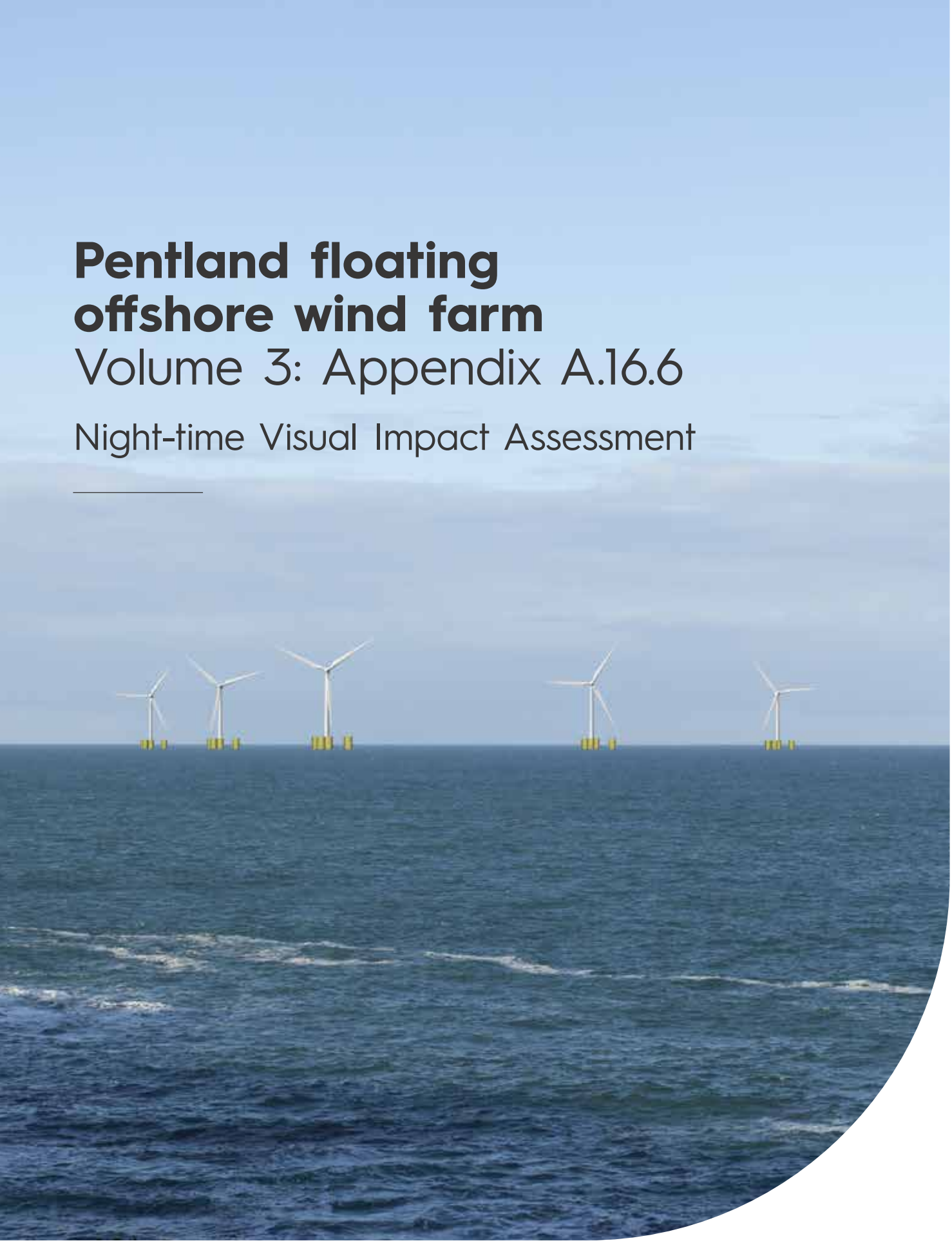
Pentland floating offshore wind farm

Volume 3: Appendix A.16.6

Night-time Visual Impact Assessment



PENTLAND FLOATING OFFSHORE WIND FARM

OFFSHORE EIAR (VOLUME 3): TECHNICAL APPENDICES

APPENDIX 16.6: NIGHT-TIME VISUAL IMPACT ASSESSMENT

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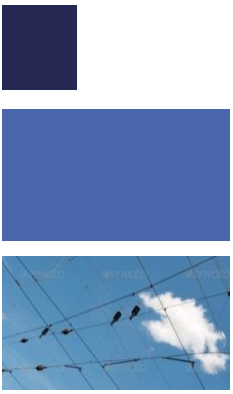

APPENDIX 16.6: NIGHT-TIME VISUAL IMPACT ASSESSMENT

1.1 Introduction

This appendix provides an assessment of the visual effects arising from the visible aviation and marine navigational lights of the Offshore Development. A description of the aviation lighting requirements during construction, operation and decommissioning is contained in Offshore EIAR (Volume 2) Chapter 15: Aviation and Radar, and a description of lighting required as an aid to marine navigation is contained in Offshore (Volume 2) Chapter 14: Shipping and Navigation.

Civil Aviation Authority (CAA) guidance requires that 'en-route obstacles' at or above 150 m above ground level are lit with visible lighting to assist their detection by aircraft. As such, there is potential that parts of the Offshore Development may be visible at night. The effect of the Offshore Development at night would result primarily from visible, medium intensity, flashing red coloured aviation light fittings located on the hubs of all seven of the WTGs, with a maximum intensity of 2,000 cd.

The Project proposes to introduce mitigation for the aviation lighting effects. It is proposed that a detection system will be mounted on all Wind Turbine Generators (WTGs), and these will detect when visibility is greater than 5 km. When this is the case the aviation lights will be dimmed to 10% of the 2,000 cd maximum so that the intensity of the light emitted would be 200 cd.

The visibility frequency data presented in Offshore EIA (Volume 3): Appendix 16.8 indicates that visibility is greater than 5 km for over 94% of the time. Visibility out at sea is likely to be more frequently less than 5 km than such land-based measurements suggest due to generally greater levels of moisture in the air over the sea, which tends to reduce visibility compared to the air directly over land. This data indicates that the aviation lights would infrequently be displayed at 2000 cd.

Visibility at night out at sea is only likely to be restricted to within a 5 km range by moisture levels, including fog. When this is the case the ability of the light to travel will be reduced substantially so that it will not be possible for the lights to be visible at 2,000 cd from even the closest point on the coast to the Offshore Development, which is a minimum of approximately 7.5 km from the coast between Crosskirk and Dounreay. The night-time visualisations have, therefore, been prepared to show how 200 cd aviation lights would appear from the representative viewpoints as this is the most likely intensity to be visible from those locations.

As NatureScot guidance requires 2000 cd intensity to be considered as a worst case scenario, regardless of the infrequency with which this would be experienced, night-time visualisations have also been prepared to show how 2000 cd aviation lights would appear from the representative viewpoints and a written assessment of the effects of both the 2000 cd and 200 cd intensities is presented in Section 1.7.

Marine navigation lights are also likely to be required on significant peripheral structures. These are flashing yellow lights with a 5 Nautical Miles (NM) (9.26 km) nominal range, mounted at the top of the four corners of each of the WTG substructures. Other lights such as structure identifiers and those needed during search and rescue operations either emit very low light levels or would only be used very rarely and are therefore not included in the visualisations or in this assessment.

All SLVIA figures are presented in Offshore EIA (Volume 3): Appendix 16.9: SLVIA Figures. This visual assessment of night-time effects is supported by plan figures as follows:

- Figure 16.7a: Hub Height ZTV with Viewpoint Locations at 50 km
- Figure 16.7b: Hub Height ZTV with Viewpoint Locations at 25 km
- Figure 16.28: Baseline Light Pollution;
- Figure 16.29: NASA Earth at Night
- Figure 16.30: Hub Height Aviation Lighting ZTV.

At this preliminary stage, the ZTVs illustrate the theoretical potential for direct line of sight from the hub height aviation lights. They do not consider the deterioration of light over distance or any potential reduction in intensity of the light below or above the light emitted at the highest intensity, which is required by the regulations to occur between 0 to +3º from the horizontal.

Four night-time viewpoints have been assessed to represent views of the aviation and marine navigational lighting from a variety of locations within the SLVIA Study Area. The locations of these representative viewpoints were agreed with THC and NatureScot and include;

- Viewpoint 1: Beinn Ratha (Figure 16.31i to n);
- Viewpoint 2: Strathy Point car park (Figure 16.32h to l);
- Viewpoint 5: Sandside Head (Figure 16.35h to l); and
- Viewpoint 10: A836 east of Forss (Figure 16.40h to l).

The assessment of the night-time visual effects on the representative viewpoints is presented in Section 1.7.

1.2 Guidance

1.2.1 Guidelines for Landscape and Visual Impact Assessment (GLVIA3)

GLVIA3 (page 103) provides the following guidance on the assessment of lighting effects:

"*For some types of development the visual effects of lighting may be an issue. In these cases it may be important to carry out night-time 'darkness' surveys of the existing conditions in order to assess the potential effects of lighting and these effects need to be taken into account in generating the 3D model of the scheme. Quantitative assessment of illumination levels, and incorporation into models relevant to visual effects assessment, will require input from lighting engineers, but the visual effects assessment will also need to include qualitative assessments of the effects of the predicted light levels on night-time visibility.*"

GLVIA3 (page 60) also provides the following guidance with regards to mitigation of obtrusive light:

"lighting for safety or security purposes may be unavoidable and may give rise to significant adverse effects; in such cases, consideration should be given to different ways of minimising light pollution and reference should be made to appropriate guidance, such as that provided by the Institution of Lighting Professionals (ILP, 2011)".

1.2.2 Institute of Lighting Professionals Guidance

Guidance produced by the Institute of Lighting Professionals (ILP) (2011) (GN01:2011) is useful in setting out some key terminology that is used in this visual assessment of turbine lighting:

- Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task;
- Skyglow – the brightening of the night sky;
- Glare – the uncomfortable brightness of a light source when viewed against a darker background; and
- Light Intrusion – the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others.

Types of obtrusive light are identified in Figure 1 of the ILP (2011).

Campaign for the Protection for Rural England (CPRE) also identifies these same broad terms as the three types of light pollution:

- "Skyglow – the pink or orange glow we see for miles around towns and cities, spreading deep into the countryside, caused by a scattering of artificial light by airborne dust and water droplets.

- Glare – the uncomfortable brightness of a light source.
- Light intrusion – light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains."

The following key guidance is noted:

"The most sensitive/critical zones for minimising sky glow are those between 90° and 100° (note that this equates to 0-10° above the horizontal).

Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°.

In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape.

Upward Light Ratio (ULR) of the Installation is the maximum permitted percentage of luminaire flux that goes directly into the sky. A ULR of 0 (zero) Candela (cd) is suggested for Dark Sky Parks."

1.2.3 NatureScot Guidance

NatureScot guidance is a material consideration to development projects in Scotland and represents current and developing thinking. NatureScot Guidance on WTG lighting is contained in para 174-177 in 'Visual Representation of Windfarms' (SNH, 2017) as follows:

"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."

A NatureScot industry wide workshop, held on 6th November 2019, indicated that a proportionate and pragmatic approach is required, both in terms of the need to assess likely significant effects under the EIA regulations, complying with current civil aviation standards and providing mitigation on a project and site-specific basis.

Mitigation options to eliminate or reduce the need for, and effects of, visible lighting are evolving quickly, and developers are exploring these with consultees and the CAA in relation to specific sites. NatureScot has offered a perspective on the efficacy of different mitigation options, noting that the most effective for onshore wind farms appears to be radar activated aviation lights, albeit accepting the considerable technical and cost implications inherent in this potential option.

Ministers and planning authorities are using planning conditions/ requirements to manage effects. It is recognised that developers need flexibility to utilise the most appropriate mitigation once they are ready to start discharging conditions. Conditions provide certainty that effects will be managed along with some flexibility for developers to identify the most appropriate mitigation option(s) post consent and prior to construction, and to agree these with the relevant decision maker.

In terms of visual effects, NatureScot's view is that lengthy debate about the exact brightness of lights shown in visualisations is potentially not helpful and that it is better to focus on where they will be visible, how many lights will be visible and the level of change from the baseline situation.

NatureScot has also taken a pragmatic view with night-time visualisations, requesting that decision makers, consultees and communities require visualisations from a small number of relevant viewpoints to understand these effects. NatureScot also recognises the challenges of capturing night-time photography and accept that some post photographic manipulation of images to provide a good representation is acceptable.

1.3 Methodology

The methodology for the assessment of the night-time visual effects is set out in Section 1.9 of Offshore EIA (Volume 3): Appendix 16.1: SLVIA Methodology.

1.4 Visual representations

1.4.1 ZTVs

ZTV analysis has been undertaken to show the areas from which the aviation lights may be theoretically visible and is presented in Figure 16.30: Hub Height Aviation Lighting ZTV. This ZTV can be used to identify where the aviation lights may theoretically be visible and how many lights may be theoretically visible from different locations. The ZTV illustrates the 'bare ground' situation and does not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility. It also does not indicate the decrease in visibility of the lights that occurs with increased distance. The nature of what is visible from 5 km away would differ markedly from what is visible from 15 km or 30 km away, although both are indicated on the ZTVs as having the same level of visibility in terms of the number of aviation lights visible.

1.4.2 Visualisations

Night-time baseline panoramas and photomontage visualisations showing medium-intensity nacelle mounted aviation lighting and platform level marine navigational lighting are presented in Offshore EIA (Volume 3): Appendix 16.9.

Although aviation lighting manufacturers must meet the minimum requirements, their products may vary in relation to recommended limits set out in ICAO standards, which makes it difficult producing accurate visualisations as the lighting characteristics of different light fittings, of the same intensity, may vary outside the minimum requirements stipulated by ICAO. The night-time photomontages shown in these figures have been produced to show both 2000 cd and 200 cd lighting.

The night-time photography at three of the four night-time viewpoints has been captured in low light conditions, after the end of civil twilight, when 'night' has been reached and when other artificial lighting, such as streetlights, car headlamps and lights on buildings are on, to show how the aviation lighting would look compared to the existing baseline at such times. Despite the flashing nature of the aviation lights, in the photomontages they are all shown to be 'on' and visible resulting in them appearing with more consistent relative impact across the views than will be the case in reality.

Existing lights shown in the photographs may appear larger and more blurred than those seen to the naked eye in the field when the photographs were captured. The term used in photography to describe this effect is 'Bokeh' which is defined as 'the way the lens renders out-of-focus points of light'. This has proved difficult to avoid when taking photographs of light at varied distances across a view. The blurred nature of the lights is also exacerbated by their movement, particularly on vehicle headlights. Where the lights of the Offshore Development have been added to the night-time photomontages, this effect has been emulated.

The WTGs used in the night-time visualisations have been positioned so that so that all the lights are visible within the visualisations, representing a worst-case impression. As the blades turn around in front of the lights there may are also incidences whereby the emitted light is hidden or when it spills across the blades producing a further incidental effect. These effects associated with WTG rotor movement cannot be captured within the limitations of the photomontages.

The intensity of the baseline lighting has been estimated using sources such as CPRE's Light Pollution Plan in Figure 16.28.

1.5 Baseline conditions

1.5.1 Introduction

The 50 km radius SLVIA Study Area for the SLVIA is shown in Figure 16.1 (Offshore EIA (Volume 3): Appendix 16.9). The night-time assessment, however, focusses on the closest coastlines and hinterland, out to a radius of approximately 15 km, where it is most likely for a significant effect to arise. The night-time assessment considers a worst-case scenario comprising seven WTGs at 300 m to blade tip above Highest Astronomical Tide (HAT), as these are the tallest turbines being considered. Each of these WTGs will be fitted with an aviation light on the hub at 170 m. With distance from the source of lighting having a reductive effect on the perceived intensity of the lighting, effects will reduce with distance from the Offshore Development. Furthermore, the seven lights will be seen to occupy an increasingly contained horizonal extent, shown on the Horizontal Angle ZTV in Figure 16.8 to be below 20 degrees of the full 360 degree view, from distances beyond 15 km.

The baseline lighting conditions across the SLVIA Study Area vary considerably and OPEN is not aware of a single data source that serves to provide a detailed or quantitative evidence base. The assessment of night-time effects is not based on quantitative measurement of light levels but relies on the professional judgement of Chartered Landscape Architects.

To help understand and illustrate the existing baseline lighting levels of the SLVIA Study Area, Figures 16.28 and 16.29 illustrate information relating to light pollution. Information presented in Figure 16.28 is derived from information prepared by Land Use Consultants (LUC) on behalf of Campaign for the Protection of Rural England (CPRE), who have produced interactive maps of the UK's light pollution and dark skies as part of a national mapping project. This is based upon data from the National Geophysical Data Center, part of the National Center for Environmental Information in the USA. LUC has processed this satellite data to prepare a map showing the areas of relative light pollution across the land within the UK (LUC/CPRE, 2016). Figure 16.29 shows NASA's Earth at Night satellite photography to give an impression of varying levels of light pollution and is produced by the National Geophysical Data Center in the USA.

Each pixel in the mapping shows the level of radiance (night lights) shining up into the night sky, which have been categorised into colour bands to distinguish between different light levels, from colour band 1 (darkest) to 9 (brightest). The map clearly identifies the main concentrations of night-time lights, creating light pollution that spills up into the sky. This is mostly concentrated in and around the main settlements due to the influence of street and building lighting, but also light pollution can be seen associated with Dounreay Nuclear Power Plant and Vulcan Naval Reactor Test Establishment (NRTE), as well as Scrabster ferry port.

Night lighting at the settled locations provides a considerable level of baseline illumination, which is most apparent when travelling through and around the coastal parts of the SLVIA Study Area. Figure 16.28 shows the limited extents of the light pollution which reflects the limited extents of settlement and other developments in this area. Where concentrations of light pollution occur, at Thurso and Scrabster, and Dounreay Nuclear Power Facility, Vulcan NRTE and Reay, lighting is intrusive in interrupting the transition between the darker landscapes and dark skies above them.

The CPRE night light information does not include any baseline data about night lights in the seascape. Whilst the small point sources of light will not give rise to sky glow or glare as is the case with lighting in settlements, the lights on the ferries and large-scale ships using the shipping channel across the Pentland Firth and less frequently in the Atlantic Ocean off the north coast, are part of the baseline context for the lighting of the Offshore Development. Another notable factor in the baseline coastal lighting are the light houses along the north coast of Caithness and west coast of Hoy.

In terms of considering the worst case scenario for the SLVIA, the 300 m turbine with a 260 m rotor diameter has been selected as this is the largest possible rotor that could be used and will present a notably larger blade than the 220 m alternative. This means that the hub height used with the 260 m rotor diameter will be 170 m as opposed to the hub heigh of 190 m that would be used with the 220 m rotor diameter. Whilst this means that for the night-time assessment that the lights are being assessed at a hub height of 170 m compared to a potential maximum hub height of 190 m, this difference of 20 m will not affect the assessment for the following reasons.

Firstly, the closest receptors will be more than 7.5 km from the closest turbine and associated aviation light and the 20 m difference in the hub heights will not be apparent from these distances and especially not at night-time. Secondly, in terms of the extents to which hub lighting at 170 m will be visible compared to hub lighting at 190 m, these will be broadly similar with only very marginal increases in the potential extents. And thirdly, from the coastal parts where the effects are most likely to have a significant effect, typically the hubs of all seven turbines would be readily visible regardless of whether the aviation lights are at 170 m or 190 m. The use of aviation lighting on 190 m high hubs would, therefore, not alter the assessment presented in this appendix of aviation lighting on 170 m hubs.

1.6 Assessment of night-time visual effects

1.6.1 Introduction

The visual influence of the aviation lighting is likely to be more noticeable than the lower levels of light intensity associated with the marine navigational lighting. This is due to the higher intensity of these lights as well as their location higher on the structures, which results in their theoretical and actual visibility being more widespread. Therefore, whilst the night-time visualisations include the marine navigation lighting, where visible, the assessment of night-time visual effects concentrates on the effects of the aviation lighting.

The assessment of night-time visual effects is undertaken through an understanding of the baseline night-time light influence, ZTV mapping and analysis, and through reference to night-time visualisations and viewpoint assessment. Whilst there are only four viewpoints that illustrate the lighting of the Offshore Development, reference can also be made to the daytime visualisations to gain an understanding of where the hub level aviation lighting may be visible and the distance of this from the receptors and viewpoints.

As the offshore wind turbine generators (WTGs) are to be constructed off-site and towed in, and then at decommissioning to be towed out and deconstructed off-site, the construction phase will involve only installation and the decommissioning phase will only involve removal. In terms of lighting requirements, this means that the WTGs will already be fitted with their aviation lighting during the construction phase, when they are installed, and decommissioning phase, when they are removed. Until the Offshore development is commissioned for operation, the aviation lights will emit a steady red light of medium intensity (2,000 candela (cd)). The installation period is planned to take approximately three months, making this effect temporary and short term.

The steady medium intensity aviation lighting used during installation will result in higher magnitudes of change in the views potentially occurring over a wider area compared with the reduced intensity aviation lighting assessed for the mitigated operational phase. However, such impacts would only arise over a short duration (approximately three months). Such night-time effects would be short term and temporary during the construction phase. It is considered that, in this instance, the resultant effects on the visual resource will not result in any further significant night-time effects to those assessed and identified for the operational phase.

1.6.2 Zone of Theoretical Visibility

Visual effects of the aviation lighting will only occur where their introduction influences the visual amenity and views experienced by people in the area. The geographic areas where these visual effects may occur is defined by the Hub Height Aviation Lighting ZTV shown in Figure 16.30.

The maximum design scenario considers aviation lighting set on the hubs of the seven WTGs at a height of 170 m, and with a blade tip hight of 300 m. The lights will emit a flashing red light of medium intensity, measured as 2,000 candelas (cd). The lights will carry a detection system responding to atmospheric conditions, such that when visibility is greater than 5 km the intensity of the lights will be reduced to 10% of their maximum intensity, which equates to 200 cd. Met office data recorded at Wick (see Appendix 16. 8) suggests that visibility of >5 km occurs 94% of the time around the north coast of Scotland although this may be slightly less frequent out over the sea due to higher moisture content. However, when visibility is less than 5 km the weather conditions will also act to reduce the intensity of the lights when viewed from the more distant areas. All seven WTGs will be fitted with 2,000 cd, flashing red, hub mounted aviation lights. Although the intensity of the lighting will be reduced to 200 cd for 94% or more of the time, both 2000 cd and 200 cd are considered in the assessment to ensure the worst case scenario is covered.

The Hub Height Aviation Lighting ZTV can be used to identify where the aviation lights may theoretically be visible and how many lights may be visible from different locations. The base mapping has been darkened to give an indication of those areas that will not be affected by visibility of the aviation lighting.

1.7 Night-time viewpoint assessment

The following section sets out the assessment of the night-time effects of the aviation lighting on the Offshore Development as experienced at the four selected viewpoints.

1.7.1 Viewpoint 1: Beinn Ratha

1.7.1.1 Baseline

The viewpoint is located on the summit of Beinn Ratha (251 m AOD) which is a small hill to the south of the settlement of Reay. While there are tracks to the north which extend down the eastern and western side of the hill, there are no tracks or paths onto the hill and the boggy and steep nature of the terrain makes the walk challenging. From the summit, panoramic views open up in all directions with sea views extending across approximately 120 degrees of the field of view to the north.

At night-time, there is practically no visible lighting in the sectors from the west through to the south-east. In the sectors from the north through to the east, the most notable influence is from lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE, and SSE Dounreay Substation, located approximately 6.2 km to the north-east. There is also an influence from lower levels of lighting relating to streetlights, properties and vehicles associated with the nearby settlement of Reay and the A836 to the north.

The views out to sea comprise very few light sources other than the white lights associated with the daily passage of ferries in the Pentland Firth at more than 20 km to the north-east, or other less frequent large ships sailing across the North Atlantic at more than 15 km to the north. While lighthouses occur at Strathy Point and Dunnet Head on the Mainland of Scotland and Tor Ness on Hoy, their lights will typically only be activated when humidity is high and visibility is poor, which limits their influence on this viewpoint.

1.7.1.2 Sensitivity

The value of the view is medium-high. Beinn Ratha and the surrounding landscape are not covered by any national or regional designations, which would otherwise denote a special scenic landscape value. The hill is, however, covered by the East Halladale Flows Wild Land Area, which is a mapped interest, and the viewpoint is located on the summit of the hill, which acts as an informal viewpoint during the day.

The susceptibility to change during night-time is medium. Receptors would be people walking on this hill, although it is unlikely that people will walk on this hill in the twilight or the hours of darkness owing to the boggy and steep terrain and partially remote nature of the hill. The focus of walkers in this area during twilight or the hours of darkness will primarily be down towards the ground to ensure they have safe footing, although there may also be opportunities to appreciate the dark skies. Susceptibility is moderated by the minimum of approximately 12.9 km between the viewpoint and the Offshore Development and the influence of lighting in the same northern sector from the settlement of Reay, Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Dounreay Substation. Susceptibility at night is moderated by the incidence of some permanent lights along the northern coast and temporary or moving lights in the wider seascape. This is reflected in the CPRE mapping of night light as illustrated in Figure 16.28.

The night-time sensitivity is **medium-high** – taking account of the assessed medium-high value of the viewpoint and the medium susceptibility to the proposed change to it.

1.7.1.3 Magnitude of change

The magnitude of change arising as a result of the operational night-time lighting will be **medium-low** in respect of the 2,000 cd lighting and **low** in respect of the 200 cd lighting. Aviation lighting will comprise a medium intensity, flashing red light mounted on the hubs of all seven offshore WTGs, at a height of 170 m above MHWS. The intensity of the lights will be reduced from their maximum of 2,000 cd to 200 cd in good visibility which, according to Met Office Data, is predicted to occur 94% of the time. The baseline photographs and cumulative wirelines from Beinn Ratha are shown in Figures 16.31i to l, the photomontage of the 2,000 cd lighting is shown in Figure 16.31m and the photomontage of the 200 cd lighting is shown in Figure 16.31n. The lights of the seven WTGs will be apparent across approximately 21 degrees of the 120-degree wide sea view and seen at a minimum of 12.9 km.

The aviation lights will add seven flashing red lights in the area of seascape to the north of this viewpoint. The magnitude of change will be moderated by the baseline influence from lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Dounreay Substation, as well as vehicle lights on the A836 and streetlights and housing lights in the settlement of Reay. These light sources are all located in the same northerly sector as the Offshore Development. These light sources, are, however, associated with the north coast and the aviation lighting will be associated with the seascape beyond the coast, thus seen to spread the influence of night-time lighting beyond the coastal edge. The night-time visualisations in Figures 16.31m and n illustrate the limited horizontal extent of these lights. While the 2,000 cd lighting will appear slightly brighter than the 200 cd lighting, the 2,000 cd lighting will not appear especially bright from this distance of 12.9 km and will form a fairly subtle addition to the wider night-time view in which lighting along the coast is already a feature. Furthermore, there will be few people on this hilltop to experience these lights, although for those that do, they will be seen to extend lighting across the view and into the adjacent seascape.

1.7.1.4 Significance of effect

The combination of the medium-high sensitivity and the medium-low or low magnitude of change will give rise to a **not significant** effect at a **moderate** level in respect of the 2,000 cd intensity lighting and at a **moderate / minor** level in respect of the 200 cd intensity lighting.

1.7.1.5 Cumulative effect

The lighting baseline will change under Scenario 1 with the addition of Strathy Wood and Strathy South onshore wind farms, at approximately 13.1 km and 16.7 km respectively, located to the south-west of the viewpoint. There will also be a change associated with the decommissioning of the Dounreay Nuclear Power Facility and Vulcan NRTE, as well as the addition of consented SHE-T Substation. Whilst the lighting requirements of these development is not known, in order to cover a worst-case scenario, it is assumed that the Strathy Wood and Strathy South onshore wind farms would require hub mounted aviation lighting owing to their blade tip heights of 180 m and 200 m.

Strathy Wood and Strathy South will add a source of lighting at a minimum of 13.1 km and 16.7 km to the south-west and will form a notable feature in the otherwise dark extents characterising this southerly sector from Beinn Ratha. The decommissioning of Dounreay Nuclear Power Facility and Vulcan NRTE will reduce the extent and levels of lighting in this area 6.1 km to the north-east of the viewpoint, although the operational SSE Substation and consented SHE-T Substation are likely to retain some low levels of lighting for security and the low levels of lighting associated with the settlement of Reay and the A836 will remain part of the baseline.

In respect of this changed context, the lighting associated with the Offshore Development will give rise to a **medium-low** cumulative magnitude of change. At 12.9 km it will be seen at a comparable range to the lighting associated with Strathy Wood, and although it will be seen in a different sector from Strathy Wood, it will still be seen in a sector where light sources are readily visible, albeit relatively low in level and with reduced extents arising from the decommissioning of Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Dounreay Substation.

Under Scenario 1, the medium sensitivity combined with the medium-low cumulative magnitude of change will give rise to a **not significant** effect at a **moderate/minor** level.

Under Scenario 2, there would be no further changes to the lighting baseline from what has been described under Scenario 1. The Scenario 1 assessment would, therefore, also apply to Scenario 2.

Under Scenario 3, there will be a cumulative interaction between the aviation lighting of the Offshore Development and the aviation lighting of the West Orkney Offshore Wind Farm. As the detail of West Orkney Offshore Wind Farm is not currently known, this assessment assumes that night-time lighting will be a requirement of this extensive offshore wind farm, albeit located a minimum of approximately 36.9 km from this viewpoint.

The seven aviation lights associated with the Offshore Development will be added into a sector of the view where there will be existing lighting associated with the West Orkney Offshore Wind Farm. The influence of the West Orkney Offshore Wind Farm will be reduced by the separation distance of a minimum of 36.9 km, and although this will notably reduce the perceived intensity of these more distant aviation lights, they will still form a baseline source that will prevent the Offshore Development lighting from appearing to introduce lighting into a dark seascape. The cumulative magnitude of change will be **medium-low** and the cumulative effect will be **not significant**.

1.7.2 Viewpoint 2: Strathy Point Car Park

1.7.2.1 Baseline

The viewpoint is located adjacent to the Strathy Point car park, 1.4 km to the south of Strathy Point. Non authorised vehicles are not allowed beyond this point and visitors must follow the 1 km track that extends north to the lighthouse. There are a small number of dispersed rural properties in this area and along the minor road that connects this car park and the A836 to the south.

Sea views are available across a field of view of approximately 170 degrees. To the north these are constrained by the rising landform of Strathy Point and to the west and south by the undulating landform of the sweeping moorland which extends from the south to meet the coastal edge. The eastern coast of Strathy Point is largely orientated eastwards with views extending east along the northern Caithness coast and north-east to the Orkney Islands in clear conditions.

Night-time lighting is limited in this area to the domestic lights associated with the rural properties set along the coastal edge and vehicle lights associated with the few vehicles passing along this minor, dead-end road. The sparse and rural settlement coupled with the notable separation from the A836 ensures that there is some degree of remoteness and tranquillity experienced in this area.

1.7.2.2 Sensitivity

The value of the view is medium-high. Strathy Point is covered by the regional designation of Farr Bay, Strathy and Portskerra SLA, which denotes a special scenic landscape value at the regional level. Next to the car park there is an interpretation board and the attraction of the lighthouse at the point make this a popular stop for visitors.

The susceptibility to change during night-time is medium-high. The view is representative of residents in this rural area, road-users stopping at this car park and walkers on the path between the car park and the light house. Most of the residential properties follow the eastern orientation of the coastline such that they enjoy views of the sea and northern coastline. In respect of visitors, other than the car park and the interpretation board, there are no visitor facilities in this area. While there are no specific features of this area that would attract visitors during the hours of darkness, the eastern orientation of the coast means visitors may come to enjoy the morning sunrise or may linger after dusk or into the hours of darkness to experience the northern lights or dark night skies. Views from this location are likely to be part of the intended experience.

Susceptibility at night is moderated to some extent by the point sources of lighting emitted from the properties some of which are located in the same sector of the view as the Offshore Development, and cars, although this is especially low level and localised, as reflected in the CPRE mapping of night light as illustrated in Figure 16.28. There are no permanent light sources at sea and those associated with passing boats are either especially infrequent or distant. While the lighthouse at Strathy Point will potentially present a close-range source of light, it is likely to only be used during periods of high humidity, which would also reduce visibility of the aviation lights on the Offshore development.

The night-time sensitivity is **medium-high** – taking account of the assessed medium-high value of the viewpoint and the medium-high susceptibility of visual receptors to the proposed change.

1.7.2.3 Magnitude of change

The magnitude of change arising as a result of the operational night-time lighting will be **medium** in respect of the 2,000 cd lighting and **medium-low** in respect of the 200 cd lighting. Aviation lighting will comprise a medium intensity, flashing red light mounted on the hubs of all seven offshore WTGs, at a height of 170 m above MHWS. The intensity of the lights will be reduced from their maximum of 2,000 cd to 200 cd in good visibility, which, according to Met Office Data, is predicted to occur 94% of the time. The baseline photographs and cumulative wirelines from Strathy Point Car Park are shown in Figures 16.32h to j, the photomontage of the 2,000 cd lighting is shown in Figure 16.32k and the photomontage of the 200 cd lighting is shown in Figure 16.32l. The lights of the seven WTGs will be apparent across approximately 13 degrees of the 170-degree wide sea view and seen at a minimum of 9.3 km.

The aviation lights will add seven flashing red lights in the area of seascape to the north-east of this viewpoint. With the baseline mainly comprising low intensity domestic lighting associated with the dispersed rural properties, the addition of flashing, red aviation lights and marine navigation lights will give rise to an apparent change in this relatively dark aspect where baseline lighting is limited. The effect will, however, be moderated by the location of these lights in the same sector of the view as the low-level baseline lights, the small number of lights visible, their relatively compact horizontal extents and their relative proximity to the Mainland of Scotland, rather than the wider ocean to the north. While the 2,000 cd lighting will appear slightly brighter than the 200 cd lighting, the 2,000 cd lighting will not appear especially bright from this distance of 9.3 km although it will form a notable addition in respect of the limited levels of baseline lighting in this location. The 200 cd will form a fairly subtle addition to the wider night-time view in which some close-range domestic lighting along the coast is already a feature, such that it will not be notable.

1.7.2.4 Significance of effect

The combination of the medium-high sensitivity and the medium magnitude of change will give rise to a **significant** effect at a **moderate** level in respect of the 2,000 cd lighting, while the medium-low magnitude of change in respect of the 200 cd lighting will give rise to a **not significant** effect at a **moderate** level.

1.7.2.5 Cumulative effect

There will be no potential for significant cumulative effects to arise in respect of Scenario 1 and Scenario 2 owing to the fact that there will be no change to the lighting context of this viewpoint as a result of any of the consented or application stage wind farms.

Under Scenario 3, there will be a cumulative interaction between the aviation lighting of the Offshore Development and the aviation lighting of the West Orkney Offshore Wind Farm. As the detail of West Orkney Offshore Wind Farm is not currently known, this assessment assumes that night-time lighting will be a requirement of this extensive offshore wind farm, albeit located a minimum of approximately 28.1 km from this viewpoint.

The seven aviation lights associated with the Offshore Development will be added into a sector of the view where there will be existing lighting associated with the West Orkney Offshore Wind Farm. The influence of the West Orkney Offshore Wind Farm will be reduced by the separation distance of a minimum of 28.1 km, and although this will notably reduce the perceived intensity of these more distant aviation lights, they will still form a baseline source that will prevent the Offshore Development lighting from appearing to introduce lighting into a dark seascape. The Offshore Lighting will, however, present lights with a greater perceived intensity and will be seen to draw offshore lighting closer to the north coast. The cumulative magnitude of change will be **medium,** and the cumulative effect will be **significant**.

1.7.3 Viewpoint 5: Sandside Head

1.7.3.1 Baseline

The viewpoint is located on the path to the north of Fresgoe Harbour that leads on to Sandside Head. This viewpoint is representative of residents who occupy the properties surrounding Fresgoe Harbour and walkers on the coastal path to Sandside Head and across Sandside Bay. From both the harbour and the bay, views of the Offshore Development are reduced in extent by the enclosing landform of Sandside Head. The coastal path to Sandside Head has been selected as this presents full visibility of the Offshore Development whilst still being close enough to represent the views of residents and walkers associated with the harbour and the bay.

At night-time, there is practically no visible lighting in the sectors from the north, through the west to the south. The most notable baseline source occurs to the east, where lighting associated with Dounreay Nuclear Power Facility and Vulcan NRTE, is shown on Figure 16.28 to be level 6 to 7, in terms of intensity, and occurring at a minimum of approximately 2 km. These energy developments are well lit through the night and this creates a glow in the sky to the east. The settlements of Reay and Isauld, at a minimum of approximately 1.5 km to the south-east, also emit baseline lighting which is shown in Figure 16.28 to be level 4 in terms of intensity, although from this viewpoint, these sources are partly obscured by intervening landform and the buildings at Fresgoe Harbour.

The views out to sea comprise very few light sources other than distant white lights associated with the daily passage of ferries in the Pentland Firth or other less frequent ships sailing across the North Atlantic to the north of the northern coast. While light houses occur at Strathy Point and Dunnet Head on the Mainland of Scotland and Tor Ness on Hoy, their lights will typically only be activated when humidity is high and visibility is poor, which limits their influence on this viewpoint.

1.7.3.2 Sensitivity

The value of the view is medium. There are no formal viewpoints in this area and Sandside Head, Sandside Bay and Fresgoe Harbour are not covered by any national or regional landscape designations which would otherwise denote a special value.

The susceptibility to change during night-time is medium. Receptors would include people walking along the coast or across the bay, which would be likely during sunrise and sunset but less likely during the hours of darkness, with the exception of possible beach barbeques in the warmer months. The key attraction for walkers in this area is the seaward views and this raises their susceptibility to night-time lighting in this sector of the view. Receptors would also include residents at Fresgoe Harbour, although the orientation of the properties to the north-east and the south-east means that direct views of the night-time lighting would not occur from inside the properties, and also the lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE and the SSE Substation would be a visible baseline feature in these views. The offshore WTGs would be partly visible from the access road and grounds around these properties.

Susceptibility is moderated by the minimum of approximately 8.2 km between the viewpoint and the Offshore Development and the influence of permanent lighting in the eastern and south-eastern sector from Dounreay Nuclear Power Facility, Vulcan NRTE and Reay, and temporary lights in the wider seascape. This is reflected in the CPRE mapping of night light as illustrated in Figure 16.28.

The night-time sensitivity at this viewpoint is **medium** taking account of the assessed medium value of the viewpoint and the medium susceptibility of receptors to the proposed change.

1.7.3.3 Magnitude of change

The magnitude of change arising as a result of the operational night-time lighting will be **medium** in respect of the 2,000 cd lighting and **medium-low** in respect of the 200 cd lighting. Aviation lighting will comprise a medium intensity, flashing red light mounted on the hubs of all seven offshore WTGs, at a height of 170 m above MHWS. The intensity of the lights will be reduced from their maximum of 2,000 cd to 200 cd in good visibility, which, according to Met Office Data, is predicted to occur 94% of the time. The baseline photographs and cumulative wirelines from Sandside Head are shown in Figures 16.35h to j, the photomontage of the 2,000 cd lighting is shown in Figure 16.35k and the photomontage of the 200 cd lighting is shown in Figure 16.35l. They will be seen to occupy approximately 31 degrees of the 200-degree wide sea view at a range of 8.2 km.

The night-time photomontage in Figure 16.35k shows that the seven aviation lights will be readily visible from Sandside Head, seen set in the North Atlantic to the north of the viewpoint. Although they will not appear especially bright, they will appear slightly brighter than the 200 cd lighting shown in the photomontage in Figure 16.35l. They will also be seen in the context of the closer-range and brighter lights associated with Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Dounreay Substation to the east and while they will extend the influence of night-time lighting into the relatively dark extents of the seascape, the change will be moderated by the existing baseline lighting.

1.7.3.4 Significance of effect

The effect arising as a result of the operational night-time lighting will be **significant** at a **moderate** level in respect of the 2,000cd lighting and **not significant** at a **moderate** level in respect of the 200 cd lighting. This finding relates chiefly to the introduction of the lighting associated with the offshore WTGs in the dark northerly sector of the view, despite the close-range baseline influence from the lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE, SSE Dounreay Substation and Reay, in the easterly and south-easterly sectors of the view.

1.7.3.5 Cumulative effect

The lighting baseline will change under Scenario 1 with the decommissioning of the Dounreay Nuclear Power Facility and Vulcan NRTE, as well as the addition of consented SHE-T Substation. The decommissioning will reduce the extent and levels of lighting in this close-range area to the east of the viewpoint, although the operational SSE Substation and consented SHE-T Substation are likely to retain some low levels of lighting for security and the low levels of lighting associated with Reay and the A836 will remain part of the baseline.

In respect of this changed context, the baseline lighting will potentially be less than it currently is but will not make a substantive difference to the baseline assessment which considers the influence from lighting in this developed coastal area to the east of the viewpoint. There will, therefore, be no notable change to the baseline assessment.

Under Scenario 1, the medium sensitivity combined with the medium cumulative magnitude of change will give rise to a **not significant** effect at a **moderate** level.

Under Scenario 2, there would be no further changes to the lighting baseline from what has been described under Scenario 1. The Scenario 1 assessment would, therefore, also apply to Scenario 2.

Under Scenario 3, there will be a cumulative interaction between the aviation lighting of the Offshore Development and the aviation lighting of the West Orkney Offshore Wind Farm. As the detail of West Orkney Offshore Wind Farm is not currently known, this assessment assumes that night-time lighting will be a requirement of this extensive offshore wind farm, albeit located a minimum of approximately 32.7 km from this viewpoint.

The seven aviation lights associated with the Offshore Development will be added into a sector of the view where there will be existing lighting associated with the West Orkney Offshore Wind Farm. The influence of the West Orkney Offshore Wind Farm will be reduced by the separation distance of a minimum of 32.7 km, and although this will notably reduce the perceived intensity of these more distant aviation lights, they will still form a baseline source that will prevent the Offshore Development lighting from appearing to introduce lighting into a dark seascape. The Offshore Lighting will, however, present lights with a greater perceived intensity and will be seen to draw offshore lighting closer to the north coast. The cumulative magnitude of change will be **medium,** and the cumulative effect will be **significant**.

1.7.4 Viewpoint 10: A836 east of Forss

1.7.4.1 Baseline

The viewpoint is located on A836 to the east of Forss where a long, straight section of the road aligns in a broadly easterly direction, opening up coastal views to west-bound road-users. This is a settled and cultivated landscape, with a dispersed pattern of rural properties set in a context of farmed fields. The absence of tree cover creates an open and exposed landscape which allows open views to extend out across the North Atlantic. From this section of the A836, open sea views extend across approximately 170 degrees of the field of view.

At night-time, while there is low level lighting associated with Forss Business and Technology Park located 3.3 km to the north-west, and the residential properties and passing vehicles in the surrounding rural landscape, there is no medium or high levels of lighting reflecting the fact that there are no large-scale developments or settlements within this local area. This is reflected in Figure 16.28 which shows low levels of light pollution in this area, and while slightly higher levels occur around Forss and Dounreay, at approximately 1.5 km and 6.6 km to the east, their separation distance reduces the intensity experienced from this viewpoint.

While the views out to sea comprise very few light sources, there are light sources visible in this sector of the view, associated with rural properties dispersed across the inclined coastal plain that falls towards the coast. Light sources at sea comprise infrequent large ships sailing across the North Atlantic to the north of the northern coast. While light houses occur at Strathy Point and Dunnet Head on the Mainland of Scotland, their lights will typically only be activated when humidity is high and visibility is poor, which limits their influence on this viewpoint.

1.7.4.2 Sensitivity

The value of the view is medium. There are no formal viewpoints in this area, and it is not covered by any national or regional landscape designations which would otherwise denote a special value.

The susceptibility to change during night-time is medium. Receptors would be people living in the residential properties in this coastal area and west-bound road-users on the A836. While many of the properties are orientated out towards the open seascape, this is in relation to the daytime views and at night-time most rural properties on this exposed coastal edge would use window coverings to keep the warmth in and this would moderate the susceptibility of residents to the effects of lighting. The views of west-bound road-users would be more susceptible as they would experience seaward views over a relatively long and straight section of the A836. The susceptibility of all visual receptors would be moderated by the close-range lighting from vehicles on the A836 and surrounding residential properties, as well as the lighting associated with Forss Business and Technology Park, seen in the same sector as the Offshore Development, and despite the very limited presence of lights associated with the seascape.

The night-time sensitivity is **medium,** taking account of the assessed medium value of the viewpoint and the medium susceptibility of receptors to the proposed change.

1.7.4.3 Magnitude of change

The magnitude of change arising as a result of the operational night-time lighting will be **medium-low** in respect of the 2,000 cd lighting and **low** in respect of the 200 cd lighting. Aviation lighting will comprise a medium intensity, flashing red light mounted on the hubs of all seven offshore WTGs, at a height of 170 m above MHWS. The intensity of the lights will be reduced from their maximum of 2,000 cd to 200 cd in good visibility, which, according to Met Office Data, is predicted to occur 94% of the time. The baseline photographs and cumulative wirelines from the A836 east of Forss are shown in Figures 16.40h to j, the photomontage of the 2,000 cd lighting is shown in Figure 16.40k and the photomontage of the 200 cd lighting is shown in Figure 16.40l. They will be seen to occupy approximately 4 degrees of the 170-degree wide sea view at a range of 13.8 km.

The night-time photomontage in Figure 16.40k shows that while the 2,000 cd lighting will be readily visible, it will not appear especially bright and with the 200 cd lighting appearing even less bright. The lighting will be seen in the same sector as the closer-range lights associated with Forss Business and Technology Park and the closer-range vehicle lights on the A836 and residential lights associated with the dispersed rural properties in this area. While the Offshore Development will extend the influence of night-time lighting into the relatively dark extents of the seascape, the change will be moderated by the existing baseline lighting in this sector of the view and in the surrounding landscape context, as well as the separation distance between this area and the lighting.

1.7.4.4 Significance of effect

The effect arising as a result of the operational night-time lighting will be **not significant** at either a **moderate / minor** level in respect of the 2,000 cd lighting and at a minor level in respect of the 200 cd lighting. This finding relates chiefly to the baseline influence from the lighting associated with Forss Business and Technology Park in the same sector as the Offshore Development and other low-level lighting associated with the A836 and surrounding rural properties. It also takes into account the reduction in intensity that will occur over the separation distance of 13.8 km.

1.7.4.5 Cumulative effect

There will be no potential for significant cumulative effects to arise in respect of Scenario 1 and Scenario 2 owing to the fact that there will be no notable changes to the lighting context of this viewpoint as a result of any of the consented or application stage wind farms or other developments.

Under Scenario 3, there will be a cumulative interaction between the aviation lighting of the Offshore Development and the aviation lighting of the West Orkney Offshore Wind Farm. As the detail of West Orkney Offshore Wind Farm is not currently known, this assessment assumes that night-time lighting will be a requirement of this extensive offshore wind farm, albeit located a minimum of approximately 35.4 km from this viewpoint.

The seven aviation lights associated with the Offshore Development will be added into a sector of the view where there will be existing lighting associated with the West Orkney Offshore Wind Farm. The influence of the West Orkney Offshore Wind Farm will be reduced by the separation distance of a minimum of 35.4 km, and although this will notably reduce the perceived intensity of these more distant aviation lights, they will still form a baseline source that will prevent the Offshore Development lighting from appearing to introduce lighting into a dark seascape. The cumulative magnitude of change will be **medium-low** and the cumulative effect will be **not significant**.

1.8 Overview of Other Representative Viewpoints

The assessment of the four representative viewpoints has found that the effects of the aviation lighting associated with the Offshore Development will be limited owing to a combination of the separation distance of more than 8.2 km between the Offshore Development and the closest coastal edge and the influence from baseline lighting along those parts of this coastal edge from where people will experience the aviation lighting. Of the four viewpoints, significant effects relating to night-time lighting were found to occur in respect of Viewpoint 2: Strathy Point car park, with this assessment relating to the higher 2,000 cd lighting, that will be infrequently experienced, and the low levels of baseline lighting experienced from this viewpoint and in respect of Viewpoint 5: Sandside Head, with this assessment also relating to the higher 2,000 cd lighting and despite the background lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Dounreay Substation to the eats of the view.

In order to ensure a complete assessment, the other 12 viewpoints are considered in respect of the detailed assessment carried out in section 1.7 and in a high-level assessment presented in Table 1.8-1 below. Baseline lighting levels relate to the Light Pollution Plan in Figure 16.28, which measures light pollution in bands of 1 to 8, with 1 measured at <0.25 Nano-watts/cm^2/sr, and 8 at >32 Nano-watts/cm^2/sr.

Table 1.8-1 SLVIA Representative viewpoints

Viewpoint	No of hubs visible	Distance (km)/ direction	Baseline lighting	% Visibility frequency over 10 years	High level assessment
3 Portskerra / Melvich	7	9.3 / SSW	Level 3 - Low	87.7	While the prominence of the aviation lights will be increased owing to their spread across the visible extents of the seascape and the framing effect of the headlands, the effect will be moderated by the low levels of baseline lighting

Viewpoint	No of hubs visible	Distance (km)/ direction	Baseline lighting	% Visibility frequency over 10 years	High level assessment
					associated with the A836 and settlements of Melvich and Portskerra, the relatively low intensity of the aviation lighting and the separation distance of 9.3 km.
4 Drum Holliston Layby	7	9.3 / S	Level 3 - Low	87.7	While the prominence of the aviation lights will be raised owing to the openness of the views from this elevated section of the A836 and their location in the undeveloped seascape, the effect will be moderated by the low levels of baseline lighting associated with the A836 and visible Dounreay and Reay, the relatively low intensity of the aviation lighting and the separation distance of 9.3 km.
6 St Mary's Chapel, Forss	7	8.2 / SE	Level 1 - Low	89.6	While the prominence of the aviation lights will be raised owing to their location out in the undeveloped seascape, the effect will be moderated by the low levels of baseline lighting associated with the Forss Business and Technology Park, the relatively low intensity of the aviation lighting and the separation distance of 8.2 km.
7 Dunnet Head	7	27.9 / E	Level 1 - Low	54.3	The lighting associated with the Offshore Development will be visible from this viewpoint but too faint to give rise to a significant effect.
8 Scrabster – Stromness Ferry	7	26.9 / NE	Level 1 - Low	49.1	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
9 Old Man of Hoy	7	33.7 / NE	Level 1 - Low	41.5	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
11 Ben Griam Beg	7	33.5 / S	Level 1 - Low	41.5	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
12 Ben Loyal	7	41.6 / SW	Level 1 - Low	21.4	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
13 A Mhoine	3	33.5 / WSW	Level 2 - Low	41.5	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
14 Ben Dorrery	7	23.3 / SSE	Level 1 - Low	64.0	The lighting associated with the Offshore Development will be visible from this viewpoint but too faint to give rise to a significant effect.

Viewpoint	No of hubs visible	Distance (km)/ direction	Baseline lighting	% Visibility frequency over 10 years	High level assessment
15 Ward Hill, Hoy	7	39.0 / NE	Level 1 - Low	30.4	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.
16 Tor Ness, Hoy	7	34.3 / NE	Level 1 - Low	41.5	The lighting associated with the Offshore Development will be too distant to affect this viewpoint.

The conclusion from this high-level assessment is that the majority of the representative viewpoints will remain largely unaffected by the aviation lighting owing to their notable separation distance combined with the medium intensity of the aviation lighting. While there is the potential for significant effects to arise along the closer range coastal areas, these are limited by the medium intensity of the aviation lights, baseline lighting, especially along developed sections of the coast and the separation distance of over 7.5 km between these coastal edges and the Offshore Development.

Significant effects relating to the night-time lighting will occur along the eastern coast of Strathy Point and the northern coast between Strathy and Baligill and at Sandside Head. The settlements and minor roads associated with these coastlines are located approximately 8.5 to 10.5 km from the Offshore Development. This assessment concurs with the assessment of the Farr Bay, Strathy and Portskerra SLA assessment presented below.

1.9 Night-time Assessment on Designated Landscapes and Mapped Interests

The effects of night-time lighting on the National Scenic Areas (NSA) and Wild Land Areas (WLA) are considered in the following appendices:

- Offshore EIA (Volume 3): Appendix 16.2: Assessment of Effects on the Special Qualities of the Kyle of Tongue NSA;
- Offshore EIA (Volume 3): Appendix 16.3: Assessment of Effects on the Special Qualities of the Hoy and West Mainland NSA;
- Offshore EIA (Volume 3): Appendix 16.4: Assessment of Effects on the Wild Land Qualities of the East Halladale Flows WLA; and
- Offshore EIA (Volume 3): Appendix 16.5: Assessment of Effects on the Wild Land Qualities of the Hoy WLA.

A key factor in these assessments is the separation distance between the NSAs and WLAs and the Offshore Development. The Kyle of Tongue is located a minimum of approximately 23 km from the Offshore Development, the Hoy and West Mainland NSA, a minimum of approximately 32 km and the Hoy WLA a minimum of approximately 33 km. These notable separation distances, combined with the small number of lights and their contained horizontal extents as seen from these distant locations, ensure that the aviation lighting will not give rise to significant effects on these NSAs and this WLA. As the maximum number of turbines is seven, the layout used in this assessment represents the worst-case scenario in respect of aviation lighting.

In respect of the East Halladale Flows WLA, which is located a minimum of approximately 11 km from the Offshore Development, while the closer proximity makes this WLA more susceptible to the effects of the aviation lighting, the lights will be seen in the same sector as the baseline lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE, Reay and the A836, all of which are located along the northern coastal edge, and therefore, closer to the WLA and intermediate between the WLA and the Offshore Development. The East Halladale Flows WLA is represented by Viewpoint 1: Beinn Ratha, the detailed assessment for which is presented at section 1.7.1 of this appendix.

The magnitude of change on this viewpoint is assessed to be medium-low in respect of the 2,000 cd lighting and low in respect of the 200 cd lighting and the effect to be not significant. A similar assessment is presented in Offshore EIA (Volume 3): Appendix 16.4, where the effects are assessed to be not significant at a moderate or moderate / minor level.

In terms of regional landscape designations, the location of the Dunnet Head Special Landscape Areas (SLA), at a minimum of approximately 25 km, is too distant for significant effects to arise as a result of the aviation lighting. The location of the Farr Bay Strathy and Portskerra SLA at a minimum of approximately 8 km presents the potential for significant effects to arise.

1.9.1 Farr Bay, Strathy and Portskerra SLA

1.9.1.1 Baseline

The SLA covers the north coast of Sutherland between Bettyhill in the west and Melvich in the east, as well as the immediate hinterland of moorland and crofting areas. This area is characterised by its dramatic, deeply indented coastline of rocky headlands and sheltered bays, backed by a mosaic of moorland and crofting landscapes. Views extend west along the coast to Cape Wrath and east to Dunnet Head, as well as north across the Atlantic Ocean and north-east across the Pentland Firth to the Orkney Islands. This landscape is defined by the coastal character, with its prominent rocky headlands and enclosed sandy bays. While reference is made to the views which are drawn south to the inland mountains, the principal views are drawn either along the coast or out to the Atlantic Ocean where the Offshore Development will be located, with the seascape having a notable influence on the character of this SLA.

Figure 16.28 shows that the levels of light pollution are low across the SLA, with some slightly higher levels associated with settlement at Portskerra, Melvich, Armadale, Kirtomy and Farr. The satellite image in Figure 16.29 concurs with this analysis, showing lighting levels across the SLA to be low, with a concentration of lighting occurring at Portskerra/Melvich and Bettyhill, to the south-west of the SLA boundary. Baseline sources of lighting in the SLA are, therefore associated with low level domestic lighting from small settlements and dispersed rural properties and low-level lighting from vehicles on the nearby A836 and other minor roads.

1.9.1.2 Sensitivity

The value of the Farr Bay, Strathy and Portskerra SLA is medium-high. The SLA is a scenic designation used by THC to denote the local value of a landscape. The ‘high’ rating is preserved for national scenic designations such as NSAs and National Parks. While the distinctive character of the coast presents an important example of this type of landscape, other SLAs of similar character occur along the north coast.

The susceptibility to change during night-time is medium-high. Visual receptors relevant to this assessment include mainly residents and road-users, the majority of which are located along or close to the northern coastal edge. Because this is a settled coast, there is some degree of baseline lighting, albeit often low in level and dispersed across the coastal area. The susceptibility of these residents and road-users will be increased by the levels of darkness that will generally be experienced, although will not be high owing to the baseline lighting that does occur. In those parts of the hinterland where baseline lighting is especially low, there is no settlement or roads, and therefore, no visual receptors with potential to be affected.

The night-time sensitivity is **medium-high** - taking account of the assessed medium-high value of the SLA and the medium-high susceptibility of visual receptors to the proposed change.

1.9.1.3 Magnitude of change

The Hub Lighting ZTV in Figure 16.30 shows visibility of the aviation lighting will occur almost continuously between Portskerra and Baligill and between Strathy and Strathy Point. To the west of Strathy Point, visibility becomes notably reduced owing to the screening effect of the prominent headland of Strathy Point. In terms of visual receptors in the SLA with potential to be affected by aviation lighting, the ZTV highlights the dispersed settlement between Strathy Point and Strathy, the small settlement of Baligill, and larger settlements of Portskerra and Melvich. The extent of baseline lighting in Portskerra and Melvich associated with the street lighting, residential properties and vehicles on the A836, notably reduces the magnitude of change associated with the 2,00 cd lighting to **low**.

The magnitude of change associated with the 2,00 cd, experienced from the eastern coast of the Strathy Point headland and Baligill, will be **medium**. Aviation lighting will comprise a medium intensity, flashing red light mounted on the hubs of all seven offshore WTGs, at a height of 170 m above HAT. The intensity of the lights will be reduced from their maximum of 2,000 cd to 200 cd in good visibility The lights of the seven WTGs will be apparent across approximately 10 to 20 degrees of the available sea views and seen at a minimum of approximately 8 and 11 km.

The aviation lights will add seven flashing red lights in the area of seascape to the north-east of these coastal settlements. With the baseline mainly comprising low intensity domestic lighting associated with the dispersed rural properties, the addition of flashing red lights of medium to low intensity will give rise to an apparent change in this relatively dark aspect where baseline lighting is limited. The effect will, however, be moderated by the low-level baseline lighting associated with these rural settlements, the small number of lights visible, their relatively low intensity, their relatively compact horizontal extents and their relative proximity to the Mainland of Scotland, rather than the wider ocean to the north.

The magnitude of change on visual receptors in all other parts of the SLA will be **low** or there will be **no change**, owing to limited or no visibility of the aviation lighting or an influence from baseline lighting.

1.9.1.4 Significance of the effect

The combination of the medium-high sensitivity and the medium magnitude of change associated with the 2,000 cd lighting will give rise to a **significant** effect at a **moderate** level from the eastern coast of the Strathy Point headland and Baligill. In respect of all other visual receptors in the SLA, the medium-high sensitivity and the low magnitude of change associated with the 2,000 cd lighting will give rise to a **not significant** effect at a **moderate / minor** level. In considering the effect that the reduced intensity lighting of 200 cd would have on the SLA, this would be **not significant** at a **moderate / minor** level.

1.9.1.5 Cumulative effects

The lighting baseline will change under Scenario 1 with the addition of Strathy Wood and Strathy South onshore wind farms, at approximately 7.1 km and 9.2 km respectively, located to the south of the SLA. There will also be a change associated with the decommissioning of the Dounreay Nuclear Power Facility and Vulcan NRTE, as well as the addition of consented SHE-T Substation. Whilst the lighting requirements of these development is not known, in order to cover a worst-case scenario, it is assumed that the Strathy Wood and Strathy South onshore wind farms would require aviation lighting owing to their blade tip heights of 180 m and 200 m.

Strathy Wood and Strathy South will add sources of lighting at a minimum of 7.1 km and 9.2 km to the south, which although likely to be low intensity from this range, will form a notable feature in the otherwise dark extents characterising this southerly aspect of the SLA. The decommissioning of Dounreay Nuclear Power Facility and Vulcan NRTE will have very little effect on the SLA owing to the limited visibility of the baseline lighting currently.

The lighting associated with Strathy Wood and Strathy South will not be readily visible from the eastern coast of the Strathy Point headland or Baligill and, therefore, the cumulative interaction of night-time lighting will be limited, and the cumulative magnitude of change will be **negligible**.

Under Scenario 1, the medium sensitivity combined with the negligible cumulative magnitude of change will give rise to a **not significant** effect at a **minor** level.

Under Scenario 2, there would be no further changes to the lighting baseline from what has been described under Scenario 1. The Scenario 1 assessment would, therefore, also apply to Scenario 2.

Under Scenario 3, there will be a cumulative interaction between the aviation lighting of the Offshore Development and the aviation lighting of the West Orkney Offshore Wind Farm. As the detail of West Orkney Offshore Wind Farm is not currently known, this assessment assumes that night-time lighting will be a requirement of this extensive offshore wind farm, albeit located a minimum range of 23 to 29 km from this SLA.

The seven aviation lights associated with the Offshore Development will be added into a sector of the seascape where there will be existing lighting associated with the West Orkney Offshore Wind Farm. The influence of the West Orkney Offshore Wind Farm will be reduced by the separation distance of a minimum of 23 to 29 km, and although this will notably reduce the perceived intensity of these more distant aviation lights, they will still

form a baseline source that will prevent the Offshore Development lighting from appearing to introduce lighting into a dark seascape. The Offshore lighting will, however, present lights with a greater perceived intensity and will be seen to draw offshore lighting closer to the north coast.

The combination of the medium-high sensitivity and the medium cumulative magnitude of change of the 2,000 cd lighting will give rise to a **significant** effect at a **moderate** level from the eastern coast of the Strathy Point headland and Baligill. In respect of all other visual receptors in the SLA, the medium-high sensitivity and the low magnitude of change will give rise to a not significant effect at a **moderate/minor** level. In considering the effect that the reduced intensity lighting of 200 cd would have on the SLA, this would be **not significant** at a **moderate / minor** level.

The combination of the medium-high sensitivity and the medium cumulative magnitude of change of the 2,000 cd lighting will give rise to a significant cumulative effect on this SLA at a moderate level in the localised extent of the coastline between out to a range of 8 to 10 km, and not significant in all remaining parts of the SLA, which make up the majority of the SLA.

1.10 Summary of Night-time Assessment

The night-time effects on visual receptors arising as a result of the aviation lighting associated with the Offshore Development have been assessed in respect of the worst-case scenario, which comprises all seven WTGs being fitted with 2,000 cd flashing red, hub mounted aviation lights (reduced to 200 cd in good visibility (>5 km)). Four representative viewpoints have been assessed in detail to demonstrate the potential effects of the aviation lighting on visual receptors along the closest section of the northern coastline to the Offshore Development. Night-time photomontages are presented at Figures 16.31m and n, 16.32k and l, 16.35k and l and 16.40k and l. A summary of this assessment is presented in Table 1.10-1 below.

Table 1.10-1 Summary of night-time assessment of representative viewpoints

Viewpoint	Sensitivity	Magnitude of change	Significance of effect	Scenario 1 cumulative effect	Scenario 2 cumulative effect	Scenario 3 cumulative effect
1 Beinn Ratha	Medium-high	Medium-low (2,000 cd) Low (200 cd)	Not significant at a moderate level (2,000 cd) or moderate / minor level (200 cd)	Medium-low / Not significant	Medium-low / Not significant	Medium-low / Not significant
2 Strathy Point car park	Medium-high	Medium (2,000 cd) Medium-low (200 cd)	Significant at a moderate level (2,000 cd) or moderate level (200 cd)	No change / No effect	No change / No effect	Medium / Significant
5 Sandside Head	Medium	Medium (2,000 cd) Medium-low (200 cd)	Significant at a moderate level (2,000 cd) or moderate / minor level (200 cd)	No change / No effect	No change / No effect	Medium / Significant
10 A836 east of Forss	Medium	Medium-low (2,000 cd) Low (200 cd)	Not significant at a moderate / minor level (2,000 cd) or minor level (200 cd)	No change / No effect	No change / No effect	Medium-low / Not significant

Significant effects would arise in respect of Viewpoint 2: Strathy Point car park and Viewpoint 5: Sandside Head, albeit only in respect of the 2,000 cd lighting which would only be experienced very infrequently and not the 200 cd lighting that would be experienced for the majority of the time.

An overview of the 12 other representative viewpoints, presented in Table 1.8-1, highlights the fact that these viewpoints will not be significantly affected by the night-time lighting. While there is potential for significant effects to arise along the northern coast between Strathy Point and Brims Ness, firstly there has to be visual receptors to experience the effects and these are limited to road-users on the A836 and residents in the settlements and dispersed rural properties. The Hub Lighting ZTV in Figure 16.30 shows that there will be no visibility from the settlements of Strathy and Forss and while there will be visibility from Portskerra, Melvich, Reay and Isauld, the effects of the offshore lighting will be reduced by the baseline lighting from the streetlights. There is also a notable influence from the baseline lighting associated with Dounreay Nuclear Power Facility, Vulcan NRTE and SSE Substation, which reduces the effects of the offshore lighting on A836 road-users.

The visual receptors that are, therefore, most susceptible to the effects of the offshore lighting are the residents of the rural properties set along the minor road between Strathy and Strathy Point and on the north coast at Baligill. While this is an inhabited coastline, there are no streetlights and limited visibility of the lighting associated with Dounreay. The introduction of the aviation lighting into a context in which baseline lighting levels are low, as shown in Figure 16.28, but where residents have views orientated towards the open seascape where the Offshore Development will be located, has the potential for significant effects to occur, in respect of the 2,000 cd lighting but not the 200 cd lighting that would be experienced most of the time. These significant effects will coincide with this localised part of the Farr Bay, Strathy and Portskerra SLA which includes the eastern coast of Strathy Point headland and the northern coast between Strathy and Baligill, and at Sandside Head, extending between a range of 8 and 10 km from the Offshore Development.

Visual receptors across all other parts of the SLVIA Study Area will not be significantly affected, owing to a combination of the relatively small number and compact layout of the Offshore Development, the separation distance between the lights and the visual receptors and the baseline influence from existing light sources associated with development along the northern coast.

There will be no significant cumulative effects associated with cumulative scenarios involving consented and application stage developments, largely owing to the limited additional influence of other future developments. In respect of the future proposed West Orkney Offshore Wind Farm, the Offshore Development lighting will give rise to significant cumulative effects at Viewpoint 2: Strathy Point car park and Viewpoint 5: Sandside Head but not at Viewpoint 1: Beinn Ratha or Viewpoint 10: A836 east of Forss.

1.11 References

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