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Volume 7C Caledonia North Appendices

Appendix 12-1 Night Time Assessment

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Volume 7C Appendix 12-1 Night Time Assessment (Caledonia North)

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Acronyms and Abbreviations

BOWL	Beatrice Offshore Windfarm Limited
CAA	Civil Aviation Authority
cd	Candela
EIAR	Environmental Impact Assessment Report
HFoV	Horizontal Field of View
km	Kilometres
LCT	Landscape Character Type
NASA	National Aeronautics and Space Administration
OWF	Offshore Wind Farm
RCCA	Regional Coastal Character Area
SLVIA	Seascape, Landscape and Visual Impact Assessment
SLA	Special Landscape Area
WTG	Wind Turbine Generator
ZTV	Zone of Theoretical Visibility

1 Introduction

- 1.1.1.1 This appendix sets out the assessment of night time effects that relate to Seascape, Landscape and Visual Impact Assessment (SLVIA) for the Caledonia Offshore Wind Farm (OWF), specifically Caledonia North, and are summarised in Environmental Impact Assessment Report (EIAR) document Volume 3, Chapter 12: Seascape, Landscape and Visual Impact Assessment.
- 1.1.1.2 The visual influence of the red, flashing, aviation lighting is likely to be more noticeable than the lower levels of light intensity associated with the navigation 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.
- 1.1.1.3 Therefore, the assessment of night time visual effects concentrates on the effects of the aviation lighting.
- 1.1.1.4 The perimeter turbines of the Caledonia North Site will be lit with medium intensity, flashing lights in accordance with Civil Aviation Authority (CAA) requirements. As set out in Volume 3, Chapter 12: Seascape, Landscape and Visual Impact Assessment, the aviation lights will be dimmed from 2000cd to 200cd during periods of clear visibility (over 5km range).
- 1.1.1.5 The assessment of night time visual effects is undertaken through an understanding of the baseline night time light influence, Zone of Theoretical Visibility (ZTV) analysis and mapping and through reference to night time visualisations and viewpoint assessment.
- 1.1.1.6 Whilst there are only five viewpoints that illustrate the lighting of Caledonia North, 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. There are, however, notably fewer aviation and navigation lights than there are Wind Turbine Generators (WTGs) in either scenario as shown on Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures (Figure 12-19).

2 Baseline Lighting

- 2.1.1.1 The National Aeronautics and Space Administration (NASA) Visible Infrared Imaging Radiometer Suite onboard two satellite platforms provides yearly Night Time Lights composite that provides cloud-free images that have been corrected for atmospheric, terrain, lunar, thermal and straylight effects. It is provided at 15 arc per second resolution which equates to 500m resolution to create a measure of night time brightness. These have been categorised into colour bands to distinguish between different light levels. The maps do not show what the view of the night sky would be from the ground. This information has been used to create Figure 12-5: Baseline Lighting NASA VIIRS NIR Light Composite 2023 (Volume 7B, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures).
- 2.1.1.2 The highest levels of lighting in the baseline environment tend to be in and around settlements where there are lights in and around buildings as well as streetlights and a higher concentration of vehicle lights. The concentration of lights in settlements can also create light glow. In the countryside lights tend to be clustered around or emitted from the scattered settlement and farmsteads. When moving through the countryside people tend to be in vehicles which have their own lighting. Once it is dark this tends to make the focus of any views ahead of the vehicle. This is except for locations which draw attention due to their lighting.
- 2.1.1.3 This far north in Scotland, night time/low light views are prevalent for much of the 24 hour period from late autumn to early spring, particularly when people are travelling to and from their places of work and/or school. Whilst this is the case, most activity that takes place outdoors or for appreciation of the landscape/seascape occurs during daylight hours. When people are indoors they generally exclude the views into or out of their homes for privacy with curtains or blinds, which are also used for insulation.
- 2.1.1.4 The baseline lighting conditions quantified by NASA show that within Moray and Aberdeenshire the coastal urbanised areas of Fraserburgh, Rosehearty, Gardenstown, Macduff, Banff, Portsoy, Cullen, Portknockie, Buckie and Lossiemouth are the brightest light sources. Less bright light sources from smaller settlements are strung out along the coast. The relatively dark parts of Moray and Aberdeenshire are located inland, across more sparsely settled landscapes that lie broadly to the south of the A96 and A98, on the fringes of the study area.
- 2.1.1.5 Within the Highlands part of the study area, the urban areas of Wick and Thurso have the greatest light influence, which extends outwards across their suburban context and surrounding landscape. The eastern coastline is influenced by a combination of light from smaller settlements strung out along the A9 at Helmsdale, Dunbeath, Lybster, and on the A99 at Keiss

and John O' Groats, and a notable source of lighting at the Subsea 7 pipeline facility 3km south of Keiss. Along the northern coast there is light influence from smaller settlements including at Gills and Castletown. The relative sparsity of settlement leaves areas of relative darkness across much of the intervening coastal landscape. Further inland, much of the coastal hinterland and landscape of the sweeping moorland and flows, and open rounded hills and uplands are unsettled, with few roads, and therefore a relatively dark part of the study area. There is light influence at smaller settlements inland at Halkirk and Watten, and at the other end of the pipeline facility near Hastigrow.

- 2.1.1.6 In the northern part of the study area that covers the southern isles of Orkney, there is considerable light influence from the Flotta Oil Terminal. There is also some light influence from the smaller settlements at Longhope, Lyness and St Margaret's Hope.
- 2.1.1.7 There are several lighthouses along the coast within the SLVIA study area. Within Highlands are Dunnet Head Lighthouse, Stroma Lighthouse, Duncansby Head Lighthouse and Noss Head Lighthouse. In the Orkney Islands are Swona Lighthouse, Cantick Head Lighthouse and the Pentland Skerries Lighthouse. In Aberdeenshire there is the Kinnaird Lighthouse. Navigational markers are also lit and are often visible from the coast.
- 2.1.1.8 Offshore, there are flashing lights on the hubs of the two Beatrice Demonstrator WTGs and static lights on the platforms of the Beatrice Oil Field. Ships and fishing boats out at sea also have lights that may be visible at different ranges from the coast. These are seen as spots of light, with platforms tending to be more brightly lit.
- 2.1.1.9 The flashing Beatrice Offshore Wind Farm Limited (BOWL), Moray East and Moray West OWFs' operational lighting is visible at night, as shown in the baseline night time photographs. The flashing nature of the actual lights makes these more noticeable than static lights.
- 2.1.1.10 'Night time' (civil twilight) baseline photographs have been taken from five viewpoints (locations shown on Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures, Figure 12-19: Hub Aviation Lighting ZTV Caledonia North) to illustrate the night-time visual baseline and consider the visual effects of turbine lighting. These baseline photographs can be found in Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations:
- Figure 12-5: Viewpoint 5: Wick (path south of South View);
 - Figure 12-9: Viewpoint 9: Lybster (end of Main Street);
 - Figure 12-15: Viewpoint 15: Cullen (viaduct);
 - Figure 12-19: Viewpoint 19: Gardenstown, Harbour Road; and
 - Figure 12-21: Viewpoint 21: B9031, west of Fraserburgh.

- 2.1.1.11 The selection of the views for the preparation of night time visualisations considers the potential for views that include lighting along the Highlands, Moray, and Aberdeenshire coasts. The use of photographic views taken civil twilight (dusk) allows recognition of the landscape features that are the context for the lights and also represents a time of day when both the basic features (not the detail) of the landscape and seascape resource are visible as well as the lights.
- 2.1.1.12 The night time viewpoint locations as well as the extent of the visualisations and night time assessment was agreed through the Scoping and consultation process with a focus on sensitive receptors.
- 2.1.1.13 The assessment focuses on the visual effects of aviation and navigational lighting; however, the impact of the Caledonia North Site lighting on coastal character at night is considered for some limited areas where coastal character and the landform/skyline of inshore islands etc may be perceived at night with lights in the background (i.e., where a perceived character effect may occur as a component of visual effects). Areas and receptors located outside the ZTV (i.e., in areas with no visibility), are scoped out of the SLVIA since they have no visibility of the Caledonia North Site and will not be affected.

3 Zone of Theoretical Visibility

- 3.1.1.1 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 aviation lighting Zone of Theoretical Visibility (ZTV) analysis in Figures 12-19 to 12-21 (Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures). The locations of the WTGs which are assumed in the maximum design scenario for SLVIA to have aviation lights fitted to the hubs are also shown on Figure 12-19 (Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures) and are as set out below.
- 3.1.1.2 The maximum design scenario includes 31 WTGs with 2000 candela (cd) flashing red, hub mounted at a height of 200m (bottom-fixed WTGs) above mean sea level. Aviation lights are located on perimeter WTGs of the Caledonia North Site.
- 3.1.1.3 The aviation light ZTVs can be used to identify where the aviation lights may theoretically be visible and how the range of numbers of lights that 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.
- 3.1.1.4 Whilst the ZTV does not take the proposed mitigation into account, the resulting impacts of the dimmed lights at 200cd are markedly reduced from those of 2000cd lights. From the coastal areas, which are all at distances of greater than 5km the 2000cd lighting would never be visible to its full luminous intensity as the more 'powerful' lights would only be 'on' when the visibility conditions are very poor (e.g., during periods of high humidity/fog). 200cd would be the level of light most likely to be seen from the coast.

4 Visualisations

4.1.1.1 NatureScot’s advice (see Volume 3, Chapter 12: Seascape, Landscape and Visual Impact Assessment, Table 12-3) in relation to how the aviation lighting should be portrayed in visualisations is that:

“Photomontage visualisations should illustrate the maximum case lighting intensity scenario. For example, 200 cd where dimming of aviation lights is proposed as embedded mitigation, and 2000 cd only where this mitigation is not proposed”.

4.1.1.2 This follows what has been agreed with Scottish Government and the working group for the draft aviation lighting assessment guidance.

4.1.1.3 The photographs have been taken so that where possible the flashing lights are shown ‘on’. Existing lights shown in the photographs appear larger and more blurred than those seen to the naked eye. A term which seems to describe this effect is ‘Bokeh’ which has been 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.

4.1.1.4 The BOWL and Moray East OWFs mitigation incorporates the reduction in lighting intensity proposed for Caledonia North. Due to the clear weather conditions during the photography it is assumed that the aviation lights are dimmed to 200cd.

4.1.1.5 In the 53.5 degree field of view baseline panoramas, the Moray West OWF aviation lights have been photomontaged into the baseline views in accordance with the approved Moray Offshore Windfarm (West) Limited (2023¹) Lighting and Marking Plan, revision 05. All Moray West aviation lights are shown as being ‘on’ in this instance.

4.1.1.6 Night time visual representations have been included in the assessment to predict and assess the possible effect of lighting of the Caledonia North Site. Lighting has been simulated using Resoft Windfarm software. The aviation lighting on the operational WTGs has been used as a basis for the lighting intensity shown with some adjustment for increased or decreased distance. Lights have been placed on the nacelle of the perimeter turbines as identified in Figures 12-19 to 12-21 (Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures).

4.1.1.7 Also seen in the baseline night time views are the Beatrice oil platforms and lighting of the vessels and platforms being used currently to erect the WTGs and OSPs. Views of construction vessels are likely to be reduced once Moray West OWF is operational but some may occur during operation.

4.1.1.8 All of the proposed flashing aviation lights within the Caledonia North Site are shown as ‘on’ in the visualisations.

- 4.1.1.9 The turbine blades when they intermittently pass in front of the lights would cause additional randomised flickering when the lights are 'on'. The turbines used in the night time visualisations have been positioned so that their blades face away from the viewpoint so that all the lights are visible and on within the visualisations.
- 4.1.1.10 The flickering effect caused by the blades interacting with the lights would be most usually apparent from a south westerly direction due to the prevailing south westerly wind.
- 4.1.1.11 The effect of Caledonia North at night is assessed primarily from the viewpoints at Wick, Lybster, Cullen, Gardenstown and Fraserburgh as representative locations within settlements from the Highlands, Moray and Aberdeenshire coast.

5 Night Time Viewpoint Assessment

5.1 Overview

5.1.1.1 The assessment of night time visual effects is undertaken through an understanding of the baseline night time light influence, ZTV analysis and mapping and through reference to night time visualisations and viewpoint assessment.

5.1.1.2 Whilst there are only five viewpoints that illustrate the lighting of the Caledonia North Site 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. There are, however, notably fewer aviation and navigation lights than there are WTGs.

5.2 Viewpoint 5 Wick (Path South of South View)

5.2.1 Baseline Condition and Sensitivity

5.2.1.1 The viewpoint is representative of those obtained by some residents of Wick and visiting tourists in the hours of darkness. It is also representative of coastal path users and of core path CA15.03 Castle of Old Wick which runs along the coastal edge to the Castle of Old Wick from the car park at the end of the minor road. Views towards the open seascape where the Caledonia North Site will be located are similar, albeit without South Head in the view.

5.2.1.2 The viewpoint is located on a locally popular coastal core path (North Head CA15.01) which runs between the rear boundary of properties and the cliff top of North Head. It may be used by dog walkers as it gets dark.

5.2.1.3 The view from the viewpoint is across Wick Bay where it meets the open sea to the east and extends westwards to the harbour area encompassing a wide range of settlement characteristics.

5.2.1.4 The immediate context of the views out to sea is the headland out to South Head where there are several buildings, street lights and a mast visible, all emitting light sources. The light from the downward facing street lights is also apparent, reflected on the ground plain in some instances.

5.2.1.5 The rocky coastline is in darkness whilst beyond and spreading out across the sea horizon it is possible to see the flashing lights of the Beatrice Demonstrator WTGs (38.1km) amidst the flashing aviation lights of the Moray West OWF at a range of 31km.

5.2.1.6 Further out to sea the lights of the BOWL turbines are visible across approximately 38 degrees of the field of view at a closer range of 18.1km.

The Moray East OWF aviation lights are largely located beyond BOWL in views from this direction and at a greater distance of 26.6km. From this location within Wick Bay and at this range the baseline OWFs are located so that they appear to extend from the land to the south and are apparent across a large proportion of the visible sea skyline. Some of the closer range navigation lights are also visible within the BOWL OWF.

- 5.2.1.7 The varied WTG dimensions is less obvious in the hours of darkness as it is not possible to readily distinguish different WTG scales from the divergent hub heights created by distance. However, the lights of the different OWFs flash at different times so that, overall, there appears to be a degree of discordancy in terms of how the OWFs appear together with the varied flashing sequences drawing attention.
- 5.2.1.8 At this range the seascape remains an intrinsically dark place in contrast with the wider views across Wick Bay to the town. The urban area is substantially lit by many features associated with the harbour and town of Wick, including lighting around the harbour, boat lighting, street lighting, lighting associated with houses and buildings in Wick and point features such as the lighting on the lighthouse, a stack, crane and a further mast. The sea within the harbour area reflects the light from these sources, increasing the influence of lighting in the scene. Lighting by vehicle headlights is also apparent.
- 5.2.1.9 There is a strong contrast between the developed and lit night time landscape around Wick Bay to the right of the view and the distant relatively 'dark' seascape to the left of the panorama. The overall impression of the night time view is of a settled, well-lit industrial harbour town in which lighting has a substantial influence on the existing night time view. The night time view from Wick Bay is likely to be experienced by residents and walkers on the north side of Wick Bay, around The Shore and Scalesburn, and by fishermen working or returning to Harbour.
- 5.2.1.10 The susceptibility levels attributed to such views at night are considered to be lower as the seascape is less valued as part of the context of a place and people tend to look out over it less than they do during the day. The susceptibility is considered to be Medium.
- 5.2.1.11 The view out to sea is unlikely to be locally valued. The headland context and contained bay view are not readily visible at night. Local interest is more likely to be directed to the activities that are visible in the harbour and town which are more visible. The value is considered to be Medium.
- 5.2.1.12 Representative of views obtained by people in their homes. The orientation of this part of the settlement is such that the view direction is generally akin to the views from the rear of a small number of properties along the southern edge of North Head towards the south. The properties on South Head and Papigoe tend to be orientated further to the east and views from

the properties take in more of the open sea (to the east toward the Caledonia North Site).

- 5.2.1.13 In combining the Medium value with the Medium susceptibility, the sensitivity of receptors at this viewpoint is considered to be **Medium**.

5.2.2 Magnitude of Change

- 5.2.2.1 The red, flashing aviation lights on the hubs of the perimeter turbines of the Caledonia North Site would be visible in the view at a minimum range of 24.6km. Approximately one third of the Caledonia North Site is located behind the Moray East OWF with approximately one sixth of this also located behind the BOWL OWF. Where this is the case the aviation lights will be seen in the immediate context of the operational lights but are likely to be differentiated by a different flashing sequence.
- 5.2.2.2 The position of the Caledonia North Site in the view is such that it will introduce more red lights into the currently open section of the sea skyline that lies between the northern extent of Moray West OWF and the coast towards North Head. Whilst the resultant collective span of the OWFs across the contained seascape between North Head and South Head is apparent during the day this will be less apparent at night as the coastal edges are in darkness. Caledonia North Site aviation lights may be seen across 32 degrees of the Horizontal Field of View (HFOV), adding a further 21 degrees to the HFOV affected by OWF aviation lighting.
- 5.2.2.3 Whilst the WTG hubs are higher above sea level than those of the operational OWF WTGs this is unlikely to be immediately apparent once it is dark as the height above the sea skyline is less/not discernible. The closer range of the BOWL WTGs ensures that the Caledonia North Site aviation lights will be slightly less prominent than these and slightly more prominent than those of the slightly more distant Moray East OWF.
- 5.2.2.4 The lights of the Caledonia North Site would be seen in the context of the extensively lit night time landscape around Wick Bay. The appearance of the red, flashing turbine lights will appear substantially diminished in the context of the bright lighting around Wick Bay, due to the relatively long distance of the Caledonia North Site from this location. Although the lighting introduces lights into a further section of dark seascape, the lights are not considered to be obtrusive and due to their relatively low position on the distant skyline, do not impede the view of the night sky.
- 5.2.2.5 The lights are likely to be viewed with the dark silhouette of the WTGs and OSPs during the hours around dusk and as point features of light during the darker hours of the night.
- 5.2.2.6 The additional lights occupy a relatively small portion of the view in comparison to the existing portion of view which is lit up around Wick and Wick Harbour, however, as a result of the addition of the Caledonia North

Site aviation lighting almost all of the sea skyline would have lighting across it.

- 5.2.2.7 Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures, Figure 12-20 Hub Aviation Lighting ZTV (Western Study Area), illustrates the extent of the ZTV within the vicinity of the viewpoint location. It shows that there is theoretical visibility of the Caledonia North Site aviation lighting throughout the eastern part of Wick including North Head (where the viewpoint is located) and eastern parts of South Head. The centre of the town has limited visibility due to the screening effects of topography. Due to screening by intervening built form within the urban area actual visibility will generally be concentrated along the coastal edge: 1km from the southern coastline of North Head and for up to 400m inland from the eastern coastline of South Head. Large parts of South Head promontory and the port of Wick will be unaffected.
- 5.2.2.8 Taking into account the description of change and the factors of magnitude described above, the magnitude of change for the Caledonia North Site is considered to be **Medium-low**.

5.2.3 Significance of Effect

- 5.2.3.1 The night time visual effect of Caledonia North Site during operation at this viewpoint for up to 1km from the southern coastline of North Head and for up to 400m inland from the eastern coastline of South Head is considered to be **Moderate-minor and Not Significant in EIA terms**. The effects will be adverse, long term and reversible.

5.3 Viewpoint 9 Lybster (End of Main Street)

5.3.1 Baseline Condition and Sensitivity

- 5.3.1.1 The viewpoint is representative of views from residential properties and parts of the settlement of Lybster.
- 5.3.1.2 The viewpoint is located near to the southerly dead-end of Main Street in the planned village of Lybster, which is orientated in a strongly north south direction with houses and street lights set out along its length. There are a small number of houses located along the coast, some of which are seen in the view presented. The view shows a foreground turning area at the end of the street with grassed verges, fenced fields, street lighting and garden boundaries. The street lighting casts light across these local features ensuring they remain visible at night.
- 5.3.1.3 The properties generally follow the strong alignment of the Main Street axis, which runs almost due south from the A99 junction, are visible in the wider view. These are generally inward looking to the Main Street. Other

properties in the view are a short terrace of two-storey local authority built houses and a more modern, detached property closer to the coast. The sea is visible in views from the gardens/rears of residences on Main Street and from the south end of the settlement near the coast.

- 5.3.1.4 There are also several core paths mostly providing links from the village to the coast and harbour, which was once the focus of the important herring fishing industry. These routes are less likely to be used at night.
- 5.3.1.5 To the south-west there is an open expanse of sea open sea horizon forming the backdrop to the foreground housing and streetscape. It is this part of the view that broadly aligns with the channelled views along Main Street. Within this part of the sea the only lights are likely to be fishing boats and potentially vessels associated with the OWFs.
- 5.3.1.6 Further round to the south and south-east and partially within the main aspect of the coastal properties it is possible to see the flashing lights of the Beatrice Demonstrator Turbines (25.9km) amidst the flashing aviation lights of the Moray West OWF at a range of 24.5km.
- 5.3.1.7 Further round to the east aviation lights of the Moray East and BOWL OWFs are visible across a further large part of the view with a high degree of overlapping. The Moray East OWF aviation lights are largely located beyond BOWL at 19.5km and partially beyond Moray West OWF at 24.4km in views from this direction and at a greater distance of 27.8km. From this location and at this range the baseline OWFs are located so that they appear to extend out from the land to the north and are apparent across approximately 95 degrees of the visible sea skyline. Some of the closer range navigation lights are also visible within the BOWL OWF.
- 5.3.1.8 The varied WTG dimensions are less obvious in the hours of darkness as it is not possible to readily distinguish different WTG scales from the divergent hub heights created by distance. However, the lights of the different OWFs flash at different times so that, overall, there appears to be a degree of discordancy in terms of how the OWFs appear together with the varied flashing sequences drawing attention.
- 5.3.1.9 At this range the seascape remains an intrinsically dark place in contrast with the close range and wider views across Lybster.
- 5.3.1.10 The night time view from Lybster is likely to be experienced by residents and people moving around the routes to the south of the settlement.
- 5.3.1.11 Representative of views obtained by people in their homes. The orientation of this part of the settlement is such that the view direction (towards the Caledonia North Site) is generally akin to oblique views from the frontages and gardens of a small number of properties with the main aspect views orientated further to the south. The susceptibility levels attributed to such views at night are considered to be lower as the seascape is less valued as

part of the context of a place and people tend to look out over it less than they do during the day. The susceptibility is considered to be Medium-low.

5.3.1.12 The view out to sea may be of some local value to residents. The value is considered to be Medium.

5.3.1.13 In combining the Medium value with the Medium susceptibility, the sensitivity of receptors at this viewpoint is considered to be **Medium**.

5.3.2 Magnitude of Change

5.3.2.1 The red, flashing aviation lights on the hubs of the perimeter turbines of the Caledonia North Site would be visible in the view at a minimum range of 34.9km to the east and south-east. Almost the entire visible Caledonia North Site will be located behind the BOWL OWF with approximately three quarters of this also located behind the Moray East OWF. Where this is the case the aviation lights will be seen in the immediate context of the operational lights but are likely to be differentiated by a different flashing sequence. Caledonia North Site aviation lights may be seen across 33 degrees of the HFoV.

5.3.2.2 The position of the Caledonia North Site in the view is such that it will introduce a higher density of red lights into areas of the view currently affected by OWF aviation lighting and a minor extension of this with a further four aviation lights seen to the east, close to the coast in the context of the closer range street lights.

5.3.2.3 Whilst the WTG hubs are higher above sea level than those of the operational OWF WTGs this is unlikely to be immediately apparent once it is dark as the height above the sea skyline is less/not discernible. The closer range of the baseline OWFs ensures that the Caledonia North Site aviation lights will be less prominent than those of the other OWFs with the Caledonia North Site lights being seen at almost twice the distance of the closest range BOWL OWF aviation lights from this location.

5.3.2.4 The lights of the Caledonia North Site would be seen in the context of the extensively lit night time landscape around Lybster. The lights are not considered to be obtrusive and due to their relatively low position on the distant skyline, do not impede the view of the night sky.

5.3.2.5 The lights are likely to be viewed with the dark silhouette of the wind turbines and OSPs during the hours around dusk and as point features of light during the darker hours of the night.

5.3.2.6 Volume 7C, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures, Figure 12-20 Hub Aviation Lighting ZTV (Western Study Area), illustrates the extent of the ZTV within the vicinity of the viewpoint location. It shows that there is patchy theoretical visibility of Caledonia North Site aviation lighting throughout the southern part of Lybster in line with the school, and the surrounding settlements. In

actuality, views will be screened by the intervening houses of the settlement, garden vegetation and landscape features of the wider landscape. Actual visibility will be limited to properties and gardens at the eastern and southern edges of the settlement, down the road corridor, from certain paths and along the coastal edge.

- 5.3.2.7 Taking into account the description of change and the factors of magnitude described above, the magnitude of change for the Caledonia North Site is considered to be **Low**.

5.3.3 Significance of Effect

- 5.3.3.1 The visual effect of the Caledonia North Site during operation at this viewpoint, along the coastal edge and slightly inland is considered to be **Minor and Not Significant in EIA terms**. Effects will be adverse, long term and reversible.

5.4 Viewpoint 15 Cullen (Viaduct)

5.4.1 Baseline Condition and Sensitivity

- 5.4.1.1 The view is representative of views gained by locals and visitors using the viaduct cycle path and visiting the harbour, and Cullen and Seatown residents and visitors who gain coastal and sea views. The view is also representative of views from the beach, local walking routes and caravan park from where views may be obtained at night.
- 5.4.1.2 The view is taken from the elevated route near the viaduct affording views over roof tops of Seatown (the former fishing village that now forms part of Cullen) seen to the north located between the viaduct and the coastline, set back from the beach in the western part of the town.
- 5.4.1.3 The village of Cullen was moved to its current location in the 1820s when a new town was built, centred around a town square, and located to the south of the viaduct.
- 5.4.1.4 Seatown is located between the viaducts and the beach with streets which run parallel or perpendicular to the shoreline. Houses along the shoreline in this part of the town are orientated so that their gable ends often face towards the sea to provide some protection from the elements and to the settlement inland. Views out to sea are mainly from external areas.
- 5.4.1.5 The rest of the town is located on higher ground. Houses face onto the street and are orientated north-east to south-west following the grid pattern. Views seaward to the north are mainly available down street corridors and from amenity spaces.
- 5.4.1.6 The street lighting within the settlement is quite prominent in the foreground with further lighting emitted from the windows of properties.

Lighting around the Cullen Bay Hotel on the A98 to the west is visible on higher ground. The lighting within the settlement of Portknockie is visible on the skyline extending out along the promontory to the north-west.

- 5.4.1.7 The lights of fishing boats, the Orkney and Shetland ferries and other vessels may also be visible out at sea from this location.
- 5.4.1.8 The key features that provide the scenic quality of the views from this location (i.e., the viaduct, the beach and the historic nature of the settlement nestled within the bay), are not discernible in the hours of darkness.
- 5.4.1.9 The aviation lighting on the Beatrice Demonstrator WTGs and the BOWL OWF are theoretically visible with some hubs above the horizon, due to the curvature of the earth. However, at ranges of 47.4km and 55km respectively these aviation lights are not generally visible to the naked eye.
- 5.4.1.10 The Moray East and Moray West OWFs are closer at 42.9km and 41.4km respectively. It was not possible to observe the Moray East OWF aviation lights during the viewpoint photography, which was carried out in excellent visibility conditions. Taking a precautionary approach it has been assumed that it may be possible to see the slightly closer range, flashing aviation lights of Moray West OWF when scrutinising the seascape in excellent visibility conditions. The aviation lights would extend across approximately 31.5 degrees of the field of view to the north-west, set back slightly from the coastline.
- 5.4.1.11 The aviation lights appear clustered in some locations. They are visible during excellent conditions. Seen at a distance along the seascape horizon they are a very minor element of the backdrop to the lit intervening views, but are not a key characteristic.
- 5.4.1.12 At this range the seascape remains an intrinsically dark place in contrast with the close range and wider views across Cullen.
- 5.4.1.13 The night time view from Cullen and Seatown is likely to be experienced by some residents, people moving around the routes within the settlement and along the beach and harbour area.
- 5.4.1.14 Representative of views obtained by people in their homes. The orientation of the coastal and higher parts of the settlement is such that the view direction (towards the Caledonia North Site) is generally akin to oblique or direct views from the frontages and gardens of a small number of properties. The susceptibility levels attributed to such views at night are considered to be lower as the seascape is less valued as part of the context of a place and people tend to look out over it less than they do during the day. The susceptibility is considered to be Medium.
- 5.4.1.15 The view out to sea may be of some local value to residents. The value is considered to be Medium.

5.4.1.16 In combining the Medium value with the Medium susceptibility, the sensitivity of receptors at this viewpoint is considered to be **Medium**.

5.4.2 Magnitude of Change

5.4.2.1 The aviation lights of Caledonia North Site are unlikely to be readily noticeable at 51.8km to the north-east. The aviation lights of the closer range Moray East WTGs were not visible during any of the night time viewpoint photography from the Moray or Aberdeenshire coast at closer range and in excellent visibility conditions.

5.4.2.2 The magnitude of change for Caledonia North Site is considered to be **Negligible**.

5.4.3 Significance of Effect

5.4.3.1 The night time visual effect of Caledonia North Site during operation at this viewpoint, along the coastal edge and from amenity areas with sea views is considered to be **Minor and Not Significant in EIA terms** largely due to the distance to Caledonia North Site. Effects will be adverse, long term and reversible.

5.5 Viewpoint 19 Gardenstown, Harbour Road

5.5.1 Baseline Condition and Sensitivity

5.5.1.1 The viewpoint is representative of the settlement of Gardenstown, its residents and visitors. It is located within Gardenstown Regional Coastal Character Area (RCCA), Cliffs and Rocky Coast – Aberdeenshire Landscape Character Type (LCT) (10) and the locally designated Aberdeenshire Coast Special Landscape Area (SLA). The Crovie Ordnance Survey mapped viewpoint and picnic area is located just along the coast to the east and will gain similar views.

5.5.1.2 The viewpoint is found on Harbour Road as it winds down the steep hill to the harbour. It is taken from an elevated location with open views across the rooftops of the town, harbour and Gamrie Bay. There is column mounted lighting along the harbour as well as street lighting and light emitted from the buildings within the settlement within the wider view. Lit marker buoys and lights on vessels may also be present in this view at times.

5.5.1.3 The town is located on a narrow coastal shelf with the settlement extending up the steep-sided hillside and onto the flat-topped hillside above. The town faces north-west across Gamrie Bay, with the small village of Crovie further to the east having a similar outlook. The houses along the coast are

often orientated the gable end toward the sea to provide some protection from the elements.

- 5.5.1.4 The view looks across a seascape panorama that is framed by More Head to the north-west and Crovie Head to the north-east. It is difficult to discern these features or the Craigandargity Rocks during or close to the hours of darkness.
- 5.5.1.5 Aviation lighting on BOWL, Moray East and Moray West OWFs is theoretically visible along the horizon at distances of 66.9km, 53.4km and 56.9km respectively. It was not possible to observe the Moray East OWF aviation lights during the viewpoint photography, which was carried out in excellent visibility conditions. Therefore, it is assumed that at these ranges aviation lights are not generally visible to the naked eye.
- 5.5.1.6 The aviation lights of the Beatrice Demonstrator WTGs are not theoretically visible.
- 5.5.1.7 At this range from the baseline OWFs the seascape remains an intrinsically dark place in contrast with the close range and wider views across Gardenstown.
- 5.5.1.8 The night time view from Gardenstown is likely to be experienced by some residents, people moving around the routes within the settlement and around harbour area.
- 5.5.1.9 Representative of views obtained by people in their homes. The orientation of the coastal and higher parts of the settlement is such that the view direction (towards the Caledonia North Site) is generally akin to oblique or direct views from the frontages and outdoor spaces of a small number of properties. The susceptibility levels attributed to such views at night are considered to be lower as the seascape is less valued as part of the context of a place and people tend to look out over it less than they do during the day. The susceptibility is considered to be Medium.
- 5.5.1.10 The viewpoint is located within the North Aberdeenshire Coast SLA. There is no mention of darkness qualities or night time influences within the Aberdeenshire Council (2023²) Statement of Importance. There is however reference to wildness qualities due to views out to sea. The Caledonia North Site could affect these through its visibility, however this is moderated by distance. The view out to sea at night may be of some local value to residents. The value is considered to be Medium.
- 5.5.1.11 In combining the Medium value with the Medium susceptibility, the sensitivity of receptors at this viewpoint is considered to be **Medium**.

5.5.2 Magnitude of Change

- 5.5.2.1 The Caledonia North Site aviation lighting is unlikely to be readily noticeable at a minimum of 52.2km to the north-north-west. The aviation

lights of the closer range Moray East WTGs were not visible during any of the night time viewpoint photography from the Moray or Aberdeenshire coast at closer range and in excellent visibility conditions.

- 5.5.2.2 The magnitude of change for Caledonia North Site is considered to be **Negligible**.

5.5.3 Significance of Effect

- 5.5.3.1 The night time visual effect of the Caledonia North Site during operation at this viewpoint and along the coastal edge of Gamrie Bay including at Crovie is considered to be **Minor and Not Significant in EIA terms**. Effects will be adverse, long term and reversible.

5.6 Viewpoint 21 B9031, West of Fraserburgh

5.6.1 Baseline Condition and Sensitivity

- 5.6.1.1 The viewpoint is representative of road-users of the B9031 and of views from the settlement of Fraserburgh. It is located within RCCA Rosehearty to Fraserburgh and Cliffs and Rocky Coast – Aberdeenshire LCT (10).
- 5.6.1.2 The viewpoint is located on the B9031 at the western edge of Fraserburgh, a town located at Kinnaird Head. The historic town which is still one of the most important fishing towns in Scotland and Europe dates back to the 16th century. The harbour is located to the east of the town, and the western end of Fraserburgh Bay. Broadsea Shore Bay is found to the north with residential development to the west and more commercial and industrial development to the east that backs onto the harbour. South of the bay lies the historic core laid out in a grid pattern with streets aligned to the north-south and east-west. Modern development is found to the south and west of the town. Views within the town are inward looking except along the coastal edge.
- 5.6.1.3 The view at the viewpoint inland is across agricultural fields which create a dark foreground to the view out over the sea. To the south street-lighting within the edge of the settlement and around the commercial development is apparent.
- 5.6.1.4 Lighting within the small village of Sandhaven is seen further along the coast to the west.
- 5.6.1.5 The view to the north is across a dark, expansive seascape panorama without a focal point. Lights within the seascape may include those on vessels. There is no potential for views of the Beatrice Demonstrator WTGs, BOWL, Moray East or Moray West OWFs aviation lights as they are concealed by the curvature of the earth largely due to their distance from the viewpoint.

- 5.6.1.6 The viewpoint is not located within and does not look out over any landscape planning designations. Views will be locally valued as views from edge of settlement properties and by road-users of the B9031. The value is considered to be Medium.
- 5.6.1.7 The viewpoint is representative of residents, visitors and road users of the B9031. Although the views from properties are static, which would normally equate to higher levels of susceptibility, views towards the sea and in the direction of the Caledonia North Site are restricted from the edge of Fraserburgh due to the settlement being set back from the coast and the intervening landscape/townscape reducing actual visibility. The susceptibility levels attributed to views at night are considered to be lower as the seascape is less valued as part of the context of a place and people tend to look out over it less than they do during the day. The susceptibility is considered to be Medium.
- 5.6.1.8 In combining the Medium value with the Medium susceptibility, the sensitivity of receptors at this viewpoint is considered to be **Medium**.

5.6.2 Magnitude of Change

- 5.6.2.1 The Caledonia North Site aviation lighting will not be readily noticeable at a minimum of 56.9km to the north-north-west. The WTG lights of the Moray East OWF were not visible during any of the night time viewpoint photography from the Moray or Aberdeenshire coast at closer range and in excellent visibility conditions.
- 5.6.2.2 The magnitude of change for the Caledonia North Site aviation lighting is considered to be **Negligible**.

5.6.3 Significance of Effect

- 5.6.3.1 The night time visual effect of the Caledonia North Site during operation at this viewpoint is considered to be **Minor and Not Significant in EIA terms**. Effects will be adverse, long term and reversible.

5.7 Summary of Night Time Visual Effects

- 5.7.1.1 The effect of the Caledonia North Site at night results from the red, flashing aviation lighting located on the nacelle of turbines on the peripheral turbines of the maximum design scenario layout. Importantly the Applicant has committed to install sensors so that when visibility of the WTGs lights from all sensors is greater than 5km in the hours of darkness the aviation lighting is reduced from 2000cd to 200cd.
- 5.7.1.2 The effect of the Caledonia North Site aviation lighting has been assessed as Not Significant from the representative viewpoints assessed. This is largely due to the long distance and low intensity of the lights at this range

as well as the lit context within which the lights would be seen at the viewpoints. In some instances the fact that the immediate context already has WTGs lit with aviation lighting moderates the magnitude of change ensuring that the effects are not significant. From other viewpoints it tends to be distance coupled with the narrow field of view affected that ensures the effects are Not Significant.

- 5.7.1.3 In general, lighting is a secondary effect of the Caledonia North Site. Where the effects have been assessed as not significant during the day, when the wind turbines are fully visible, they would not have significant effects at night as a result of lighting, when the wind turbines are not visible. Due to the slightly lower levels of sensitivity at night/dusk locations the distance from, and extent of, views affected by the Caledonia North Site aviation lighting may be slightly greater before the threshold for significant effects is triggered.
- 5.7.1.4 The duration of the effect of the lights on receptors is likely to be over a relatively short period, more commonly experienced during evening and morning hours of darkness, around dusk and sunrise. The visual effects of Caledonia North at night are also limited by the activity of receptors at night. Receptors that experience views at night are generally limited to residents of settlements, rural properties and motorists using the road network. Views from within properties are likely to be restricted by the use of window coverings, particularly in winter. Views from routes, beyond the extent of settlements may have lower levels of lighting in their immediate context; however, vehicle headlights and lack of scenic interest tends to reduce the susceptibility of travellers in vehicles at night, reducing their sensitivity to the impact of the aviation lights on views.
- 5.7.1.5 Views from remote rural/coastal locations, beaches, mountains and footpaths, etc. are visited infrequently at night.
- 5.7.1.6 The assessment of night time effects is also based on clear night time viewing conditions. At dusk and sunrise it may be possible to identify the formation of the turbines with the red, flashing aviation lighting, but only in conditions of good and excellent visibility.
- 5.7.1.7 At sunrise it may also be possible, in views from the west, to see the turbines lit and backlit by the rising sun.

6 Night Time Effects on Seascape and Landscape Character

6.1 Introduction

6.1.1.1 NatureScot’s scoping response (see Volume 7, Appendix 3) suggested that the baseline character and assessment of night time effects should also include consideration of effects on landscape and coastal character. This is considered in the following section, in particular where the landform/skyline of inshore islands etc may be perceived at night with lights in the background (i.e., where a perceived character effect may occur as a component of visual effects).

6.1.1.2 Whilst it has been assessed in Section 5 that the effects on the representative viewpoints will be Not Significant these viewpoints are all located within or on the edge of settlements and are therefore influenced by a lit fore and/or middle ground. Areas of landscape and coastal character that may be affected by views of the Caledonia North Site aviation lighting are considered to be areas that do not have lighting as part of their inherent character, particularly where darkness or a sense of perceived wildness are present as inherent characteristics.

6.2 Views Towards Inshore Islands

The only place where views of inshore islands may be affected by the aviation lights of the Caledonia North Site is in views from Orkney as represented by Viewpoint 1, where they may be visible on WTG hubs which may be seen above and around the landform of Muckle Skerry. At a minimum range of 45.2km it is considered that the non-obtrusive nature of the lights would not be sufficient to alter the landscape or coastal character of parts of the Orkney Islands.

6.3 Effects on Seascape and Coastal Character

6.3.1.1 Volume 7B, Appendix 12-2: Seascape, Landscape and Visual Impact Assessment Figures, Figure 12-5: Baseline Lighting NASA VIIRS NIR Light Composite 2023 illustrates the baseline lighting environment within the Study Area. This shows the areas that are relatively dark and those that are relatively light. The areas that are most likely to be affected by the impact of aviation lights are along the coast.

6.3.1.2 The southern parts of the Orkney Islands are shown to have low or no influence by lighting.

6.3.1.3 Within the southern part of the Study area in Moray and Aberdeenshire the only sections of the coast that are not shown to have some degree of

lighting as an inherent aspect of their baseline character are the stretch of coast between approximately Gardenstown and Rosehearty in Aberdeenshire. These sections of coast coincide with the Culbin to Burghead Coast SLA and the North Aberdeenshire Coast SLA respectively.

- 6.3.1.4 Within the Highlands there are long sections of the coast between settlements that have a low influence by lighting. A section to the south-west of the western part of the Study Area is coincidental with the Flow Country and Berriedale Coast SLA whilst locations along the north Highland coast are coincidental with the Dunnet Head and Duncansby Head SLAs.
- 6.3.1.5 Table 6-1 sets out a preliminary assessment of the night time effects on the sections of the coastal landscape where the inherent character is not affected by lighting and may be more sensitive to the effects of the aviation lighting of the Caledonia North Site.
- 6.3.1.6 It has been assessed that there is no potential for significant night time effects on seascape or landscape character. This takes into account the higher value of areas designated as SLAs where they may also be more susceptible to changes that may affect their relative wildness and may be affected by views of development features such as lighting.

Table 6-1: Preliminary assessment of night time effects on seascape and landscape character.

Section of Coast Where Influence by Lighting is Low	Potential for Significant Night Time Effect on Seascape or Landscape Character
Southern coastlines of Orkney	<p>Degree of hub visibility is represented by Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations, Figure 12-1, Viewpoint 1. No of WTGs with aviation lights fitted to hubs will be less. Narrow field of view affected by lights which are unlikely to be noticeable at this range.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>
Between Dunnet Head and Duncansby Head	<p>Degree of hub visibility from high points along these coastlines is represented by Figure 12-2, Viewpoint 2 and Figure 12-3, Viewpoint 3 (Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations). No of WTGs with aviation lights fitted to hubs will be less.</p> <p>Lighting unlikely to be readily noticeable at a range of approximately 53.9km at Dunnet Head. Foreground includes scattered settlement, which is likely to include some light emissions.</p> <p>Flashing aviation lights likely to be visible in clear conditions at a range of 37.7km from the high point at Duncansby Head, however from north and west of the viewpoint Figure 12-20: Hub Aviation Lighting ZTV (Western Study Area) (Volume 7C, Appendix 12-2: Seascape, Landscape and</p>

Section of Coast Where Influence by Lighting is Low	Potential for Significant Night Time Effect on Seascape or Landscape Character
	<p>Visual Impact Assessment Figures) theoretical visibility of the aviation lighting is very limited.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>
<p>Between Duncansby Head and Keiss</p>	<p>Degree of hub visibility from Duncansby Head is represented by Figure 12-3, Viewpoint 3 and degree of hub visibility from Keiss is represented by Figure 12-4, Viewpoint 4 (Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations). No of WTGs with aviation lights fitted to hubs will be less.</p> <p>Flashing aviation lights likely to be visible in clear conditions across a relatively narrow extent of the wide panoramic views available at a minimum range of 37.7km from the high point at Duncansby Head. Would be perceived as part of character in the context of BOWL aviation lighting at slightly closer range of a minimum of 37km and across a wider field of the view.</p> <p>Access to the coastal areas south of Duncansby Head is restricted to the coastal path which is unlikely to be used after dark as it would present health and safety issues. There would therefore be few people present to be able to perceive character change as part of the context. Further south along the coast aviation lighting of BOWL will become more influential due to closer proximity.</p> <p>Further south along the coast scattered settlement at Skirza is likely to have some influence as part of the foreground where light is emitted from properties. Further south along the coast aviation lighting of BOWL will become more influential due to closer proximity.</p> <p>Perceived change to character through further addition of aviation lights by the Caledonia North Site would be incremental rather than a new effect.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>
<p>Between Keiss and Wick</p>	<p>Between Keiss and Wick there is existing lighting influence on character through lights emitted by lighthouses, within and around settlements and industry. Existing aviation lighting, particularly from BOWL is visible at closer range to this coastline and has an existing influence on seascape and landscape character as part of contextual character influence. Change in such influence by introduction of the Caledonia North Site would be limited and incremental.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>
<p>Between Wick and Navidale</p>	<p>Aviation lighting visibility represented by night time visualisations at Figure 12-5 Viewpoint 5 and Figure 12-9 Viewpoint 9 (Volume 7C, Appendix 12-3: Seascape,</p>

Section of Coast Where Influence by Lighting is Low	Potential for Significant Night Time Effect on Seascape or Landscape Character
	<p>Landscape and Visual Impact Assessment Visualisations). Degree of hub visibility from viewpoints along this coastline is represented by Viewpoints 6, 7, 10 and 12 (Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations). No of WTGs with aviation lights fitted to hubs will be less.</p> <p>Character influenced by baseline OWFs (particularly BOWL and Moray West OWFs, which are closest to the coast).</p> <p>Change in such influence by introduction of the Caledonia North Site would be limited and incremental.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>
<p>Between Gardenstown and Roseheartly</p>	<p>Aviation lighting visibility represented by night time visualisation at Figure 12-19 Viewpoint 19 (Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations).</p> <p>Degree of hub visibility from viewpoints along this coastline is represented by Figure 12-20, Viewpoint 20 (Volume 7C, Appendix 12-3: Seascape, Landscape and Visual Impact Assessment Visualisations). No of WTGs with aviation lights fitted to hubs will be less. The Caledonia North Site will introduce views of aviation lights to the sea context which forms part of the character of the seascape and landscape of this coastline.</p> <p>Whilst the character is relatively dark there are light influences from small and large settlements along the coast that also form part of the character influence as part of their context.</p> <p>The flashing aviation lights of the Caledonia North Site are unlikely to be readily noticeable at a minimum range of approximately 52.2-53.7km as represented by the viewpoints noted above. They would be seen across a relatively narrow part of the broad seascape context and would not be obtrusive.</p> <p>No potential for a night time significant effect on seascape or landscape character.</p>

7 References

¹ Moray Offshore Windfarm (West) Limited (2023) 'Lighting and Marking Plan. Revision: 05'

² Aberdeenshire Council (2023) 'Aberdeenshire Council Local Development Plan'. Available at: <https://www.aberdeenshire.gov.uk/planning/plans-and-policies/ldp-2023/> (Accessed 05/09/2024)

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