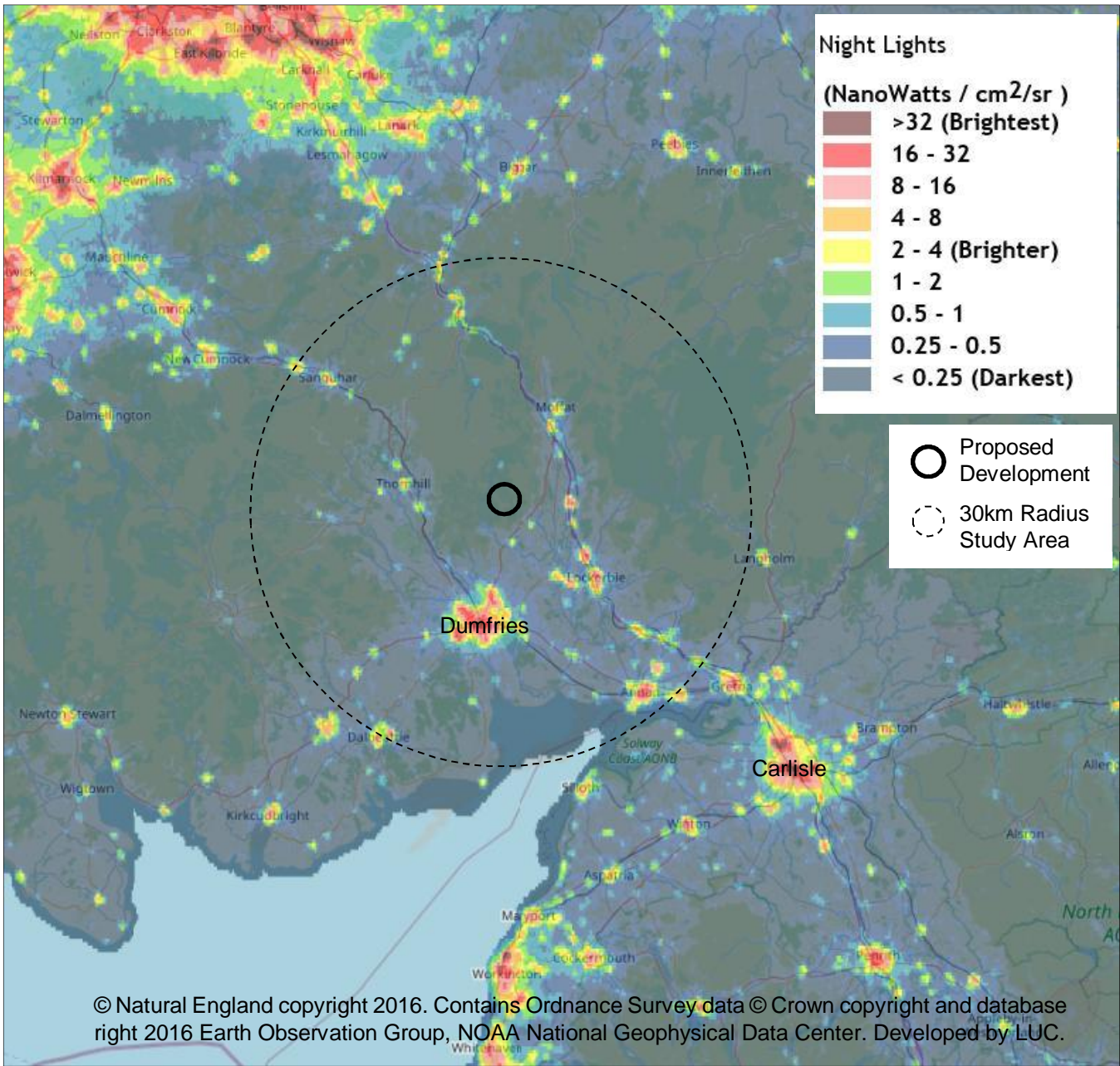


Plate 5.5.1: Light Pollution Data for Study Area

31. **Figure 5.5.2** and **Plate 5.5.1** clearly shows the influence of lighting associated with the settlements at Dumfries, Lockerbie and the smaller towns and villages within Annandale and Nithsdale, along the valleys and road corridors. The darkest skies are within the Thornhill Uplands to the north of the Site, the Galloway Hills to the west, and the Eskdalemuir and Langholm Hills to the east. There are localised areas of lighting directly to the south east of the Site relating to the settlement pattern along the A701, and to the west relating to the A76.
32. From field survey and viewpoint photography there are small sources of white light dotted around the edges of the main settlement areas which relate to either isolated properties or businesses, and lighting associated with the substation at the operational Harestanes Windfarm.

## 5.6 Assessment of lighting effects

### 5.6.1 Zone of Theoretical Visibility Analysis

33. The ZTV in **Figure 5.5.1** illustrates the general visibility of the nacelle lighting (125 m height) and the tower lighting (62.5 m) across the Study Area. The tower lighting at 32 candela is unlikely to be visible over long distances due to its low intensity and candela level.
34. The ZTV illustrates that there would be no tower lighting visible within a band of approximately 3 km from the proposed turbines; the foothills landform would screen the towers at this close distance. The tower lighting would also be screened at the edges of the Lowther Hills and along the edge of the Annandale Upland Fringe. Elsewhere the potential visibility of the tower lighting would generally follow the pattern of nacelle visibility.
35. The potential visibility of nacelle (and tower) lighting would be largely across the wider Annandale area and Lower Nithsdale around Dumfries, within 10-15 km. There would be more fragmented visibility across the upland fringes, foothills and uplands to the east, south east, south west and west. The Lowther Hills to the north of the Site prevent any visibility further north and north west.

### 5.6.2 Viewpoint Analysis

36. As required by NatureScot a table detailing the potential visibility of lighting at all the viewpoints considered in the LVIA has produced. This is presented below in **Table 5.5.1** and should be read in conjunction with the wirelines and photomontages in **EIA Report Figures 5.11-5.31**.

Proposed Turbine Number N = Nacelle Lighting T = Tower Lighting / 0 = No visibility ✓ = Potential Visibility																
VP	T1		T2		T3		T4		T5		T6		T7		T8	
	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	✓	0	0	0	0	0	0	0
3	✓	✓	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	✓	0	✓	0	✓	✓	✓	✓
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	0	0	0	0	0	0	0	0	✓	0	✓	0	✓	✓	✓	0
9	0	0	0	0	0	0	✓	0	✓	✓	✓	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	✓	✓	✓	0	✓	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	✓	0	✓	0	✓	✓	✓	0
12	✓	0	✓	✓	✓	✓	✓	0	✓	✓	✓	0	✓	0	✓	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	✓	0	✓	✓	✓	✓	✓	✓
15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	0	0	0	0	✓	0	✓	0	✓	0	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	✓	✓	✓	✓	0	✓	✓	✓	0	✓	✓	✓	✓
18	✓	0	✓	0	✓	✓	✓	0	✓	0	✓	0	✓	0	0	0
19	✓	✓	✓	0	✓	0	✓	0	✓	0	✓	0	✓	0	✓	0
20	✓	0	0	0	✓	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Proposed Turbine Number N = Nacelle Lighting T = Tower Lighting / 0 = No visibility ✓ = Potential Visibility																
VP	T1		T2		T3		T4		T5		T6		T7		T8	
	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
21	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 5.5.5: Viewpoint Lighting Table

39. The information provided in **Table 5.5.1** and understanding the viewpoint locations shows that it is only the elevated positions in the Study Area where the tower and nacelle lighting would potentially be visible for all of the turbines – such as Queensberry (Viewpoint 7), Hart Fell (Viewpoint 15), and Bishop Forest Hill (Viewpoint 21). The elevation difference across the Site would separate the visibility of turbines T1-T3 from T4-T8 in some places, so that from the north east and east for example (Viewpoint 4 Raehills, Viewpoint 11 Roman & Reivers Route, and Viewpoint 9 B7020 Chapel Wood) visibility of T1-T3 would be reduced. The closer viewpoints (Viewpoints 2, 3 and 5) also illustrate that the screening of the proposed turbines by the rising landform would limit the number of lights visible.
40. An assessment of the effects of the lighting on three viewpoints is provided in the following tables. In addition to the Hart Fell viewpoint, the two other viewpoints were chosen to represent areas that are not influenced by existing lighting, have sensitivities relating to local landscape designations as well as being areas that would be visited at night or represent local residents.
- Viewpoint 6: South of Rashy Heights, 8.58km from the Proposed Development, lies within the Thornhill Uplands Regional Scenic Area (RSA) (**EIA Report Figure 5.16g-h**);
  - Viewpoint 15: Hart Fell, 21.43km from the Proposed Development, lies within the Talla-Hart Fell Wild Land Area and was requested as a night view by NatureScot. (**EIA Report Figure 5.25g-h**); and
  - Viewpoint 17: Shieldhill, 8.10km from the Proposed Development, lies within the Torthorwald RSA and edge of settled Annandale. (**EIA Report Figure 5.27e-f**).

Viewpoint 6: South of Rashy Height	
Grid Reference:	293149, 597437
EIA Report Figure References:	5.16 a-h (Lighting visualisation Figure 5.16h)
Receptor Type(s):	Road Users Walkers Thornhill Uplands RSA Southern Uplands LCT – Lowthers Unit
Distance and Direction from nearest turbines of Proposed Development:	8.58 km North West
Elevation:	296m AOD
Viewpoint description – Existing View Dusk/Dawn	
This viewpoint is located on the minor road that lies between Thornhill to the west and the Forest of Ae to the south. It is on a local high point (294 m AOD) below Rashy Height (38 0m AOD) to the north, at the edge of the Southern Uplands LCT.	
At dawn or dusk, as illustrated by <b>EIA Report Figure 5.16g</b> , the gently undulating broad foothills form the skyline to the south and south east, with the notable silhouette of Queensberry to the east. The operational Harestanes and Minnygap turbines can just be picked out on the skyline, as well as the blankets of commercial forestry. To the south west and west the layers of the more distant foothills and uplands over the River Nith form the backdrop to the open expansive foreground. To the north of the viewpoint, the dark silhouette of rising land of the Southern Uplands is apparent in the background	
There are a few sources of light which are associated with isolated properties to the south and south west but generally there is very little obvious existing artificial light in the view.	

Viewpoint 6: South of Rashy Height	
Predicted View	
The wireline ( <b>Figure 5.16e</b> ) illustrates the nacelle lighting on all eight turbines and the tower lights of all but T8 would be potentially visible. The lights would appear above the skyline and at slightly different elevations, arranged in a group of five (T4-T8), a group of two (T2 & T3) and a single light (T1) to the west.	
Scale of Effect	
Whilst during the day, the Proposed Development would be difficult to differentiate from the operational Harestanes turbines from this viewpoint, the aviation lighting would identify the proposed turbines. It is unlikely that the tower lighting would be particularly noticeable, especially due to the screening by forestry and operational turbines.	
The nacelle lighting would be noticeable but at over 8 km from the viewpoint, it would not be particularly bright.	
The Proposed Development would introduce a new light source into an otherwise dark environment but at a distance where it would not become a defining feature or so bright that it dominates the view. The scale of effect is considered Medium.	

Table 5.5.2: Viewpoint 6: Rashy Hill

Viewpoint 15: Hart Fell	
Grid Reference:	311313, 613578
EIA Report Figure References:	5.25 a-h (Lighting Visualisation Figure 5.25h)
Receptor Type(s):	Talla-Hart Fell Wild Land Area Walkers Southern Uplands LCT – Moffat Hills Unit Moffat Hills RSA
Distance and Direction from nearest turbine of Proposed Development:	21.43km North / North East
Elevation:	806m AOD
Viewpoint description – Existing View	
This viewpoint is located at the summit of Hart Fell. There is a notable difference in the presence of baseline lighting between the south and to the west. To the south across Annandale towards Lockerbie, and to the south west towards Dumfries and Solway Firth beyond, there are a number of concentrated light sources as well as a consistent spread of lighting associated with the settlement pattern. The landform of the foothills at Ae can be more clearly seen in the lower light levels intersecting between Annandale and Nithsdale, with some lighting visible behind from Nithsdale. As the land rises to the Lowther Hills to the west, this screens the valley light sources and is a much darker part of the view. The conical shape of Queensberry is visible at the southern end of this part of the Southern Uplands.	
Predicted View (including operational cumulative sites)	
The wireline illustrates from this elevated viewpoint that the nacelle and tower lighting on all proposed turbines would be potentially visible. T1 -T4 would lie behind the operational Harestanes Windfarm, with slightly higher blade tips. T3 and T4 would appear close together, as would T6 and T7. T5-T8 would lie just beyond the operational turbines, in a loose cluster, and below the skyline.	
Scale of Effect	
The Proposed Development would be over 21km from this viewpoint. Whilst it is clear there are other light sources visible within the wider view at similar or further distances, they are generally white and brighter lighting than a 200 candela red light. The photomontage illustrates that the nacelle lights would appear as small dots of red light in an area of the view which is transitional between the lit areas to the south and the darker more rural southern uplands to the west and north. They would be discernible but unlikely to be a particular focus of the view.	



Viewpoint 15: Hart Fell

The Proposed Development would introduce lights to the area of the foothills that it lies within, but within the overall view, it would appear more associated with the lit settled landscape to the south, and the light spill from sources in Nithsdale behind the foothills. The lighting on the proposed turbines would be seen separately to and have less influence on the darker Southern Uplands areas to the west and north. The scale of effect is considered to be Low to Negligible.

Table 5.5.3: Viewpoint 15 Hart Fell

Viewpoint 17: South of Shieldhill	
Grid Reference:	302985, 584184
EIA Report Figure References:	5.27 a-f (Lighting visualisation Figure 5.27f)
Receptor Type(s):	Local Residents Upland Fringe LCT – Torthorwald Ridge Unit Torthorwald Ridge RSA
Distance and Direction from nearest turbine of Proposed Development:	8.10km South
Elevation:	120m AOD
Viewpoint description – Existing View	
This viewpoint is located at the northern edge of the Torthorwald Ridge. At dawn or dusk, in clear conditions, as illustrated by Figure 5.27e, the broad undulating forested foothills form the skyline with the conical and flat topped silhouette of Queensberry notable in the distance. The operational Harestanes and Minnygap turbines can also be seen silhouetted against the sky. The layers of the gently rolling pasture with hedgerows and woodland are just discernible in the foreground. There are some artificial light sources from scattered properties across Annandale and edge of Torthorwald but no major sources of artificial light visible.	
Predicted View	
The wireline illustrates that the nacelle and tower lights on all but T4 would be visible. The lights of T1-T3 would be at a similar elevation, with T1 and T3 either side of Queensberry and the nacelle light of T2 at the same elevation as the top of Queensberry. T5-T8 would lie separately to the east as a group of four.	
Scale of Effect	
The Proposed Development would appear silhouetted against the skyline, except for T2 which is largely in front of Queensberry. The layers of the landscape are difficult to see, such that the settled dales merge into the foothills which merge into the more distant Queensberry Hill, so that the view appears foreshortened. The proposed turbines would appear closer and potentially more prominent than during the day due to the darker light reducing the level of detail in the view. However, this more simplistic and uniform view of the landform that the darkness creates increases the horizontal scale of the landscape such that the turbine lighting would appear within a smaller proportion of it, reducing the scale of effect. The darkness would also reduce the number of landscape features which form scale reference points that would make it difficult to compare against the proposed turbines. The Proposed Development would introduce a new light source into an otherwise generally dark environment but at a distance where it would not become a defining feature or so bright that it dominates the view. The scale of effect is considered Medium.	

Table 5.5.4: Viewpoint 17: South of Sheildhill

41. Viewpoints as part of the main assessment where night-time visualisations have not been produced can still be used to understand the potential effects of lighting. This is through an understanding of the baseline environment and potential for light sources. A summary is provided below.
42. Viewpoints close to the south and south east of the Site: Viewpoint 2 A701 near Kirkland, Viewpoint 3 West of Kirkgate, and Viewpoint 10, A701 South of Ae Bridgend, would all be influenced by light spill from settlements along the road as well as transient lighting from traffic on the A701. The Proposed Development would introduce

lighting in the foothills above these viewpoints which would be noticeable but less prominent due to the surrounding foreground light sources.

43. Viewpoints to the south east of the Proposed Development, in Annandale (Viewpoint 9 B7020 Chapel Wood, 16 West of Templand, and 19 Annandale Way, Hightae) would have some potential to be influenced by lighting associated with the dispersed settlements and roads, where the treed nature of the area doesn't enclose views. The Proposed turbine aviation lighting would introduce points of light above the settled dales, which would be noticeable across a small proportion of the views available.
44. Viewpoints closer to the main settlements particularly Dumfries. Moffat, Beattock and Lochmaben and the main road corridors (A74(M), A701 and A76) includes Viewpoint 8 Southern Upland Way, Beattock, Viewpoint 11 Roman and Reivers Route, Moffat, Viewpoint 12 North of Dumfries, and Viewpoint 18 A76 Holywood. These would have greater baseline lighting influences so that whilst the Proposed turbine aviation lighting might be visible above the skyline it would be less readily noticeable in the context of the foreground lighting or light spill in the wider area.
45. Viewpoints from the more elevated viewpoints at the outer extents of the Study Area (Viewpoint 14 A701 South of Devils Beef-tub, Viewpoint 20 Burnswark Hill, and Viewpoint 21 Bishop Forest Hill) generally encompass wide panoramic views where the Proposed turbine aviation lighting would be potentially seen, but within a very narrow portion of the views available, which also include the numerous light sources across the settled dales landscapes.
46. Analysis of the above viewpoint assessment shows that in views towards the Proposed Development from the more open areas in between the main settlements in the south there would be a higher scale of effect as the proposed turbines with lighting would appear against a darker backdrop with little baseline lighting. Locations in these areas where existing foreground lighting is apparent would obviously reduce the prominence, in addition to the screening by the extensive treed natures of this area. Views from the east would see the Proposed Development in the context of the lighting prevalent across Annandale and Nithsdale such that the proposed turbine lighting would have a lower scale of effect.

5.6.3 Lighting Effects on Landscape Character

47. Reference should be made to **Chapter 5: LVIA** and **EIA Report Figure 5.3 Landscape Character** which identifies the landscape receptors across the Study Area. Based on the ZTV (**Figure 5.1.1** and **EIA Report Figure 5.4 Landscape Character with ZTV**) and the LVIA assessment, the landscape character types (LCTs) most likely to be affected by the lighting of the Proposed Development would be:

- Foothills with Forest – Ae unit (host LCT) and Foothills – Beattock unit
- Upland Fringe – Ae Fringe and Torthorwald Ridge units
- Middle Dales – Annandale units
- Southern Uplands – Lowther Hills unit

48. An assessment is presented below on the LCTs above, combined where effects would be similar. This also includes the Regional Scenic Areas (RSA) of Torthorwald Ridge, and Thornhill Uplands.

5.6.3.1 Foothills with Forest and Foothills – Ae and Beattock units

49. The Foothills with Forest LCT Ae unit and Foothills LCT Beattock unit almost appear as one continuous gently undulating large scale area in lower light levels as the forestry is less conspicuous than during the day. Viewed from outside the LCT, the intricacies of the valleys and rounded periphery hills are not so clearly differentiated from the interior foothills, which gives it overall a more simplistic large scale character. The numerous operational Harestanes and Minnygap turbines have the potential to be silhouetted against the dusk/dawn sky when viewed from within and outside the LCT such that there is still the evidence of man-made features compared to the more remote uplands to the north. There are no obvious existing light sources within the LCT, except potentially intermittent lighting at the Harestanes substation. There is however the influence of lighting at the periphery to the south, east and west within the transport corridors and settled Nithsdale and Annandale areas.

50. As an unlit landscape close to the more remote and darker uplands to the north, but with operational turbines a feature still perceived at dusk/dawn and proximity to the brighter settled areas to the east, south and south west, the susceptibility to turbine aviation lighting is considered Medium. The value of the landscape is Medium. The sensitivity level to turbine aviation lighting is considered Medium.
51. The Proposed Development would introduce a light source within the southern edge of the Foothills with Forest LCT. This would be within a small proportion of the overall LCT area (including the Foothills LCT), closer to the influences of the settled landscapes to the south rather than the darker uplands to the north. The lighting would be visible across a wide (High) extent of the LCT units. The presence of lighting would change the rural dark character at dusk/dawn and night to one characterised by turbine aviation lights, highlighting the windfarm development that would otherwise be less noticeable within the landscape at this time. The scale of effect is considered High-Medium. The subsequent magnitude of change is High-Medium.
52. Taking into account the Medium sensitivity, the significance of effect of the turbine aviation lighting on the Foothills with Forest LCT Ae unit and Foothills LCT Beattock unit would be **Major-Moderate and significant**.

#### 5.6.3.2 Middle Dales – Annandale unit

53. The Middle Dales – Annandale unit is characterised by the broad, open gently rolling landform contained by the foothills and uplands. The Annandale Middle Dale LCT unit lies to the south east of the Proposed Development, east of the Upland Fringe of Ae and Torthorwald Ridge, between approximately 3-10km from the Proposed Development. It includes the A74(M) corridor and is in close proximity to settlements at Moffat, Lochmaben, Lockerbie and Beattock. Generally, as can be seen on Plate 1, these areas have high light levels relating to the settlements and roads, with darker areas relating to the open farmland. Overall, with a general higher light level than the rural landscapes to the north. The Foothills with Forest and Foothills LCTs form a backdrop to the north west of this LCT, which appears as gently undulating broad hills elevated above the dales. Queensberry and the Lowther Hills to the north would also be potentially visible beyond the foothills, which in lower light levels, may appear as one upland mass.
54. The susceptibility of the LCT unit to turbine aviation lighting would be Medium-Low based on the influence of existing lighting. The value of the landscape is considered Medium as it has a local value relating to the settled and managed landscape. The subsequent sensitivity would be Medium-Low.
55. The lighting ZTV (**Figure 5.5.1**) illustrates that there would be potential to see the nacelle and tower lighting from most parts of the Annandale unit. The Proposed Development would introduce lighting within the Foothills at an elevation and portion of the view not currently lit when viewed from the Middle Dale LCT Annandale unit. The foothills form a dark backdrop to the area and the presence of turbine lighting would highlight the proposed turbines (where not obviously silhouetted against the sky) and extend the influence of lighting to the north from the main areas of existing lighting influence that cover much of the LCT unit. Whilst the physical attributes of the LCT unit would not change, the turbine aviation lighting would have some influence on the perceived rural nature and darkness of the setting provided by the foothills so that the scale of effect is considered Medium across a Medium extent of the area. The magnitude of change would be Medium.
56. Taking into account the Medium-Low sensitivity, the significance of effect on the Middle Dales LCT Annandale unit would be **Moderate-Minor and not significant**.

#### 5.6.3.3 Upland Fringe – Ae Fringe

57. The Ae Fringe unit of the Upland Fringe LCT units lie to the south and west of the Proposed Development, within approximately 3-10km. The character of the Ae Upland Fringe landscape unit at dusk/dawn is darker than the Annandale and Nithsdale landscapes directly to the east and west but it has light sources associated with settlement and traffic along the A701 and scattered properties across the area. The treed nature of the area also limits light spill across the LCT. The southern edge of the LCT would have greater light influences from Dumfries and its suburbs. The western edge lies close to the A76 and would be influenced by lighting at and around the village of Thornhill. The Foothills with Forest and Foothills LCTs form a gently undulating backdrop to the north with silhouetted operational turbines against the sky potentially visible.

58. The LCT unit is generally dark but with existing light sources associated with roads and scattered properties, and influences from nearby larger settlements. Combined with the treed nature, the susceptibility to turbine aviation lighting is considered Medium. Part of the LCT lies within the Thornhill Uplands RSA, and valued due to the sculptural ridges at the edge of the scenic valley landscapes, however as acknowledged within the main assessment, this part of the LCT has no visual influence from the Proposed Development. Elsewhere, its value is slightly lower as a less distinctive and scenic landscape, but has value relating to its settled and wooded natures, with rich historic heritage. The value of the LCT is considered Medium. The sensitivity level to turbine aviation lighting is considered Medium.
59. The lighting ZTV (**Figure 5.5.1**) illustrates that there would be potential to see the nacelle and tower lighting from the southern parts of the Ae unit. There would be very limited visibility within the western parts of the unit including Thornhill Uplands RSA. The wireline and photomontage for Viewpoint 10 on the A701, South of Ae Bridgend (**Figure 5.20**) illustrates a potential daylight view from this area which shows that nacelle lighting would be visible on five of the turbines appearing above the skyline.
60. The Proposed Development would introduce lighting within the Foothills at an elevation and portion of the view not currently lit when viewed from the Ae unit of the Upland Fringe LCT. The foothills form a dark backdrop to the area and the presence of turbine lighting would highlight the proposed turbines (where not obviously silhouetted against the sky) and extend the influence of lighting to the north from the main areas of existing lighting influence to the south west and west. The turbine aviation lighting would have an influence on the perceived rural nature and darkness of the backdrop to the southern part of this landscape unit. The scale of effect is considered Medium across a Medium extent of the area as there would be no visibility of the Proposed Development from over half the LCT. The magnitude of change would be Medium.
61. Taking into account the Medium sensitivity, the significance of effect of turbine aviation lighting on the Upland Fringe LCT Ae Fringe unit would be **Moderate and significant**.

#### 5.6.3.4 Upland Fringe – Torthorwald Ridge Unit (and Torthorwald RSA)

62. The Torthorwald Ridge unit of the Upland Fringe LCT lies to the south of the Proposed Development, within approximately 6-20km. It is also designated as a Regional Scenic Area (RSA).
63. The character of this landscape units at dusk/dawn is darker than the Annandale and Nithsdale landscapes directly to the east and west but it has light sources associated with settlement across the lower slopes, and along the main roads which lie across the ridge including the A701 to the north, A709 through the centre of the area, and the A75 in the south. Traffic along these main routes will also cause transient light sources. The Foothills with Forest and Foothills LCTs form a gently undulating backdrop in views to the north with silhouetted operational turbines against the sky potentially visible. From more elevated parts of the unit, Queensberry can be seen beyond, although would appear as part of the closer foothills in lower light levels. The more distant Southern Uplands form the skyline to the north east. Existing lighting influences from the main settlement would affect the western edge of the unit overlooks Dumfries and the eastern edge which overlooks Lochmaben, and Lockerbie and the A74(M) corridor slightly further east. The southern extents would also be influenced by the lighting associated with the settlement and industries around the Solway Firth.
64. The Torthorwald Ridge is generally dark but with existing light sources associated with the several roads that lie through it and scattered properties, and influences from nearby larger settlements. Combined with the treed nature and complex landform limiting views out except from the more elevated areas, the susceptibility to turbine aviation lighting is considered Medium. The Torthorwald unit of the LCT is a regionally designated landscape and is valued due to the distinctive landform contrasting against the settled dales. The value of the LCTs is considered High-Medium. The sensitivity level to turbine aviation lighting is considered High-Medium.
65. The lighting ZTV (**Figure 5.5.1**) illustrates that there would be potential to see the nacelle and tower lighting from the north facing slopes which are at the northern end and eastern side of the of the Torthorwald Ridge. The potential dawn view from the northern end of the Torthorwald Ridge is illustrated by **EIA Report Figure 5.27e-f** at Sheildhill, and a Medium scale of effect was assessed in **Table 5.5.4** above.



66. The Proposed Development would introduce lighting within the Foothills at an elevation and portion of the view not currently lit when viewed from the Torthorwald Ridge. The foothills form a dark backdrop to the area and the presence of turbine lighting would highlight the proposed turbines (where not obviously silhouetted against the sky) and extend the influence of lighting to the north from the main areas of existing lighting influence in the south, east and west. This would be most apparent from the northern end of the Torthorwald Ridge. Further south along the ridge, beyond approximately 10km, the influence of lighting from the settlements either side would become greater, and distance from the Proposed Development would be such that the aviation lighting would be less discernible.

67. Whilst the physical attributes of the LCT unit would not change, the turbine aviation lighting would have a slight influence on the perceived rural nature and darkness of the backdrop to views from the northern parts of this landscape unit. The scale of effect is considered Low across a localised (low) extent of the area. The magnitude of change would be Low.

68. Taking into account the High-Medium sensitivity of the unit, the significance of effect of turbine aviation lighting on the Upland Fringe LCT Torthorwald unit and RSA would be **Moderate-Minor and not significant**.

#### 5.6.3.5 Southern Uplands – Lowther Hills unit (including parts of the Thornhill Uplands RSA)

69. The Lowther Hills unit of the Southern Uplands LCT lies to the north of the Proposed Development, beyond approximately 6km from the Site. It is characterised by smooth rounded hills between 500-700 m AOD and includes the more isolated conical Queensberry hill close to the Foothills with Forest. There is a general absence of any settlement which gives a strong sense of naturalness and seclusion, accentuated at dusk/dawn by the lack of any lighting. The scale of the upland landscape becomes more imposing at dusk/dawn when silhouetted against the skyline and appearing as a dramatic backdrop to Nithsdale. Operational wind turbines at Harestanes and Minnygap to the south and Clyde windfarm within the uplands to the north would be silhouetted in the skyline from some places but otherwise recessive without lighting. From within the LCT at night, there would be influences of lighting from the settled Nithsdale valleys and also the main transport corridors to the north and east.

70. The susceptibility of the Lowther Hills unit to turbine aviation lighting is High due to the lack of any lighting and its general rural secluded nature. The Lowther Hills unit is partly within the Thornhill Uplands RSA and has value in its strong sculptural relief and lack of development, giving it a High-Medium value. The sensitivity is considered High-Medium.

71. The lighting ZTV (**Figure 5.5.1**) illustrates that there would be potential to see the nacelle and tower lighting from only the southern edge of the LCT as the height of the uplands precludes views from further north within the Lowthers unit. There would be none or very limited visibility within the Thornhill Uplands RSA part of the unit. The potential dawn view from the edge of this unit is illustrated by Viewpoint 6 on **EIA Report Figure 5.16g-h** just south of Rashly Heights, and a Medium scale of effect was assessed in **Table 5.5.2** above.

72. The Proposed Development would introduce lighting in views from the southern edges of the Lowther Hills. Depending on the elevation of the viewpoint, the lights could appear in the sky above the foothills or against the landscape. From the lower slopes, as demonstrated by Viewpoint 6 at Rashly Heights (**Figure 5.28h**), the foothills screen the views of the settled landscape below such that the lighting would be more prominent and one of the few light sources visible. From more elevation positions, such as Queensberry, the turbine lighting would be perceived much more closely in the context of the lighting influences from Dumfries and the surrounding settled dales landscape.

73. Whilst the physical attributes of the LCTs would not change, the proposed turbine aviation lighting would have some influence on the perceived rural nature and darkness of the setting provided by the foothills at the southern edge of the LCT, but in the context of the wider lighting influences from the settled valleys below. The scale of effect is considered overall Low over a localised (low) area of the LCT. The magnitude of change would be Low.

74. Taking into account the High-Medium sensitivity, the significance of effect on the Southern Uplands LCT Lowther Hills unit would be **Moderate-Minor and not significant**.

#### 5.6.3.6 Talla Hart-Fell Wild Land Area

75. The effects of turbine aviation lighting on the special qualities of the Talla-Hart Fell Wild Land Area are addressed in **Appendix 5.4: Wild Land Assessment**. It was concluded that there would be no significant effects due to distance (over 18 km), limited extent of visibility within the WLA, and that from this direction of view any visibility of turbine aviation lighting would be within a narrow horizontal extent and seen in the context of the lighting influences from the settled dales area, retaining the naturalness, remoteness and sanctuary of the WLA.

#### 5.6.4 Visual Amenity

76. The turbine aviation lighting of the Proposed Development on visual amenity within the Study Area has the most potential to affect residents in individual properties in the more rural areas with no street lighting, or those engaged in activities such as wildlife watching or wild camping. The Galloway Dark Sky Park or promoted stargazing viewpoints do not lie within the Study Area.

77. The assessment in **Chapter 5: LVIA** found that people living and walking in the Annandale area and Ae Upland fringes to the south and south east of the Site, would experience significant effects in daylight hours from the Proposed Development as it would appear as a prominent feature on the foothills which provide a setting to these settled landscapes. Also taking into consideration the viewpoint analysis in **Section 1.6.2**, and landscape assessment in **Section 1.6.3** the assessment on visual receptors therefore focuses on these receptors within approximately 10km from the Site since they would experience views of the Proposed Development in relatively close proximity against a dark backdrop i.e. in views from the south and south east. Visual receptors beyond approximately 10km within the settled landscape will have more and greater intervening light sources potentially visible from Dumfries, the A74(M) and Lockerbie, and in combination with the further distance, the brightness of the proposed aviation lighting will diminish.

#### 5.6.4.1 Visual Receptors within approximately 5km of the Site

78. Within approximately 5km of the Proposed Development the main visual receptors with potential visibility of the Proposed Development are local residents within the south and south east, on the lower slopes of the upland fringes and foothills, generally west of or along the A701. They would generally be isolated properties and would experience a general level of darkness without the influence of street lighting. They would have a Medium sensitivity to lighting, in accordance with the methodology set out in 5.4.1.2.

79. As illustrated by the ZTV (**Figure 5.5.1**) and through the wirelines for viewpoints 2, 3 and 10 (**EIA Report Figures 5.12, 5.13 and 5.20**) people who live in close proximity to the Proposed Development on the lower slopes of the foothills or upland fringes are sheltered from the full visibility of all the turbines of the Proposed Development due to the screening function of the elevated and undulating nature of the foothills in the foreground.. There would be potential for the nacelle lighting of some proposed turbines to be seen just above the skyline from some close properties, but generally above the direct line of sight. It was found through the RVAA (**Appendix 5.4**) that the majority of properties in this area are set into the hillside and orientated so that their main aspect is across the valleys to the south east, the opposite direction to the Proposed Development. In addition, many of the isolated properties sit enclosed by woodland or shelterbelt planting. Nonetheless, where visible, the proposed turbine aviation lighting would introduce a notable new light source in close proximity, highlighting the presence of the turbines within an otherwise dark backdrop. It is considered that the scale of effect would be High-Medium across a wide (high) extent of this area. The magnitude of change would be High-Medium.

80. Taking into account local residents in this area have a Medium sensitivity to turbine aviation lighting, the significance of effect on people living and walking within approximately 5km of the Proposed Development is **Major-Moderate and significant**.

#### 5.6.4.2 Visual Receptors within Annandale, approximately within 5-10km from the Site

81. The settled area of Annandale includes the settlements at Beattock and Lochmaben and is in close proximity to the towns of Dumfries, Lockerbie, and Moffat. There are also many villages, hamlets and scattered individual houses and farms. Plate 1 illustrates the generally brighter levels of lighting associated with the settlement pattern across this area in contrast to the darker foothills and uplands to the north. As described for the landscape assessment of the Middle Dales LCT above, at dusk/dawn and darkness, the gently rolling landform and treed nature of this area would screen and filter existing light sources across it such that outside the main settlement areas, lighting would appear more sporadically. From the Torthorwald Ridge, which lies between the dales and

includes properties on its lower slopes, and where vegetation does not serve a screening function, there would be wider views of the baseline lighting.

82. The turbine aviation lighting of the Proposed Development would highlight the position of the turbines when seen from the closer settled areas, introducing light within an otherwise dark backdrop. As described in the assessment of Viewpoint 17 at Shieldhill (**EIA Report Figure 5.27f**) the more simplistic and uniform view of the foothills and uplands landform that the darkness creates also provides a longer elevated skyline which would potentially reduce the perceived scale of the proposed turbines and the prominence of their turbine aviation lighting as it would appear within only a small proportion of the overall view.
83. Where there is less influence of existing lighting across Annandale and lower Nithsdale, the turbine aviation lighting of the Proposed Development would become a focus across a relatively narrow horizontal extent of the otherwise dark foothills in views towards the north for visual receptors in this area. The scale of effect is considered High-Medium, across a medium to low extent of the area. The subsequent magnitude of change is Medium.
84. Taking into account local residents within the more rural and darker parts of this area would have a Medium sensitivity to turbine lighting, the resulting significance of effect is **Moderate and significant** for those within approximately 5-10km. Residents within the villages and towns with street lighting, and also road users in this area would have a Medium-Low and Low sensitivity and the significance of effect would be **Moderate-Minor and not significant**.

5.7 Summary

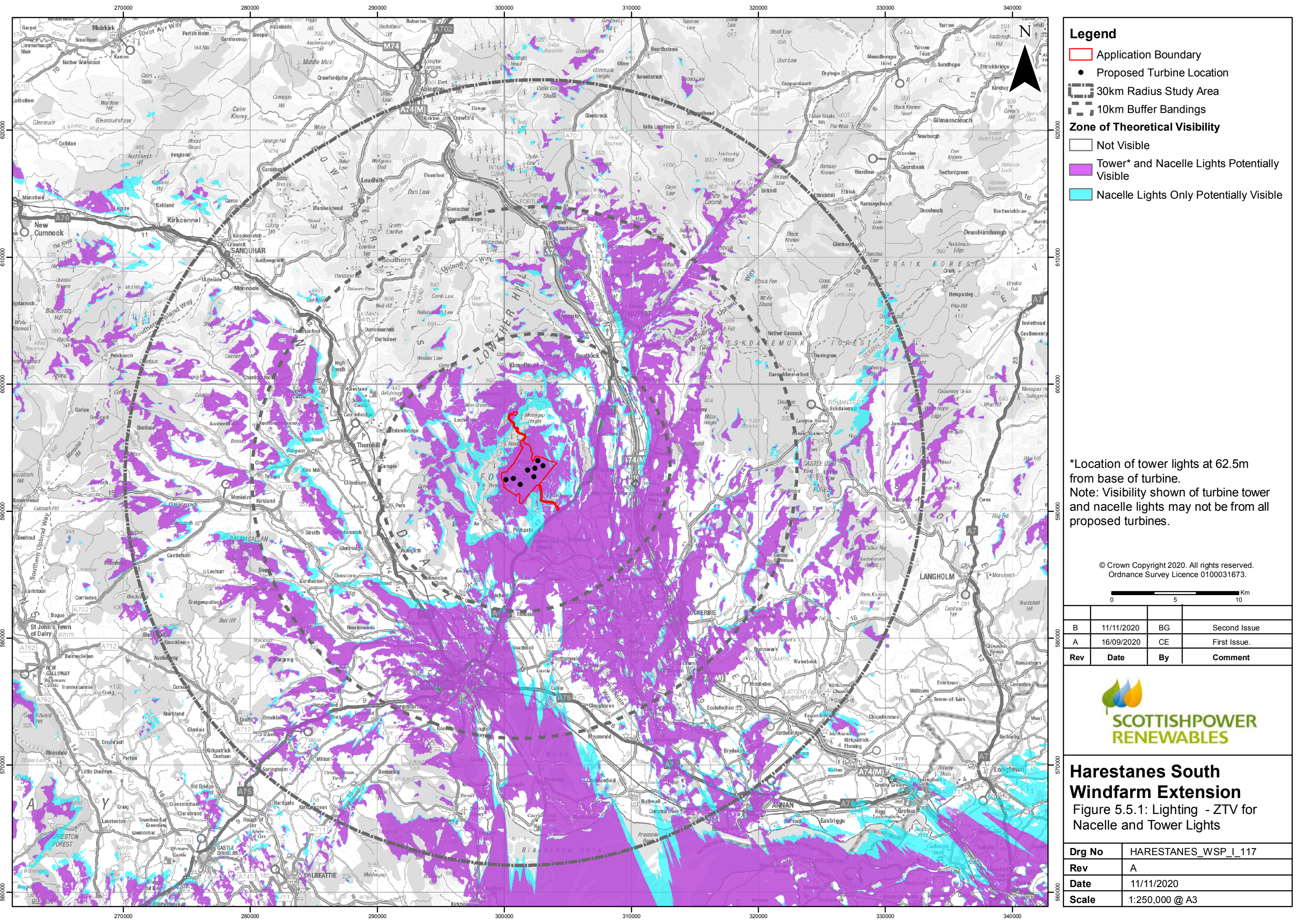
Receptor	Receptor Sensitivity	Operational Baseline Magnitude of Change	Significance of Effect
Landscape Character			
Foothills with Forest – Ae unit, and Foothills – Beattock unit	Medium	High-Medium	<b>Major-Moderate Adverse Significant</b>
Middle Dale – Annandale	Medium-Low	Medium	Moderate-Minor Adverse Not Significant
Upland Fringe – Ae Fringe unit	Medium	Medium	<b>Moderate Adverse Significant</b>
Upland Fringe –Torthorwald Ridge unit	High-Medium	Low	Moderate-Minor Adverse Not significant
Southern Uplands – Lowthers	High-Medium	Low	Moderate-Minor Adverse Not Significant
Visual Receptors			
Local Residents within 5km	Medium	High-Medium	<b>Major-Moderate Adverse Significant</b>
Local Residents in isolated properties in Annandale, within 5-10km	Medium	Medium	<b>Moderate Adverse Significant</b>
Local Residents in villages and towns in Annandale, within 5-10km	Medium-Low	Medium	Moderate-Minor Adverse Not Significant
Road users in Annandale, within 5-10km	Low	Medium	Moderate-Minor Adverse Not Significant

Table 5.7.1 Summary of assessment of turbine lighting

5.8 Conclusion

85. The Proposed Development would introduce sources of light into a currently dark area of the forested foothills. They would occupy a small proportion of the overall Foothills with Forest and Foothills LCTs but as the only source of light in the LCT would have a wider influence and change the perceived night-time character of the foothills and adjacent LCTs to the south and south east.
86. At lower light levels the Foothills appear to become a dark elevated backdrop to the Middle Annandale LCT unit, Ae Upland Fringe unit and the northern end of the Torthorwald Ridge Upland Fringe unit. The introduction of lighting would alter the perception of this darker and rural setting to an area characterised by eight lit turbines, extending the influence of lighting from the settled landscape below.
87. The containment by the Southern Uplands limits the visual influence on the more sensitive darker rural areas further north and north east and to the west and north west. Where potentially visible from landscapes to the north and north east, the potential for significant effects is reduced by distance and the direction of views towards the Site where the proposed turbine aviation lighting would be seen within the context of the lighting influences from the settled dales area beyond.
88. Residents in close proximity to the Proposed Development are largely located on the lower slopes of the foothills and upland fringe; their views screened by the intervening landform. There is potential for nacelle lighting on some turbines to be seen just above the skyline where they would introduce a notable new light source in close proximity, highlighting the presence of the turbines within an otherwise dark backdrop and would create significant effects.
89. Residents outside of the influence of lighting from the main settlements within Annandale (within approximately 10km from the Proposed Development) would potentially experience significant effects where the proposed turbine aviation lighting would highlight the turbines within the dark backdrop associated with the more rural foothills and uplands landscapes to the north, but would be moderated by distance and that it would occupy a narrow horizontal extent of the potential views available.





**Legend**

Application Boundary

Proposed Turbine Location

30km Radius Study Area

10km Buffer Bandings

**Zone of Theoretical Visibility**

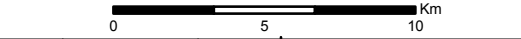
Not Visible

Tower\* and Nacelle Lights Potentially Visible

Nacelle Lights Only Potentially Visible

\*Location of tower lights at 62.5m from base of turbine.  
Note: Visibility shown of turbine tower and nacelle lights may not be from all proposed turbines.

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B	11/11/2020	BG	Second Issue
A	16/09/2020	CE	First Issue.
Rev	Date	By	Comment

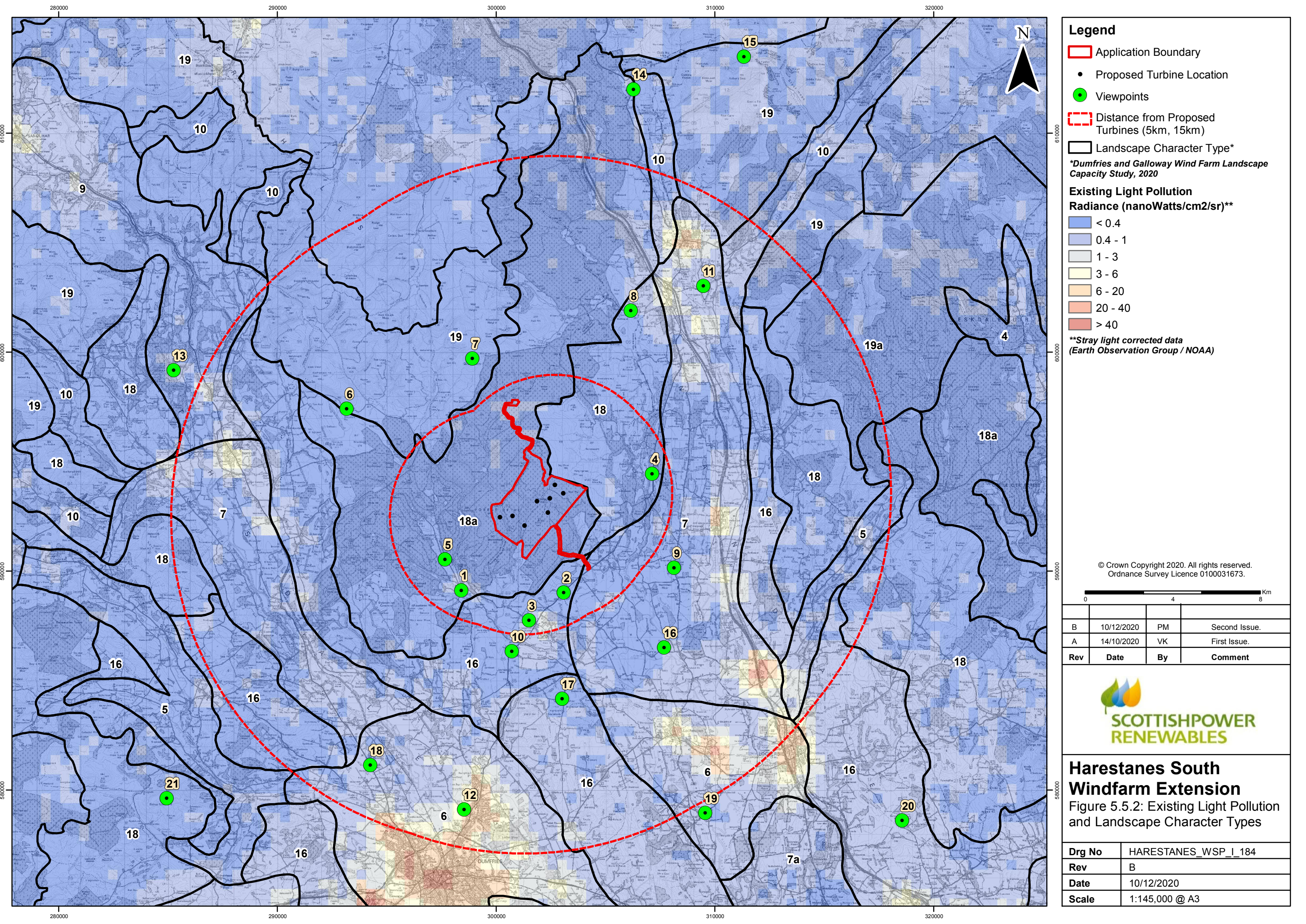


**Harestanes South Windfarm Extension**

Figure 5.5.1: Lighting - ZTV for Nacelle and Tower Lights

Drg No	HARESTANES_WSP_I_117
Rev	A
Date	11/11/2020
Scale	1:250,000 @ A3





**Legend**

Application Boundary

Proposed Turbine Location

Viewpoints

Distance from Proposed Turbines (5km, 15km)

Landscape Character Type\*

*\*Dumfries and Galloway Wind Farm Landscape Capacity Study, 2020*

**Existing Light Pollution**

**Radiance (nanoWatts/cm2/sr)\*\***

< 0.4

0.4 - 1

1 - 3

3 - 6

6 - 20

20 - 40

> 40

**\*\*Stray light corrected data  
(Earth Observation Group / NOAA)**

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0 4 8 Km

B	10/12/2020	PM	Second Issue.
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A	14/10/2020	VK	First Issue.
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Rev	Date	By	Comment
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**Harestanes South  
Windfarm Extension**

Figure 5.5.2: Existing Light Pollution  
and Landscape Character Types

<b>Drg No</b>	HARESTANES_WSP_I_184
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<b>Rev</b>	B
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<b>Date</b>	10/12/2020
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<b>Scale</b>	1:145,000 @ A3
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