Night Time Effects

1.0 Introduction

Onshore wind turbines of over 150m in height require mandatory visible spectrum aviation lighting, for the proposed Development this will comprise:

- 1 no. 2000 candela steady red light mounted on the nacelle
- 3no. 32 candela steady red lights mounted around the tower (so as to be visible in all directions) at half the hub height

This appendix assesses the effects of aviation lighting on landscape and visual receptors at all low light periods when the proposed lighting may be visible. This includes early morning, evening and night time periods although as agreed with SNH and SLC during scoping, the assessment focusses on the dusk period from evening through to night. In the assessment, the term 'dusk' refers to this generic period rather than the formal astronomical definition.

This assessment defines the existing landscape and visual baseline at times of lower light levels (i.e. at dusk, night and dawn periods); describes the key aviation lighting aspects of the Development as they relate to landscape and visual matters; describes the nature of the anticipated change upon both the landscape and visual environments; and, assesses the magnitude and significance of the changes for the operational stage of the proposed Development.

Figures supporting this appendix are included in Volume 2 of the EIAR.

2.0 Approach and Methodology

Night time assessment of visible aviation lighting for onshore wind turbines on landscape and visual receptors is an emerging area and as such, there is no specific policy or guidance on the subject.

The approach and methodology of this assessment follows the same structured approach as chapter 4 of the EIAR which, along with the scope of this assessment, has been agreed with South Lanarkshire Council ('the Council') and Scottish Natural Heritage (SNH). A summary of consultation responses is included in chapter 4 of the EIAR and set out fully in Technical Appendix 4.2 (LVIA Scoping Correspondence).

The assessment terminology and judgements used are the same as for chapter 4 of the EIAR however the approach to the sensitivity of receptors is adapted as follows:

2.1. Sensitivity of landscape character areas to lighting

For landscape character areas, susceptibility is judged based on the degree to which the character area is currently characterised by darkness – informed by satellite mapping of light distribution and site observations. Value is judged the same as for the daytime assessment unless specific factors suggest otherwise – for example identification as a dark sky site which would increase value; or where factors that contribute to value in daytime are irrelevant at night – which may reduce value at night.

2.2. Sensitivity of visual receptors at night

For visual receptors the assessment takes account of the different importance attached to views in the night time environment:

Generally, the value attached to night time views is considered to be low unless there is a particular feature that can be best appreciated in the hours of darkness. This may include views of stars and the night sky that are only possible in particularly dark areas or views of well known landmarks that are lit up at night.

The susceptibility of receptors also differs at night reflecting the different activities people undertake in the hours of darkness. For example, drivers using roads at night tend to be more focused on the road and the area illuminated by their headlights than during the day and may have oncoming headlights, cats eyes or other reflective signage drawing their attention, resulting in lower susceptibility. This is particularly the case on unlit rural roads that may be narrow and winding. On the other hand, people taking part in activities requiring darkness, such as stargazing, would be of higher susceptibility.

The sensitivity of visual receptors at night is generally rated as follows:

- National value and High susceptibility – visitors to Dark Sky Parks.
- Local value and High susceptibility – visitors to dark sky discovery sites or public observatories.
- Community value and High susceptibility – wild campers, people engaged in night time activity such as bat watching or residents of notably dark areas (i.e. rural locations with no street lighting) in the streets around their homes where dark skies are integral to the amenity.
- National (or Local) value and Medium susceptibility – visitors to nationally important or well known local landmarks that are illuminated at night e.g. the Kelpies.
- Community value and Medium susceptibility – residents in urban areas or semi-urban/rural areas (where street lighting is present) in the streets around their homes, users of cycle routes and railways.
- Community value and Low susceptibility – drivers using local, unlit roads.
- Limited value and Low susceptibility – users of main roads and people at their place of work.

2.3. Scope

It has been agreed that a study area of 15km is sufficient to identify all potentially significant effects on landscape and visual receptors as a result of the proposed aviation lighting. This is based on the observed visibility of similar lights and represents a requested increase on the 10km study area previously used and accepted by decision makers as adequate for Lethans Wind Farm. The assessment considers the impact of lighting on landscape character, visual receptors and landscape designations.

A subset of the viewpoints used in the LVIA will be used to aid the assessment of night time effects, these are 2, 3, 4, 5, 7, 8, 10 and 11. In addition to these, viewpoint 19 at Rigside, used in the original ES for the consented scheme, is included to represent receptors at the outer edge of the study area. A wireframe visualisation is also presented for viewpoint 20 to further illustrate effects on distant receptors, however, as it is several kilometres beyond the 15km study area and in a similar direction and not far from viewpoint 19, no judgements are made for this viewpoint.

2.4. Perception of light over distance

During the agreement of scope, it was agreed that in order to support development of night time assessment approaches, attempts would be made to source available research in respect of how humans perceive light dimming with distance.

Reasonable attempts have been made to source this, including contacts with academic researchers in relevant fields. We have been unable to source definitive research on this topic, and therefore set out the available information and relevant observations below.

The physics of lighting tells us that the amount of light reaching any given point reduces with distance. An aviation light will emit a fixed amount of light, which spreads out in all directions, expanding with distance – like an inflating balloon. The amount of light reaching an area of fixed size, such as a person's eye, is therefore markedly reduced by distance.

Atmospheric conditions also play a role, with lights observably appearing brighter in drier conditions when the light is less scattered and reflected by water droplets in the air.

However, human night vision and perception is optimised to gather the available light, and notice contrast – so the perception of the brightness of a light may reduce less with distance than physics would suggest. A similar observation was made when research was undertaken to support wind farm visualisation standards – resulting in paper visualisations being increased in size to reflect the fact that the human perception of proximity and size is slightly exaggerated compared to what measured distances would suggest.

In the specific case of red light, two factors may be at play in affecting our perception, but they work in opposite directions. Human night vision is less sensitive to the colour red than to other colours such as green and blue – which will make a red light appear dimmer than some other colours. However, there is also research which suggests that we are psychologically attuned to find red a particularly noticeable colour – hence its use for warnings.

In practice, it can be observed that more distant lights appear dimmer (as well as smaller) whilst on site. As an example – on this project we observed that red roadside reflectors and car tail lights near to the viewer appear brighter than the aviation lights on the mast at Darvel when these elements are seen together driving along the A71 west of Strathaven, despite those nearby light sources being intrinsically less bright.

3.0 Assessment of Effects

This section identifies those groups of landscape and visual receptors likely to experience notable effects as a result of the proposed turbine lighting. The baseline description of the existing night time environment for each receptor group is provided alongside the assessment of effects for ease of reference.

This section considers both landscape character and visual receptors before considering designated landscapes. It is common for designations to encompass both character and visual considerations within their special qualities or purposes of designation. It therefore makes a more natural reading sequence to draw together those aspects of character and views which relate to the designation if they have been described earlier in the chapter.

3.1. Night Time Visual Environment of the Study Area

The existing intensity of artificial lighting across the study area is illustrated on Figure 1 to this Appendix using satellite data (VIIRS Day/Night) from March 2018. This illustrates that there is a very low level of artificial light within 5km of the proposed Development. To the south and west the landscape across the 15km study area also tends to have very little artificial light with only a few small settlements contributing notably to lighting within the night time visual environment. To the north and east, settlement is far more extensive beyond 5km with artificial lighting in towns and villages, as well as along main roads between them, combining to create a much higher degree of light pollution within the study area. Lighting beyond the study area is also experienced from many areas within it; for example, in more elevated locations the lights of Glasgow and the central

belt can be seen extending into the far distance and these also contribute to notable skyglow in darker areas that are more remote from artificial light sources.

There are also a number of other light sources, beyond those generally associated with settlements and transport corridors, both within and beyond the study area that can be seen from within the study area and vary in prominence depending on the context of the view. These include a number of quarries and opencast mines that are brightly floodlit at night, generally with white lights, and several transmitter masts with red aviation lighting that is the same colour and intensity as required on the proposed turbines. These include the 152m Darvel Mast, located within the study area, and the much taller masts at Black Hill (306m) and Kirk o'Shotts (183m) located in North Lanarkshire. Unlike the proposed turbines, masts have lights mounted at regular intervals. This vertical linear arrangement is noticeable from the surrounding landscape.

There are a number of existing turbines with red nacelle lights within the study area although these are smaller and have lower intensity lighting than the 2000 candela lighting proposed. These include several turbines adjacent to the M74 and a small number located on hills to the south of Stonehouse. In addition to these the existing Kype Muir windfarm will have low intensity 25 candela lights installed on its cardinal turbines which introduces red lights immediately adjacent to the proposals.

3.2. ZTV Studies

Final ZTV studies were prepared to inform this assessment based on the on the Final Layout. These are shown on Figures 2 and 3 to this appendix and illustrate:

- Figure 2 – the number of turbines visible at hub height (to indicate the number of 2000 candela nacelle lights visible)
- Figure 3 – the number of turbines visible at mid-tower height (to identify the number of 32 candela tower lights visible)

ZTV studies include the screening effect of woodland and settlements in order to provide a more realistic illustration of potential visibility of proposed lighting compared to that of a bare earth model. It is however acknowledged that lights may, in limited instances, be visible through areas of woodland where it is not particularly dense or when leaves are not present on trees. Where this may be the case for a particular receptor this is noted in the text, however it would have little bearing on the overall pattern of visibility within the study area.

As can be seen from the two ZTV studies the greatest number of turbine lights visible tends to be from two areas: One is located the north of the proposed Development and broadly runs along and to the north of the A71 corridor as a fairly continuous band taking in open landscape along with the outskirts of Strathaven, Glassford, Chapelton and Stonehouse. The other area consists of elevated areas to the south where all the 2000 candela nacelle lights may be seen at once. Within 5km of the proposed turbines the number of nacelle lights potentially visible is generally less than in more distant areas and tends to be relatively patchy, particularly to the south and west, with large areas having no potential views as a result of the varying topography and extent of coniferous woodland cover.

Figure 3 indicates that the theoretical visibility of the 32 candela tower lights is more constrained with lights on fewer turbines visible from large parts of the study area, particularly along the A71 corridor to the north and in the general vicinity of Darvel to the west. It also illustrates that tower lights are visible in fewer parts of the study area than the nacelle lights due to their lower elevation. This is particularly notable in areas to the north and northwest within approximately 4-6km such as the areas around Sandford and Drumclog.

3.3. Landscape Effects

Local landscape character types within the 15km study area are illustrated on Figure 1 to this appendix. This shows that those character areas to the north and east of the site, beyond 5km, are already characterised by fairly extensive artificial lighting and would not experience any notable effects on landscape character as a result of the proposed Development.

Character types within 5km and to the south and west of the study area have a much lower intensity of artificial light present within them. However, from the majority of these, as described in section 3.1 above, views out to distant light sources are characteristic. It follows, therefore, that the only character types likely to experience notable effects on landscape character as a result of the proposed development are those that are directly affected by the introduction of aviation lighting within them and some of those immediately adjacent where the introduction of lighting nearby would be fundamentally different to other remote sources of artificial lighting.

The main source of effects would occur as a result of the 2000 candela nacelle lighting which would be both brighter and more widely visible than the 32 candela tower lights. The ZTV on Figure 2 indicates that the primary areas of visibility of the nacelle lights occurs across the host character sub-type, 7A Rolling Moorland Forestry, and the adjacent units of the parent type 7 Rolling Moorland.

Other character types within darker parts of the study area, generally to the south, are either shown to have very limited potential visibility of the proposed lighting or so far removed that notable effects on landscape character are unlikely and these areas are not considered further.

3.3.1. **7 Rolling Moorland**

The key characteristics of this landscape type are defined as:

- *"distinctive upland character created by the combination of elevation, exposure, smooth, rolling or undulating landform, moorland vegetation and the predominant lack of modern development;*
- *these areas share a sense of apparent wildness and remoteness which contrasts with the farmed and settled lowlands and the windfarm-dominated Plateau Moorlands;*
- *there are extensive views over the surrounding Ayrshire and Lanarkshire lowlands from the hilltops."*

In addition to these sub type 7A Rolling Moorland Forestry is further defined as having a *"dominance of commercial forestry"*. The night time character of these areas is not discussed in the current character assessment however these areas are generally dark with little existing light pollution, as illustrated by Figure 1 to this appendix. Existing lighting within this character type tends to be limited to occasional isolated dwellings, such as those near viewpoint 2, and in sub-type 7A Rolling Moorland Forestry there are virtually no artificial light sources at present. This will change on completion of Kype Muir wind farm which will have low intensity red lighting located on the four cardinal turbines within this sub-type and immediately adjacent to the site.

Despite limited sources of artificial lighting present within the landscape type, the upland character and extensive views over the surrounding landscape mean visible sources of artificial light, albeit somewhat removed, are characteristic of the type. This includes lights associated with settlements, road corridors and occasional red aviation lighting e.g. on the Darvel Mast and several small turbines in neighbouring character types. As a result this landscape character type is considered to have High-Medium susceptibility to the proposed turbine lighting. Taking this with the Community value of the landscape, as set out in the original ES, the character type is considered to have **Medium** sensitivity to the proposed turbine lighting.

The proposed Development would introduce a cluster of red aviation lighting into a dark area where the only other similar light source will be the much lower intensity red aviation lighting on the adjacent Kype Muir wind turbines. This would result in Large scale effects extending up to

around 3km to the north, similar to at viewpoint 2, and around 2km to the northwest and southeast beyond which the number of potentially visible lights reduces as a result of changes in topography. In areas covered by coniferous forestry the extent of Large scale effects would be considerably reduced due to limited visibility of the lighting. In areas beyond 3km the scale of landscape effects would rapidly reduce to Negligible due to reduced visibility and the presence of other light sources.

In the host units of this character type the Long-term effects would be Large scale and occur over an Intermediate extent and would be of **High** magnitude, **Major-moderate** and **Significant**. These effects would be **Adverse** given the degree of lighting introduced into this relatively dark area.

Over other units of the wider character type, beyond the site, the Long-term effects would no greater than Small scale and would occur over a Limited extent of the character type. These effects would be **Negligible** magnitude, **Minimal** and **Not Significant**.

3.4. Visual Effects

The approach to assessing visual receptors is slightly different to that of the main LVIA chapter and focusses on visual receptor groups which include a number of receptors where effects are likely to be similar in nature and significance. This may include settlements, incorporating surrounding paths, local roads and outlying housing or a series of transport routes at a similar distance and/or direction from the proposals. Effects on key routes, such as main roads and rail, and accessible landscapes are considered separately.

3.4.1. Visual Aids

Wirelines illustrating the number of turbine lights theoretically visible and their positions relative to each other and the land form are included within Figure 6 to this Appendix. These provide no illustration of the size or intensity of the lights and do not take account of screening by above ground features such as vegetation or buildings.

Figures 4 and 5 to this Appendix are photomontage visualisations for viewpoints 5 and 7. For each of these viewpoints two montages have been produced, one just before sunset and one just after when the landform can still be seen. Photomontages are calibrated with reference to photography of the built turbine at Methil, Fife which has a 2000 candela nacelle light. The reference viewpoints (Figures 7 and 8) are located at distances which approximately correspond with the distances of viewpoints 5 and 7. Further detail in respect of the production of night time photomontages is included at Annex A.

The viewpoint description, description of effects and scale of effects for each viewpoint (see Figure 1 for viewpoint locations) is set out on the relevant wireline visualisation. The scale of effect at each viewpoint is summarised in Table 1.

Table 1: Summary of scale of effects on viewpoints

Viewpoint	Distance, Direction	Scale of Night Time Effect	Positive / Neutral / Adverse
VP2: South Kirkwood	2.6 km north	Large	Adverse
VP3: Sandford	5.5 km north	Small	Adverse
VP4: B7086 at Deadwaters	5.3 km northeast	Medium	Adverse
VP5: A71 west of Strathaven	6.5 km north	Medium	Adverse
VP7: Gilmourton	4.7 km northwest	Large-Medium	Adverse
VP8: A71 at Caldermill	5.7 km northwest	Medium	Adverse
VP10: Stonehouse	8.2 km northeast	Medium-Small	Neutral

Viewpoint	Distance, Direction	Scale of Night Time Effect	Positive / Neutral / Adverse
VP11: Drumclog	5.5 km northwest	Medium	Adverse
VP19: Rigside	15.4 km east	Negligible	Neutral

3.4.2. **Visual Receptor Groups**

Strathaven – 6.2 km north

Strathaven is a town that is widely lit by street lighting. The ZTV's on Figure 2 and 3 show that there is limited potential visibility of the proposed turbine lighting within the town itself and from the majority of streets where theoretical visibility is shown the lighting is unlikely to be especially noticeable beyond existing street lighting. Areas that are shown to have notably increased potential visibility include the cemetery, parts of which would have fairly open views due to its elevated position, and the fields adjacent to Kirklandpark Primary School although neither of these areas is likely to be frequently visited in the hours of darkness.

The most affected parts of Strathaven would be the outskirts of the town, primarily to the southern edges and in the vicinity of Hills Road. In these areas views out across the darker surrounding landscape are possible and the proposed turbine lighting would be seen across the skyline, similar to that illustrated at viewpoint 5. The lighting would be seen in the context of other occasional lighting within the landscape associated with isolated dwellings, farms and some low intensity aviation lighting on small turbines and at Kype Muir. Roads approaching the south, east and west of the town are likely to be similarly affected.

As set out at section 2.2 people in and around urban and semi urban areas are considered to be **Medium** sensitivity. Long-term effects at Strathaven would be Medium scale over a Localised extent and would be **Medium** magnitude, **Moderate** and **Not Significant**. These effects would be **Adverse** due to the notable addition of red lighting into currently mostly dark skies.

Small settlements between approximately 3km and 6km to the northwest

This group includes Drumclog, Gilmourton and Caldermill as well as other small groups of houses at a similar distance and direction from the site. These settlements tend to be well lit by modern LED street lighting along the main roads within or passing through the settlements but notably darker outside these areas due to the small number of houses and few other sources of external lighting. Turbine lighting may occasionally be visible from main streets although the foreground street lighting would be more notable. As illustrated by the wirelines for viewpoints 7, 8 and 11, the lights would typically be seen in a simple relatively linear arrangement. The primary area of effects would be to the periphery of settlements where turbine lighting may be seen from houses and gardens and minor roads. Effects would vary slightly between Large-Medium and Medium scale, dependent on distance and the nature of view.

As set out at section 2.2 people in and around settlements with street lighting are considered to be **Medium** sensitivity.

Long-term effects on Gilmourton, which is closer to the proposed Development and has few lights in outward views towards the site, would be Large-Medium scale over a Wide extent and would be **High-Medium** magnitude, **Major-Moderate** and **Significant**. These effects would be **Adverse** due to the notable addition of red lighting into currently dark skies.

Long-term effects on the slightly more distant settelements of Caldermill and Drumclog, which also have more lights in views towards the site, would be Medium scale over an Intermediate extent and would be **Medium** magnitude, **Moderate**, **Not Significant** and **Adverse**.

Small settlements between approximately 5km and 6km to the north and northeast

This group includes Sandford and Deadwaters as well as other small groups of houses at a similar distance and direction from the site. These settlements tend to be well-lit by modern LED street lighting along the main roads within or passing through the settlements, but notably darker outside these areas due to the small number of houses and few other sources of external lighting. Effects here would be similar to those described for the group of settlements to the northwest however the intervening topography in this direction would tend to screen a slightly greater number of the proposed lights which would result in a slight reduction in the scale of effects, as illustrated by the wireframes for viewpoints 3 and 4. As for the views from the northwest, the varied turbine heights tend to result in the lights forming a simple linear pattern. Views from this area would also include more existing red low-intensity aviation lighting associated with small turbines and that on the cardinal turbines at Kype Muir – which would be seen in front of the proposed lighting.

As set out at section 2.2 people in and around settlements with street lighting are considered to be **Medium** sensitivity.

Long-term effects on Sandford would be Medium scale over a Localised extent and would be **Medium** magnitude, **Moderate** and **Not Significant**. These effects would be **Adverse** due to the notable addition of red lighting into skies that are generally perceived as dark despite the presence of some existing low intensity aviation lighting.

Long-term effects on Deadwaters would be Medium scale over an Intermediate extent and would be **Medium** magnitude, **Moderate**, **Not Significant** and **Adverse**.

Other settlements within the study area

Other settlements within the study area are indicated by the ZTV's to have little to no potential visibility of the proposed turbine lighting. Where potential views are shown, such as the outskirts of Stonehouse or Darvel, the proposed turbine lights would be seen at a distance where they would constitute only a very small change to the baseline environment and would not be particularly notable due to the presence of other lighting within the settlements and the wider landscape. These effects would be **Negligible**.

Minor roads between settlements

The study area encompasses a large proportion of semi-rural landscape that is criss-crossed by numerous minor roads which are often narrow and winding and have no street lighting and limited signage. These cross areas that are generally dark however this requires drivers to focus on the road ahead of them and means visibility beyond the beam of the headlights is reduced due to the contrast between the bright light emanating from the car and the dark landscape beyond. Whilst the proposed lighting would be visible from many of the minor roads within the study area the road users focus would generally be elsewhere and the lights would be perceived as part of the background although would be more notable on sections of routes where the direction of travel is towards the proposed turbines. As set out in section 1.1, users of unlit local roads are considered to be of **Medium-Low** sensitivity.

The only minor roads within 5km of the proposals are the B743, and those that provide access to Gilmourton and a small number of isolated dwellings. Users of this latter group would generally only be residents of those isolated houses and effects on this receptor group within 3km of the site are considered within Technical Appendix 4.3 - Residential Visual Amenity Assessment. Effects on the B743 and local roads 3-5km from the site are likely to be most notable in the vicinity of East and West Cauldcoats where southbound drivers on the B743 would be oriented towards the proposed lighting and the greatest number of lights would be potentially visible. Long term effects on these routes would be similar to viewpoint 7 at Gilmourton and would be up to Large-Medium scale (though less across most of the area where fewer lights would be visible) across a Localised extent.

These effects would be **Medium** magnitude, **Slight** and **Not Significant**. The effects would be **Adverse** due to the notable addition of red lighting into currently dark skies.

The majority of minor roads between settlements are located beyond 5km of the proposed turbines where the scale of Long-term effects would be Medium to a distance of approximately 8km from the turbines, as illustrated by the viewpoints. These would occur across an Intermediate extent of the group and would also be **Medium** magnitude, **Slight**, **Not Significant** and typically **Adverse** although this would tend to Neutral and effects would be slightly reduced for routes where drivers are heading towards Strathaven which interposes closer lighting in the view ahead.

Beyond 8km, effects reduce below Medium, and the combination of more limited areas of visibility of the lighting and a higher frequency of settlements and lit areas mean that effects would tend to Small scale and then Negligible and typically be Neutral. Long-term, Small scale effects would arise over a Localised extent. These effects would be of **Negligible** Magnitude, **Minimal** Significance and would be **Neutral** and **Not Significant**.

3.4.3. **Key Routes**

The only key route within the study are likely to experience notable effects is the A71. Other main roads, including the M74, are either shown by the ZTV's to have very limited potential visibility of the proposed turbine lighting or are located at a distance where effects are likely to be Negligible.

The only rail route within the study area terminates in the well-lit town centre of Larkhall and is approximately 14.5km from the nearest turbine.

A71

This route extends broadly northeast-southwest across the study area, linking the larger settlements including Stonehouse, Strathaven and Darvel as well as other minor settlements along the route. As it passes through these it is generally illuminated by bright street lights but between settlements the route is unlit and passes through a dark landscape. As set out at section 1.1, users of main road routes are considered to have **Low** sensitivity to the proposed lighting.

In areas where no street lighting is present there generally cats eyes and frequent reflective signage that, along with oncoming headlights, provide the primary focus for road users with other light sources within the landscape being secondary. In these darker areas the proposed lighting would be seen to one side of the road and would appear similar to viewpoints 5, 8 and 11. In areas where the road passes through settlements the combination of street lights and localised screening mean the proposed lighting would be of limited note. Long-term effects on this route would be Medium scale and occur over an Intermediate extent, these would be **Medium** magnitude, **Slight** and **Not Significant**. The effects would be **Adverse** due to the notable addition of red lighting into currently dark skies.

A70

During scoping discussions, the stretch of the A70 between Nether Wellwood and Lugar was also considered, however this will have intermittent and distant views of 1-5 turbine hubs at distances of 12.5-17km and effects will be Negligible.

3.4.4. **Accessible and Recreational Landscapes**

The only landscapes likely to experience regular use during the hours of darkness are those promoted for specific activities such as designated Dark Sky Parks or dark sky discovery sites used for stargazing. No such landscapes exist within the study area. Other types of accessible landscape are unlikely to experience regular use during the hours of darkness and are not considered in this context.

3.5. Effects on Landscape Designations

The only designated landscape located where notable effects may occur is the River Ayr Sensitive Landscape Area. Other designated landscapes within the study area are located in areas where surrounding lighting is widespread (Special Landscape Areas to the northeast) or at a distance where effects are likely to be negligible (Special Landscape Areas and Sensitive Landscape Areas to the south and southeast).

As set out in the main assessment and original ES, the River Ayr Sensitive Landscape Area designation relates to the landscape character of the East Ayrshire Plateau Moorlands character type within the study area. This area would have limited potential visibility of the proposed turbine lighting, as illustrated by the ZTV's, and as set out at section 2.4 this area would not experience significant effects on landscape character. Effects on this designated landscape are considered to be **Negligible.**

4.0 References

Version 1 VIIRS Day/Night Band Nighttime Lights (Raw) - https://ngdc.noaa.gov/eog/viirs/download_dnb_composites.html

VIIRS Data (Processed) - https://www.lightpollutionmap.info

Annex A – Night Time Montage Methodology

1. Calibration photographs were taken of the offshore demonstrator turbine at Methil in Fife which is fitted with 2000 candela nacelle lighting similar to that proposed for Kype Muir Extension. These photographs were taken from locations at a similar distance and ambient light level to those viewpoints being montaged and using the same camera equipment and similar exposure settings to the photographs used to produce the montages.

2. The model of the proposals was then rendered with turbine lighting shown in the correct locations, using industry standard software with realistic lighting reflecting the date and time of day the viewpoint photographs were taken at in order to give an impression of the 'brightness', colour relating to light on surfaces, and texture of surfaces at night. This rendered model was then fitted to the night time photographs using the wireframes created for the day time photomontage as a reference.

3. Finally, the proposals were rendered in a photo editing package to illustrate the proposals appearance based on existing lighting in the panoramas, the calibration photographs, foreground features in the view that would screen parts of the proposal and the render from the 3D model to give an accurate representation of the proposals. Red lights typically appear 'less red' in photographs than experienced with the naked eye so the proposed lighting shown in montages has been enhanced to present a colour that more closely resembles that which would be experienced in real life.