Technical Appendix 5.1

Landscape and Visual Impact Assessment Methodology

1. Introduction

1.1 This Technical Appendix describes in detail the methodology that has been used to carry out the Landscape and Visual Impact Assessment (LVIA) for the Proposed Development. The LVIA identifies and assesses the effects that the Proposed Development would have on the landscape and visual resource of the 35km radius Study Area.

1.2 This Appendix is structured as follows:

- categories of effects;
- significance of effects;
- assessment of physical landscape effects;
- assessment of effects on landscape character;
- assessment of effects on wild land;
- assessment of effects on views;
- assessment of cumulative effects;
- nature of effects;
- duration and reversibility of effects; and
- visualisation methodology.

2. Categories of Effects

2.1 In this assessment, potential effects on the landscape and visual resource are grouped into five categories:

- **Effects on Physical Elements**: are restricted to the area within the Proposed Development Area and are the direct effects on the existing fabric of the Site, such as the removal of forestry and alteration to ground cover. This category of effects is made up of landscape elements, which are the components of the landscape, such as moorland, that may be directly and physically affected by the Proposed Development.
- **Effects on Landscape Character**: landscape character is the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and the way that this pattern is perceived. Effects on landscape character arise either through the introduction of new elements that physically alter this pattern of elements, or through visibility of the Proposed Development, which may alter the way in which the pattern of elements is perceived. This category of effects is made up of landscape character receptors, which fall into two groups; landscape character types and landscape-related designated areas.
- **Effects on Wild Land Areas**: where it is relevant to include an assessment of effects on Wild Land Areas (WLAs) this is carried out in accordance with NatureScot guidance[1]. A WLA assessment has not been included in this LVIA due to the lack of potential for significant effects on WLAs.
- **Effects on Views**: the assessment of effects on views is an assessment of how the introduction of the Proposed Development would affect views throughout the Study Area (including at night-time). The assessment of effects on views is carried out in three parts:

[1] NATURESCOT (2020) Assessing Impacts on Wild Land Areas Technical Guidance. NatureScot.

- an assessment of the effects that the Proposed Development would have on a series of viewpoints;
- an assessment of the effects that the Proposed Development would have on views from principal visual receptors, which include relevant settlements and routes throughout the Study Area; and
- night-time effects of visible aviation lighting on views.

- **Cumulative Effects**: arise where the Study Areas for two or more wind farms overlap so that both of the wind farms are experienced at proximity where they may have a greater incremental effect, or where wind farms may combine to have a sequential effect.

3. Significance of Effects

3.1 The objective of the assessment is to predict the likely significant effects of the Proposed Development on the landscape and visual resource. The EIA Regulations require that the direct and indirect significant effects of the Proposed Development are identified, described and assessed, and therefore the LVIA effects are assessed to be either significant or not significant. 'Guidelines for Landscape and Visual Impact Assessment: Third Edition' (GLVIA3)[2] also provides guidance on this, noting that (paragraphs 3.32 and 3.33):

"*LVIAs should always distinguish clearly between what are considered to be the significant and non-significant effects…it is not essential to establish a series of thresholds for different levels of significance of landscape and visual effects, provided that it is made clear whether or not they are considered significant*."

3.2 The broad principles used in the assessment of significance of the five categories of effects are the same (other than the assessment of effects on WLAs) and are described below. The detailed methodology for the assessment of significance does, however, vary, and the specific criteria used are described in this Appendix.

3.3 The significance of effects is assessed through a combination of two considerations; the sensitivity of the landscape receptor or view and the magnitude of change that would result from the addition of the Proposed Development.

3.4 Sensitivity is an expression of the ability of a landscape receptor or view to accommodate the Proposed Development. Sensitivity is determined through a combination of the value of the receptor and its susceptibility to the Proposed Development.

3.5 Magnitude of change is an expression of the extent of the effect on landscape receptors and views that would result from the introduction of the Proposed Development. The magnitude of change is assessed in terms of a number of variables, including the size and scale of the impact and the geographical extent of the affected area.

3.6 While this methodology is not reliant on the use of a matrix to arrive at the conclusion of a significant or not significant effect, a matrix is included below (Table 1) to illustrate how combinations of sensitivity and magnitude of change can lead to levels of effects and significant/not significant effects.

[2] Landscape Institute and IEMA (2013). Guidelines for Landscape and Visual Impact Assessment: Third Edition (GLVIA3). Routledge

Table 1: Significance of Effect

		Magnitude of Change					
		High	Medium-High	Medium	Medium-Low	Low	Negligible/ No Change
Sensitivity	High	Major *Significant*	Major *Significant*	Major/ moderate *Significant*	Moderate *Significant or Not Significant*	Moderate/ minor *Not Significant*	Minor *Not Significant*
	Medium-High	Major *Significant*	Major/ moderate *Significant*	Major/ Moderate *Significant*	Moderate *Significant or Not Significant*	Moderate/ minor *Not Significant*	Minor Not *Significant*
	Medium	Major/ moderate *Significant*	Major/ Moderate *Significant*	Moderate *Significant or Not Significant*	Moderate/ minor *Not Significant*	Minor *Not Significant*	Minor *Not Significant*
	Medium-Low	Moderate *Significant or Not Significant*	Moderate *Significant or Not Significant*	Moderate/ minor *Not Significant*	Minor *Not Significant*	Minor *Not Significant*	Negligible *Not Significant*
	Low	Moderate *Significant or Not Significant*	Moderate/ minor *Not Significant*	Minor *Not Significant*	Minor *Not Significant*	Negligible *Not Significant*	Negligible *Not Significant*

3.7 Effects with a level of 'major' or 'major/moderate' are considered to be significant, while effects with a 'moderate' level may be significant or not significant, subject to the assessor's professional judgement and depending on the specific relevant factors that arise at a particular landscape or visual receptor. In accordance with GLVIA3, experienced professional judgement is applied to the assessment of all effects and reasoned justification is presented in respect of the findings of each case. Effects assessed as being 'moderate/minor', 'minor' or 'negligible' are considered to be not significant.

3.8 A significant effect occurs where the Proposed Development would provide one of the defining influences on a landscape element, landscape character receptor or view. A not significant effect occurs where the effect of the Proposed Development is not material, and the baseline characteristics of the landscape element, landscape character receptor, view or visual receptor continue to provide the definitive influences.

3.9 Significant cumulative effects arise where a 'wind farm landscape' is apparent as a result of the addition of the Proposed Development to other existing or proposed wind farms, so that the addition of the Proposed Development would result in wind turbines becoming one of the prevailing or key characteristics.

3.10 It should be noted that if the Proposed Development itself is assessed to have a significant effect, it does not necessarily follow that the cumulative effect would also be significant.

3.11 This assessment assumes clear weather and optimum viewing conditions. This means that effects that are assessed to be significant may be not significant under different, less clear conditions.

4. Assessment of Physical Landscape Effects

4.1 Physical effects are the direct effects on the fabric of the site such as the removal of trees and alteration to ground cover and are restricted to the area of the site. The objective of the assessment of physical effects is to determine which landscape elements would be affected and whether these effects would be significant or not significant. The variables considered in the sensitivity of landscape elements, and the magnitude of change upon them, are described below.

Sensitivity of Landscape Elements

4.2 The sensitivity of a landscape element is an expression of its ability to accommodate the Proposed Development. This is dependent on the value of the landscape element and its susceptibility to the change that would arise from the addition of the Proposed Development.

- The value of a landscape element is a reflection of its importance in the pattern of elements which constitute the landscape character of the area. For example, the value of woodland is likely to be increased if it provides an important component of the local landscape character. If a landscape element is particularly rare - as a remnant of a historic landscape layout for example - its value is likely to be increased.
- The susceptibility of a landscape element is a reflection of the degree to which the element can be restored, replaced or substituted. For example, it may be possible to restore ground cover following the excavation required for the building of turbine foundations, and this would reduce the susceptibility of this element.

4.3 The sensitivity of each receptor is a product of the specific combination of value and susceptibility to the Proposed Development as evaluated by professional judgement. The evaluation of sensitivity is described for each receptor in the assessment, and levels of sensitivity - high, medium or low - are applied. Interim levels of sensitivity – medium-high and medium-low - may also be applied where appropriate for the combination of value and susceptibility.

Magnitude of Change on Landscape Elements

4.4 The magnitude of change on landscape elements is quantifiable and is expressed in terms of the degree to which a landscape element would be removed or altered by the Proposed Development. Definitions of magnitude of change are applied in order that the process of assessment is made clear.

- High where the Proposed Development would result in the complete removal of a landscape element or substantial alteration to a key landscape element;
- Medium where the Proposed Development would result in the removal of a notable part of a landscape element or a notable alteration to a key landscape element;
- Low where the Proposed Development would result in the removal of a minor part of a landscape element or a minor alteration to a key landscape element; and

- Negligible where the alteration to the landscape element is barely discernible.

4.5 There may also be intermediate levels of magnitude of change – medium-high, medium-low and low-negligible - where the change falls between two of the definitions.

Significance of Effects on Landscape Elements

4.6 The significance of the effect on landscape elements is dependent on all of the factors considered in the sensitivity of the receptor and the magnitude of change upon it. A significant effect would occur where the degree of removal or alteration of the landscape element is such that the form of the element would be redefined. If the landscape element is of a high sensitivity, a significant effect can occur with a relatively limited degree of removal or alteration. A not significant effect would occur where the form of the landscape element is not redefined as a result of the Proposed Development. If the landscape element is of lower sensitivity, it may undergo a higher level of removal or alteration yet remain as a not significant effect.

5. Assessment of Effects on Landscape Character

5.1 Landscape character is the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and the way that this pattern is perceived. Effects on landscape character arise through the introduction of new elements that physically alter this pattern of elements, the removal of characterising elements, or through visibility of the Proposed Development, which may alter the way in which the pattern of elements is perceived. This category of effects is made up of landscape character receptors, which fall into two groups; landscape character types and designated areas.

5.2 The objective of the assessment of effects on landscape character is to determine which landscape character receptors would be affected by the Proposed Development, and whether these effects would be significant or not significant. The assessment of effects on landscape character involves an evaluation of sensitivity and magnitude of change, and the resultant assessment of significance.

Sensitivity of Landscape Character Receptors

5.3 The sensitivity of a landscape character receptor is an expression of its ability to accommodate the Proposed Development as part of its own character or as part of the visual setting or context to the character receptor. This is dependent on the value of the landscape receptor and its susceptibility to change.

Value of Landscape Character Receptors

5.4 The value of a landscape character receptor is a reflection of the value that is attached to that landscape. The landscape value is classified as high, medium or low, and the basis for this evaluation is determined through the application of professional judgement to the following factors.

- Landscape designations: a receptor that lies within a recognised landscape-related planning designation will generally have an increased value, depending on the proportion of the receptor that is covered and the level of importance of the designation

(international, national, regional or local). It is important to note that the absence of designations does not preclude local resource value, as an undesignated landscape character receptor may be important as a resource in the local or immediate environment, particularly when experienced in comparison with other nearby landscapes;

- Landscape quality: the quality of a landscape character receptor is a reflection of its attributes, such as scenic quality, sense of place, rarity and representativeness and the extent to which these attributes have remained intact. A landscape with consistent, intact and well-defined, distinctive attributes is generally considered to be of higher quality and, in turn, higher value, than a landscape where the introduction of inappropriate elements has detracted from its inherent attributes; and
- Landscape experience: the experience of the landscape character receptor can add to its value and relates to a number of factors including the perceptual responses it evokes, the cultural associations that may exist in literature or history, or the iconic status of the landscape in its own right, the recreational value of the landscape for outdoor pursuits, and the contribution of other values relating to the nature conservation or archaeology of the area.

Susceptibility to Change of Landscape Character Receptors

5.5 The susceptibility of a landscape character receptor to change is a reflection of its ability to accommodate the changes that would occur as a result of the addition of the Proposed Development. The assessment of the susceptibility of the landscape receptor to change is classified as high, medium or low, as determined through the application of professional judgement to the following factors.

- The specific nature of the Proposed Development: the susceptibility of landscape receptors is specific to the change arising from the particular development that is proposed, including its individual components and features, and its size, scale, location, context and characteristics;
- Landscape character: the key characteristics of the existing landscape character of the receptor are considered in the evaluation of susceptibility as they determine the degree to which the receptor may accommodate the influence of the Proposed Development. For example, a landscape that is of a particularly wild and remote character may have a high susceptibility to the influence of the Proposed Development due to the contrast that it would have with the landscape, whereas a developed landscape where built elements and structures are already part of the landscape character may have a lower susceptibility. However, there are instances when the quality of a landscape may have been degraded to an extent whereby it is considered to be in a fragile state and therefore a degraded landscape may have a higher susceptibility to the Proposed Development; and
- Landscape association: the extent to which the Proposed Development would influence the character of the landscape receptors across the Study Area also relates to the associations that exist between the landscape within which the Proposed Development is located and the landscape receptor from which the Proposed Development is being experienced. This association would be most important where the landscapes are directly related; for example, if the Proposed Development is located in an upland landscape that has a strong enclosing influence on an adjacent valley landscape. Elsewhere, the association may be less important; for example,

where the Proposed Development lies inland of a coastal landscape that has its main focus outwards over the sea.

Levels of Sensitivity

5.6 The sensitivity of each receptor is a product of the specific combination of value and susceptibility to the Proposed Development as evaluated by professional judgement. The sensitivity of the landscape receptor is evaluated as high, medium or low. Interim levels of sensitivity – medium-high and medium-low - may also be applied where appropriate.

Magnitude of Change on Landscape Character Receptors

5.7 The magnitude of change that the Proposed Development would have on landscape receptors is assessed in terms of the size or scale of the change, the geographical extent of the area influenced and its duration and reversibility. The key elements of the Proposed Development that would influence the level of change on landscape character are the movement, form, material, colour and scale of the turbines, although infrastructure is also considered.

Size or Scale

5.8 This criterion relates to the size or scale of change to the landscape that would arise as a result of the addition of the Proposed Development, based on the following factors.

- The degree to which the pattern of elements that makes up the landscape character would be altered by the Proposed Development, through removal or addition of elements in the landscape. The magnitude of change would generally be higher if key features that make up the landscape character are extensively removed or altered, and if many new components are added to the landscape.
- The extent to which the Proposed Development would change - physically or perceptually - the characteristics that may be important in the creation of the distinctive character of the landscape. This may include the scale of the landform, its relative simplicity or irregularity, the nature of the landscape context, the grain or orientation of the landscape, the degree to which the receptor is influenced by external features and the juxtaposition of the Proposed Development with these key characteristics.
- The distance between the landscape character receptor and the Proposed Development. Generally, the greater the distance, the lower the scale of change as the Proposed Development would constitute a less apparent influence on the landscape character.
- The extent of the Proposed Development that would be seen from the landscape receptor. Visibility of the Proposed Development may range from one turbine blade tip to all of the turbines, and generally the greater the extent of the Proposed Development that can be seen, the greater the change.

Geographical Extent

5.9 The geographic area over which the landscape effects would be experienced is also evaluated. The extent of the effect would vary depending on the specific nature of the Proposed Development and is principally a reflection of the extent of the landscape receptor that would be affected by visibility of the Proposed Development.

Duration and Reversibility

5.10 The duration and reversibility of landscape effects are based on the period over which the Proposed Development is likely to exist and the extent to which the Proposed Development would be removed and its effects reversed at the end of that period. Duration and reversibility are not always incorporated into the overall magnitude of change, and may be stated separately.

Levels of Magnitude of Change

5.11 An evaluation of the magnitude of change on landscape receptors is made by combining the considerations of size or scale of change, geographical extent and, where relevant, duration and reversibility. The magnitude of change is assessed as high, medium, low or negligible according to the following definitions.

- High, where the Proposed Development would result in a major alteration to the baseline character of the landscape, providing a prevailing influence and/or introducing elements that are substantially uncharacteristic in the receiving landscape.
- Medium, where the Proposed Development would result in a moderate alteration to the baseline character of the landscape, providing a readily apparent influence and/or introducing elements that may be prominent but are not necessarily uncharacteristic in the receiving landscape.
- Low, where the Proposed Development would result in a minor alteration to the baseline character of the landscape, providing a slightly apparent influence and/or introducing elements that are characteristic in the receiving landscape.
- Negligible, where the alteration to landscape character is barely discernible.

5.12 There may also be intermediate levels of magnitude of change – medium-high, medium-low or low-negligible - where the change falls between two of the definitions.

Significance of Effects on Landscape Character Receptors

5.13 The significance of the effect on each landscape character receptor is dependent on the factors that are considered in the sensitivity of the receptor and the magnitude of change upon it. These factors are combined using professional judgement to arrive at an overall assessment as to whether the Proposed Development would have a significant or not significant effect on the receptor. The matrix shown in Table 1 above is also used to inform the threshold of significance when combining sensitivity and magnitude of change.

5.14 A significant effect would occur where the combination of the variables results in the Proposed Development becoming one of the defining influences on the receptor. A not significant effect would occur where the effect of the Proposed Development is not definitive, and the landscape character of the receptor continues to be characterised principally by its baseline characteristics. In this instance, a not significant effect would indicate that the Proposed Development may have an influence on the landscape character of the receptor, but this influence would not be a defining one.

6. Assessment of Effects on Wild Land

6.1 Where it is relevant, an assessment of effects on wild land is carried out in accordance with NatureScot guidance[3], which provides a methodology. A WLA assessment has not been included in this LVIA due to the lack of potential for significant effects on WLAs.

7. Assessment of Effects on Views

7.1 The assessment of effects on views is an assessment of how the introduction of the Proposed Development would affect views throughout the Study Area (including at night-time). The assessment of effects on views is carried out in three parts:

- an assessment of the effects that the Proposed Development would have on a series of viewpoints;
- an assessment of the effects that the Proposed Development would have on views from principal visual receptors, which include relevant settlements and routes throughout the Study Area; and
- night-time effects of visible aviation lighting on views.

7.2 The objective of the assessment of effects on visual receptors is to determine what the likely effects of the Proposed Development would be on views across the Study Area, and whether these effects would be significant or not significant. The assessment of effects on views involves an evaluation of sensitivity and magnitude of change, and the resultant assessment of significance.

Sensitivity of Viewpoints and Visual Receptors

7.3 The sensitivity of views and visual receptors is determined by a combination of the value of the view and the susceptibility of the viewer or visual receptor to the Proposed Development.

Value of Views

7.4 The value of a view is a reflection of the recognition and the importance attached formally through identification as a viewpoint on mapping, by signposting or through planning designation; or informally through the value which society attaches to the view. The value of a view is classified as high, medium or low, based on the following factors.

- Formal recognition: the value of views can be formally recognised through their identification on maps as formal viewpoints, are signposted and provide facilities to facilitate the enjoyment of the view such as parking, seating and interpretation boards. Specific views may be afforded protection in local planning policy, where they are recognised as valued views. Specific views can also be cited as being of importance in relation to landscape or heritage planning designations; for example the value of a view may be increased if it presents an important vista from a designed landscape or lies within or overlooks a designated area such as a National Scenic Area (NSA), which implies a greater value to the visible landscape.
- Informal recognition: views that are well-known at a local level or have particular scenic qualities can have an increased value, even if there is no formal recognition or

[3] NATURESCOT (2020) Assessing Impacts on Wild Land Areas Technical Guidance. NatureScot.

designation. Views or viewpoints are sometimes informally recognised through references in art or literature and this can also add to their value.

- Scenic quality: the value of the view is a reflection of the scenic qualities gained in the view. This relates to the content and composition of the landscape, whereby certain patterns and features can increase the scenic quality while others may reduce the scenic quality.

Susceptibility to Change to Change of Views and Visual Receptors

7.5 Susceptibility relates to the nature of the viewer and how susceptible they are to the potential effects of the Proposed Development. This is determined by the occupation of the viewer and the extent to which their attention or interest is likely to be focussed on the view, and the visual amenity that they experience at the viewpoint.

7.6 The most common groups of viewers considered in the visual assessment include residents, people taking part in outdoor recreation such walkers or cyclists, road-users, and workers. Viewers whose attention is focussed on the landscape – walkers or cyclists on recognised walking or cycling routes, for example - are likely to have a high susceptibility, as would residents of properties that gain views of the Proposed Development. Viewers travelling in cars or on trains would tend to have a medium susceptibility as their view is transient and moving. However, people travelling in cars on a national tourist route can have a heightened susceptibility as they are likely to have an awareness of the surrounding landscape. The least sensitive viewers, with a low susceptibility, are usually people at their place of work as they are often less sensitive to changes in the view, although this depends on the nature of their work.

7.7 Susceptibility is also dependent upon the baseline visual amenity that is experienced at the viewpoint, including consideration of the principal visual characteristics (e.g. those features that define the view) and the viewer's experience of these characteristics.

Levels of Sensitivity

7.8 The sensitivity of each receptor is a product of the specific combination of value and susceptibility to the Proposed Development as evaluated by professional judgement. The sensitivity of the view or visual receptor is evaluated as high, medium or low by combining the value and susceptibility to change. Interim levels of sensitivity – medium-high and medium-low - may also be applied where appropriate for the combination of value and susceptibility.

Magnitude of Change on Views

7.9 The magnitude of change on visual receptors and views is assessed in terms of the size or scale of the change, the geographical extent of the visual effect and, in some situations, its duration and reversibility. The key elements of the Proposed Development that would influence the level of change on views are the movement, form, material, colour and scale of the turbines, although infrastructure is also considered.

Size or Scale

7.10 This criterion relates to the size or scale of change to the view that would arise as a result of the Proposed Development, based on the following factors.

- The scale of the change in the view, with respect to the loss or addition of features in the view and changes in its composition;
- The distance between the visual receptor and the Proposed Development. Generally, the greater the distance, the lower the magnitude of change as the Proposed Development would constitute a smaller-scale component of the view;
- The proportion of the Proposed Development that would be seen. Visibility may range from one blade tip to all of the turbines. Generally, the more of the Proposed Development that can be seen, the higher the magnitude of change;
- The field of view available and the proportion of the view that is affected by the Proposed Development. Generally, the more of a view that is affected, the higher the magnitude of change would be. If the Proposed Development extends across the whole of the open part of the outlook, the magnitude of change would generally be higher. Conversely, if the Proposed Development covers just a part of an open, expansive and wide view, the magnitude of change is likely to be reduced as the Proposed Development would not affect the whole open part of the outlook;
- The scale and character of the context within which the Proposed Development would be seen and the degree of contrast or integration of any new features with existing landscape elements, in terms of scale, form, mass, line, height, colour and texture. The scale of the landform and the patterns of the landscape, the existing land use and vegetation cover, and the degree and type of development and settlement seen in the view will be relevant; and
- The consistency of the appearance of the Proposed Development. If the Proposed Development appears in a similar setting and form, and from a similar angle each time it is apparent, it would appear as a single, familiar site, and this can reduce the magnitude of change. If, on the other hand, it appears from a different angle and is seen in a different form and setting, the magnitude of change is likely to be higher.

Geographical Extent

7.11 The extent of effects on views is based on the following factors.

- The extent of a receptor (a road, footpath or settlement, for example) from which the Proposed Development may be seen. If the Proposed Development is visible from extensive areas, the overall magnitude of change is likely to be higher than if it is visible from a limited part of a receptor.
- The extent to which the change would affect views and whether this is unique to a particular viewpoint or if similar visual changes occur over a wider area represented by the viewpoint.
- The position of the Proposed Development in relation to the principal orientation of the view and activity of the receptor. If the Proposed Development is seen in a specific, directional vista, the magnitude of change would generally be greater than if it were seen in a glimpsed view at an oblique angle of view.

Duration and Reversibility

7.12 The duration and reversibility of effects on views are based on the period over which the Proposed Development is likely to exist and the extent to which it would be removed and its effects reversed at the end of that period. Duration and reversibility are not always incorporated into the overall magnitude of change, and may be stated separately.

Levels of Magnitude of Change

7.13 The magnitude of change on views and visual receptors is evaluated by combining the considerations of size or scale of change, geographical extent and, where relevant, duration and reversibility. The magnitude of change is assessed as high, medium, low or negligible according to the following definitions:

- High, where the Proposed Development would result in a major alteration to the baseline view, providing a prevailing influence and/or introducing elements that are substantially uncharacteristic in the view;
- Medium, where the Proposed Development would result in a moderate alteration to the baseline view, providing a readily apparent influence and/or introducing elements that may be prominent but are not necessarily uncharacteristic in the view;
- Low, where the Proposed Development would result in a minor alteration to the baseline view, providing a slightly apparent influence and/or introducing elements that are characteristic in the view; and
- Negligible, where the alteration to the view is barely discernible.

7.14 There may also be intermediate levels of magnitude of change – medium-high, medium-low and low-negligible - where the change falls between two of the definitions.

Significance of Effects on Views

7.15 The significance of the effect on each view or visual receptor is dependent on the factors that are considered in the sensitivity of the view or receptor and the magnitude of change upon it. These factors are combined using professional judgement to arrive at an overall assessment as to whether the Proposed Development would have a significant or not significant effect on the view or visual receptor. The matrix shown in Table 1 above is also used to inform the threshold of significance when combining sensitivity and magnitude of change.

7.16 A significant effect would occur where the combination of the variables results in the Proposed Development becoming one of the defining influences on the view or visual receptor. A not significant effect would occur where the effect of the Proposed Development is not definitive, and the view continues to be characterised principally by its baseline characteristics. In this instance, a not significant effect would indicate that the Proposed Development may have an influence on the view, but this influence would not be a defining one.

Assessing Night-Time Effects on Views

7.17 The nature of the daytime and night-time visual effects arising from wind farms differs considerably, as during daylight hours visibility of the turbines gives rise to effects that are different to the effects of lighting at night. As a result, the assessment of sensitivity and

magnitude of change for night-time effects is carried out using different criteria/definitions, as those that are included in this appendix for daytime effects are not all appropriate or relevant to a night-time assessment.

Night-Time Effects

7.18 The Civil Aviation Authority (CAA) requires that 'en-route obstacles' at or above 150m above ground level are lit with visible lighting to assist their detection by aircraft. As the turbines in the Proposed Development are more than 150m to tip height there is a requirement for the turbines to display medium intensity 'steady' red aviation lights (emitting 2,000 candela (cd)) at night. These would be fitted to the nacelles of some of the Proposed Development turbines. Low intensity mid-tower lights would not be required. All nacelles would also be fitted with infra-red lighting for Ministry of Defence (MoD) purposes; this is not visible to the human eye and is therefore not relevant to the visual impact assessment.

7.19 It is proposed that visibility sensors are installed on the turbines to measure prevailing atmospheric conditions and visibility range. Should atmospheric conditions (for example an absence of low cloud cover, rain, mist, haze or fog) mean that visibility is greater than 5km from the Proposed Development, CAA policy permits lights to operate in a lower intensity mode of 200cd, this being a minimum of 10% of their capable illumination. If visibility is restricted to 5km or less by weather conditions, the lights would operate at their full 2,000cd. In effect, the CAA policy allows 'dimming' of the lights depending on meteorological conditions, which has the effect of reducing the perceived intensity of light in clear conditions. This dimming has been illustrated in the night-time visualisations, which illustrate 2,000cd and 200cd intensity at each night-time assessment viewpoint.

7.20 Visible aviation obstruction warning lights are designed to emit light horizontally in 360 degrees and offer a reduced light intensity above and below the horizontal. This in line with ICAO Annex 14[4] which requires the intensity of emitted light to be most intense at 0° (horizontal) and lower below the horizontal. Whilst aviation lighting manufacturers must meet the minimum requirements, their products may vary in relation to recommended limits set out in ICAO standards and the lighting characteristics of different light fittings may therefore vary outside the minimum requirements stipulated by ICAO. The medium intensity obstruction lights will conform to the ICAO specification as set out in Annex 14.

7.21 Data from the testing of a CEL medium intensity obstruction light has been used in this assessment to provide an example of the reduction in lighting intensity above and below the horizontal. Whilst the precise model of light to be used for the Proposed Development is not known at this time, it is considered that such an example provides a useful understanding of the potential visual mitigation of the intensity of the lights for receptors viewing them from areas of the study area that are below the horizontal. The CEL data has been used to define the amount of light emitted at particular angles above and below the horizontal for use in the assessment, see Table 2 below.

Table 2: Intensity of Turbine Light based on the CEL Obstruction Light

Vertical angle	Turbine Lighting Intensity (Intensity of Turbine Light shown in Candelas (cd))

[4] See Table 6.3 of ICAO Annex 14 to the Convention on International Civil Aviation - Volume I Aerodrome Design and Operations (ICAO, Eighth Edition). (2018).

	2000cd scenario	200cd scenario
0° to 2°	2200/2500 cd	220/250 cd
0° to -1	2200 to 980 cd	220 to 98 cd
-1° to -2°	980 to 420 cd	98 to 42 cd
-2° to -3°	420 to 220 cd	42 to 22 cd
-3° to -4°	220 to 170 cd	22 to 17 cd
Below -4°	<170 cd	<17 cd

7.22 On the basis of the CAA requirements, therefore, it is evident that the intensity of the visible lights of the Proposed Development will be dependent on the clarity of atmospheric visibility and the degree of negative / positive vertical angle of view from the light to the receptor. It should also be noted that the definitions in Table 5.2 do not take account of the potential for some of the emitted light spilling onto the passing blades which would be visible at all negative angles, albeit as a less intense and diffuse reflected glow.

7.23 It is evident that the actual effect/perception of visible aviation lights at the Proposed Development would be dependent on a range of factors, including the model and intensity of lights used, the clarity of atmospheric visibility and the degree of negative vertical angle of view from the light to the receptor. For this visual assessment, a worst-case approach is applied which considers the effects of both 2,000cd lights and 200cd lights during periods of clear visibility. It should be noted however, that as the required medium intensity lights need only be used to their optimum output or intensity during periods of poor visibility, that 2,000cd lighting actually represents an unrealistic worst-case position, as it is unlikely to be experienced at that maximum illumination level. Similarly, 200cd is unlikely to be experienced by observers at locations lower than the turbine nacelle heights due to the reduction in light intensity at negative elevation angles that can be achieved through selection of specific lights with embedded mitigation.

7.24 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."

7.25 Current advice as to how lighting is represented in visualisations is provided in NatureScot guidance.

"The visualisation should use photographs taken in low light conditions, preferably when other artificial lighting (such as street lights and lights on buildings) are on, to show how the wind farm lighting will look compared to the existing baseline at night. It is only necessary to illustrate visible lighting, not infrared or other alternative lighting requirements.…We have found that approximately 30 minutes after sunset provides a reasonable balance between visibility of the landform and the apparent brightness of artificial lights, as both should be visible in the image."

7.26 This approach has been followed for the night-time visualisations that are included in this LVIA, which capture photographs at the four viewpoints and create photomontage images based on OPEN's experience gained from examining light fittings in situ across Scotland. The night-time photography has been taken in low light conditions, when other artificial lighting (such as streetlights and lights on buildings) is on, to show how the Proposed Development lighting would look in comparison with the existing night-time baseline.

7.27 It should be noted that the night-time photography has been taken in periods of good visibility that is greater than 5km. As a result, the night-time photomontage representations of the 2,000 cd lights are an unrealistic over-representation of the likely visibility of visible aviation lighting. This is because visibility on the site (and probably at the viewpoint itself) is very likely to be considerably poorer (<5km) when the lights are operating at that intensity.

7.28 Where existing lights are shown in the photographs, they 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 has been defined as 'the way the lens renders out-of-focus points of light', and this phenomenon is difficult to avoid when taking photographs of light in a view. Where the aviation lights of the Proposed Development have been added to the night-time views, this bokeh effect has been emulated, based on the calibration OPEN has experienced in its research.

7.29 The movement of turbine blades passing in front of the aviation lights on each rotation causes a flickering effect when the lights are activated. The turbines shown in the night-time visualisations have been positioned so that their blades face away from the viewpoint and all of the lights are therefore visible, representing a worst-case impression. 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.

7.30 The visual assessment of turbine lighting is intended to determine the likely effects that the Proposed Development would have on the visual resource e.g., it is an assessment of the effects of visible aviation lighting on views experienced by people at night. The assessment of visible lighting is a visual effect because the lighting would not be activated at times when there is a clear perception of landscape character, during daylight hours, and would not affect the physical pattern of elements that constitutes landscape character. The assessment of effects of visible aviation lighting therefore focusses on viewpoints and visual receptors and does not apply to landscape character assessment.

Night-Time Sensitivity

7.31 The factors that are considered in the sensitivity of views and visual receptors in daytime are not all applicable at night-time. For example, viewpoints located within a Dark Sky Park (where one clear objective to is observe the night sky) may have a higher night-time value, as may residential views that are valued by their occupants at night-time. In other situations, the value of views may decrease at night when the detail of the view, or of elements that add value to it within a landscape, cannot readily be discerned. The popularity, reason for use and level of use of a viewpoint during the day may also be completely different to its use at night.

7.32 The susceptibility of people experiencing night-time outdoors will depend on the degree to which their perception is affected by existing baseline lighting. In brightly lit areas, or when travelling on roads from where sequential experience of lighting within and outwith the vehicle may be experienced, the susceptibility of receptors is likely to be lower than from within areas where the baseline contains no or limited existing lighting.

Night-Time Magnitude of Change

7.33 The definitions used to describe the magnitude of change that may arise at night as a consequence of the appearance of visible aviation lights are set out below.

- High, where the addition of aviation lighting results in large scale of change/large intrusion to the existing night-time baseline conditions/darkness in the view, due to a full and/or close-range view of visible aviation lighting and/or a high degree of contrast/low degree of integration with level of baseline lighting in the view. Results in obtrusive light which compromises or diminishes the view of the night sky.
- Medium, where the addition of aviation lighting results in moderate scale of change/moderate intrusion to the existing night-time baseline conditions/darkness in the view, due to partial and/or middle-distance view of visible aviation lighting and/or moderate level of contrast/integration with level of baseline lighting in the view. Results in light that may partially compromise or diminish the view of the night sky, but which is not considered obtrusive.
- Low, where the addition of aviation lighting results in small scale of change/minor intrusion to the existing night-time baseline conditions/darkness in the view, due to limited and/or distant view of aviation lighting and/or low degree of contrast/high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.
- Negligible, where the addition of aviation lighting results in a largely indiscernible change/negligible intrusion to the existing night-time baseline conditions/darkness in the view, due to glimpsed view of lighting and/or slight degree of contrast/very high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.

7.34 The term ‘obtrusive’ is defined as “*noticeable or prominent in an incongruous or intrusive way”.*

7.35 Intermediate levels of effect may be identified between these levels where, on the application of professional judgement, a level of change lies between two definitions.

8. Assessment of Cumulative Effects

Introduction

8.1 The outcome of the cumulative assessment is the identification of any significant cumulative effects that may arise from the addition of the Proposed Development to the cumulative situation, in accordance with NatureScot guidance[5], which states that cumulative assessment

[5] NATURESCOT (2021). Guidance - Assessing the cumulative landscape and visual impact of onshore wind energy developments

should "*focus on the likely significant impacts and those which are likely to influence the outcome of the consenting process*".

8.2 The objective of the assessment is to: "…*describe, visually represent and assess the ways in which a proposed wind farm would have additional impacts when considered with other consented or proposed wind farms. It should identify the significant cumulative impacts arising from the proposed wind farm*" (NatureScot, 2021).

8.3 Guidance (NatureScot, 2021) goes on to say "*The aim of the cumulative assessment is to identify the magnitude of additional cumulative change which would be brought about by the proposed development when considered in conjunction with other wind farms*".

8.4 In some situations, it is also relevant to consider the "*combined effects of all the past, present and future proposals together with the new project*" as noted in paragraph 7.18 of GLVIA3. This type of cumulative effect is described in GLVIA3 (paragraph 7.17) as "*incremental change as a result of successive individual developments such that the combined landscape and/or visual effect is significant even though the individual effects may not be*". While the assessment in the LVIA only assesses the additional landscape and visual effects of the Proposed Development, conclusions are drawn by the author in relation to these combined effects.

8.5 The cumulative assessment considers four scenarios of wind farm development.

- The operational and under-construction scenario includes wind farms that are operational or under construction (e.g. wind farms where there is certainty as to the presence and influence of these sites).
- The consented scenario includes consented (not yet constructed) wind farms as well as operational and under construction wind farms (e.g. wind farms where there is some degree of certainty as to their presence and influence).
- Application stage wind farm scenarios are considered on a case-by-case basis as there is no certainty as to whether or not they will be present in the future. This scenario also includes wind farms that are operational and under-construction, and consented.
- Scoping stage wind farm scenarios are considered on a case-by-case basis as there is no certainty as to whether or not they will be present in the future. This scenario also includes wind farms that are operational and under-construction, and consented.

Types of Cumulative Effect

8.6 The aim of the cumulative assessment is to identify the additional changes which would be brought about by the Proposed Development when considered in conjunction with other wind farms. In accordance with guidance (NatureScot, 2021), the LVIA for each receptor considered assesses the effect arising from the addition of the Proposed Development to the cumulative situation, and not the overall effect of multiple wind farms. Adjacent developments may complement one another, or may be discordant with one another, and it is the increased or reduced level of significance of effects which arises as a result of this change that is assessed in the cumulative assessment.

8.7 However, in considering the detailed cumulative effects described within the LVIA, a broad statement relating to the combined cumulative effect of multiple wind farms in the area has also been provided in the LVIA summary.

Cumulative Landscape Effects

8.8 7.4.3 The cumulative development of wind farms within a particular area may build up to create different types of landscape. Significant cumulative landscape effects may arise where a 'Landscape with wind farms' is created, as a result of the addition of the Proposed Development to other existing or proposed wind farms, which results in wind turbines becoming sufficiently prolific that they become a prevailing or key landscape and visual characteristic.

8.9 The significance of the cumulative landscape effect from the addition of the Proposed Development reflects the intensification of wind farms within the landscape, which is assessed as follows:

- The Proposed Development forms a separate isolated feature from other wind farms within the landscape, too infrequent and of insufficient influence to be perceived as a characteristic of the area. The cumulative landscape effect of the Proposed Development is unlikely to be significant.
- The addition of the Proposed Development results in wind farms forming a key characteristic of the landscape, exerting sufficient presence as to establish or increase the extent of a 'landscape with wind farms', but not of sufficient dominance to be a defining characteristic of the area. The cumulative landscape effect of the Proposed Development may be significant or not significant, depending on the sensitivity of the receptor, magnitude of the change and specific effects arising from the Proposed Development.
- The addition of the Proposed Development results in wind farms forming the prevailing characteristic of the landscape, seeming to define the landscape as a 'wind farm landscape' character type. The cumulative landscape effect of the Proposed Development is likely to be significant.

8.10 These effects can occur at varying scales, for example, effecting a local character type, or at a regional level, which is assessed as part of the geographic extent assessment in the LVIA.

Cumulative Visual Effects

8.11 Cumulative visual effects consist of combined and sequential effects:

- Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be 'in combination', where several wind farms are within the observer's main angle of view at the same time, or 'in succession', where the observer has to turn to see the various wind farms. The cumulative visual effect of the Proposed Development may be significant or not significant depending on factors influencing the cumulative magnitude of change, such as the degree of integration and consistency of image with other wind farms in combined views; and the position of the development relative to other wind farms and the landscape context in successive views.
- Sequential visibility occurs when the observer has to move to another viewpoint to see different developments. Sequential effects are assessed along regularly used routes such as major roads, railway lines and footpaths. The occurrence of sequential effects range from 'frequently sequential' (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to 'occasionally sequential' (long time lapses between appearances, because the

observer is moving slowly and/or there are large distances between the viewpoints). The cumulative visual effect of the Proposed Development is more likely to be significant when frequently sequential.

8.12 The methodology for the assessment of cumulative landscape and visual effects involves the undertaking of a baseline study of the existing and potential future wind farm/other relevant development influence, an evaluation of sensitivity, magnitude of change and the resulting significance of cumulative effects.

Cumulative Magnitude of Change

8.13 The cumulative magnitude of change is an expression of the degree to which landscape character receptors and visual receptors/views would be changed by the addition of the Proposed Development to wind farm developments that are already operational, consented or at application stage. The cumulative magnitude of change is assessed based on a number of criteria, as follows.

- The location of the Proposed Development in relation to other wind farm developments. If the Proposed Development is seen in a part of the view or setting to a landscape receptor that is not affected by other wind farm development, this would generally increase the cumulative magnitude of change as it would extend wind farm influence into an area that is currently unaffected. Conversely, if the Proposed Development is seen in the context of other sites, the cumulative magnitude of change may be lower as wind farm influence is not being extended to otherwise undeveloped parts of the outlook or setting.
- The extent of the developed skyline. If the Proposed Development would add notably to the developed skyline in a view, the cumulative magnitude of change would tend to be higher as skyline development can have a particular influence on both views and landscape receptors.
- The number and scale of wind farm developments seen simultaneously or sequentially. Generally, the greater the number of clearly separate developments that are visible, the higher the cumulative magnitude of change would be. The addition of the Proposed Development to a view or landscape where a number of smaller developments are apparent would usually have a higher cumulative magnitude of change than one or two large developments as this can lead to the impression of a less co-ordinated or strategic approach.
- The scale comparison between wind farm developments. If the Proposed Development is of a similar scale to other visible wind farms, particularly those seen in closest proximity to it, the cumulative magnitude of change would generally be lower as it would have more integration with the other sites and would be less apparent as an addition to the cumulative situation.
- The consistency of image of the Proposed Development in relation to other wind farm developments. The cumulative magnitude of change of the Proposed Development is likely to be lower if its turbine height, arrangement and layout design are broadly similar to other wind farms in the landscape, as they are more likely to appear as relatively simple and logical components of the landscape.
- The context in which the wind farm developments are seen. If developments are seen in a similar landscape context, the cumulative magnitude of change is likely to be lower due to visual integration and cohesion between the sites. If developments are seen in

a variety of different landscape settings, this can lead to a perception that wind farm development is unplanned and un-coordinated, affecting a wide range of landscape characters and blurring the distinction between them.

- The magnitude of change of the Proposed Development as assessed in the main assessment. The lower this is assessed to be, the lower the cumulative magnitude of change is likely to be. Where the Proposed Development itself is assessed to have a negligible magnitude of change on a view or receptor there would not be a cumulative effect as the contribution of the Proposed Development would equate to the 'no change' situation.

8.14 Definitions of cumulative magnitude of change are applied in order that the process of assessment is made clear.

- High: where the addition of the Proposed Development to other wind energy developments in the landscape or view would result in a major incremental change, loss or addition to the cumulative wind farm situation.
- Medium: where the addition of the Proposed Development to other wind energy developments in the landscape or view would result in a moderate incremental change to the cumulative wind farm situation.
- Low: where the addition of the Proposed Development to other wind energy developments in the landscape or view would result in a minor change to the cumulative situation.
- Negligible: where the addition of the Proposed Development to other wind energy developments in the landscape or view would result in a minor incremental change, loss or addition to the cumulative situation.
- None: where the addition of the Proposed Development to other wind energy developments in the landscape or view would have no change to the cumulative windfarm situation and its addition equates to a 'no change' situation.

8.15 There may also be intermediate levels of cumulative magnitude of change – medium-high, medium-low and low-negligible - where the change falls between two of the definitions.

Significance of Cumulative Effects

8.16 The objective of the cumulative assessment is to determine whether any effects that the Proposed Development would have on landscape receptors and visual receptors, when seen or perceived in combination with other existing and proposed sites, would be significant or not significant. Significant cumulative landscape and visual effects arise where the addition of the proposed wind turbines or other similar/large scale development to a specific baseline, leads to windfarms becoming a prevailing landscape and visual characteristic of a receptor that is sensitive to such change. Cumulative effects may evolve as follows:

- A small scale, single windfarm would often be perceived as a new or 'one-off' landscape feature or landmark within the landscape. Except at a local site level, it usually cannot change the overall existing landscape character, or become a new characteristic element of a landscape.
- With the addition of further windfarm development, windfarms can become a characteristic element of the landscape, as they appear as landscape elements or components that are repeated. Providing there was sufficient 'space' or undeveloped landscape/skyline between each windfarm, or the overlapping of several windfarms

was not too dense; the Proposed Developments or other similar/large scale developments would appear as a series of developments within the landscape and would not necessarily become the dominant or defining characteristic of the landscape nor have significant cumulative effects.

- The next stage would be to consider larger commercial windfarms/developments and/or an increase in the number of windfarms/developments within an area that either overlap or coalesce and/or 'join-up' along the skyline. The effect is to create a landscape where the windfarm element is a prevailing characteristic of the landscape. The result would be to materially change the existing landscape character of a landscape type, or the landscape in a view and resulting in a significant cumulative effect. A landscape characterised by windfarm development may already exist as part of the baseline landscape context.

8.17 In relation to the significance of cumulative landscape effects, GLVIA3 notes (paragraph 7.28) that *"the most significant cumulative landscape effects are likely to be those that would give rise to changes in the landscape character of the study area of such an extent as to have major effects on its key characteristics and even, in some cases, to transform it into a different landscape type. This may be the case where the project being considered itself tips the balance through its additional effects."*

8.18 GLVIA3 (paragraph 7.38) goes on to state the following in relation to the significance of cumulative visual effects:

"*Higher levels of significance may arise from cumulative visual effects related to:*

- *developments that are in closer proximity to the main project and are clearly visible together in views from the selected viewpoints;*
- *developments that are highly inter-visible, with overlapping ZTVs – even though the individual developments may be at some distance from the main project and from individual viewpoints, and when viewed individually not particularly significant, the overall combined cumulative effect on a viewer at a particular viewpoint may be more significant."*

8.19 It should be noted that if the Proposed Development itself is assessed to have a significant effect, it does not necessarily follow that the cumulative effect would also be significant.

8.20 Less extensive, but nevertheless significant cumulative landscape and visual effects may also arise as a result of the addition of the Proposed Development where it results in a landscape or view becoming defined by the presence of more than one wind farm or similar/large scale development, so that other patterns and components are no longer definitive, or where the Proposed Development contrasts with the scale or design of an existing or Proposed Development. Higher levels of significance may arise from cumulative landscape and visual effects related to the Proposed Development being in close proximity to other wind farms when they are clearly visible together in views, however provided that the Proposed Development is designed to achieve a high level of visual integration, with few notable visual differences between wind farms, these effects may not necessarily be significant. In particular, the effects of a wind farm extension are often less likely to be significant, where the effect is concentrated, providing that the design of the wind farms are compatible, and that the capability of the landscape to accommodate the change is not exceeded.

8.21 The capability of the landscape or view to accommodate the change proposed may be assessed as being exceeded where the landscape or visual receptor becomes defined by wind farm development, or if the Proposed Development extends across landscape character types or clear visual/topographic thresholds in a view. More substantial cumulative effects may result from wind farms that have some geographical separation, but remain highly inter-visible, potentially resulting in extending effects into new areas, such as an increased presence of wind farm development on a skyline, or the creation of multiple, separate wind farm defined landscapes.

8.22 In accordance with guidance (NatureScot, 2021), the LVIA for each receptor considered assesses the effect arising from the addition of the Proposed Development to the cumulative situation, and not the overall effect of multiple windfarms. However, in considering the detailed cumulative effects described within the LVIA, a broad statement relating to the combined cumulative effect of multiple windfarms in the area has also been provided in the LVIA summary.

9. Nature of Effects

9.1 The nature of effects refers to whether the landscape and/or visual effect of the Proposed Development is positive or negative (herein referred to as 'beneficial' and 'adverse'). Guidance provided by the Landscape Institute on the nature of effect in GLVIA3 states that ‘in the LVIA, thought must be given to whether the likely significant landscape and visual effects are judged to be positive (beneficial) or negative (adverse) in their consequences for landscape or for views and visual amenity’, but it does not provide guidance as to how that may be established in practice. The nature of effect is therefore one that requires interpretation and, where applied, this involves reasoned professional opinion. In relation to many forms of development, the LVIA will identify 'beneficial' and 'adverse' effects by assessing these under the term 'Nature of Effect'. The landscape and visual effects of wind farms are difficult to categorise in either of these brackets as, unlike other disciplines, there are no definitive criteria by which the effects of wind farms can be measured as being categorically 'beneficial' or 'adverse'. In some disciplines, such as noise or ecology, it is possible to quantify the effect of a wind farm in numeric terms, by objectively identifying or quantifying the proportion of a receptor that is affected by the Proposed Development and assessing the nature of that effect in justifiable terms. However, this is not the case in relation to landscape and visual effects where the approach combines quantitative and qualitative assessment.

9.2 Generally, in the development of 'new' wind farms, a precautionary approach is adopted, which assumes that significant landscape and visual effects will be weighed on the adverse side of the planning balance. Unless it is stated otherwise, the effects considered in this assessment are considered to be adverse. Beneficial or neutral effects may, however, arise in certain situations and are stated in the assessment where relevant, based on the following definitions:

9.3 Beneficial effects contribute to the landscape and visual resource through the enhancement of desirable characteristics or the introduction of new, beneficial attributes. The Proposed Development contributes to the landscape by virtue of good design, even if it contrasts with

the existing character. The removal of undesirable existing elements or characteristics can also be beneficial, as can their replacement with more appropriate components.

9.4 Neutral effects occur where the Proposed Development fits with the existing landscape character or visual amenity. The Proposed Development neither contributes to nor detracts from the landscape and visual resource and can be accommodated with neither beneficial or adverse effects, or where the effects are so limited that the change is hardly noticeable. A change to the landscape and visual resource is not considered to be adverse simply because it constitutes an alteration to the existing situation.

9.5 Adverse effects are those that detract from the landscape character or quality of visual attributes experienced, through the introduction of elements that contrast, in a detrimental way, with the existing characteristics of the landscape and visual resource, or through the removal of elements that are key in its characterisation.

10. Duration and Reversibility

10.1 The effects of the Proposed Development are of variable duration, and are assessed as short-term or long-term, and permanent or temporary/reversible. It is anticipated that the operational life of the Proposed Development would be 40 years. The wind turbines, substation and Site access tracks would be apparent during this time, and these effects are considered to be long-term.

10.2 Other infrastructure and operations such as the construction processes and plant (including tall cranes for turbine erection) and construction compounds would be apparent only during the initial construction period of the Proposed Development and are considered to be short-term effects. Borrow pit excavation would also be short-term as borrow pits would be restored at the end of the construction process.

10.3 The reversibility of effects is variable. The most apparent effects on the landscape and visual resource, which arise from the presence of the wind turbines, are temporary/ reversible as the turbines would be removed on decommissioning. The effects of the tall cranes and heavy machinery used during the construction and decommissioning periods are also temporary.

10.4 The access tracks may be left in situ at decommissioning at the request of the landowners, or they would otherwise be covered with topsoil and left to naturally regenerate. Turbine foundations (except for the top 1m which would be removed) and underground cabling would be left in-situ below ground with no residual landscape and visual effects.

10.5 In order to avoid repetition, the duration and reversibility of effects are not reiterated throughout the assessment.

11. Visualisation Representations

11.1 Zones of Theoretical Visibility (ZTVs) and visualisations, including wirelines and photomontages, are graphical images produced to assist and illustrate the LVIA and the cumulative assessment. Viewpoint photography and photomontages have been produced in accordance with the NatureScot guidance on ‘Visual Representation of Wind Farms - Version 2.2’ (SNH, 2017), THC’s ‘Visualisation Standards for Wind Energy Developments’ (THC,

2016), GLVIA 3 (Landscape Institute and IEMA, 2013) and the Landscape Institute Technical Guidance Note on Visual Representation of Development Proposals (Landscape Institute, 2019).

Zone of Theoretical Visibility (ZTV)

11.2 The ZTVs have been generated using Geographic Information System (GIS) software to demonstrate the number of turbines that may theoretically be seen from any point in the study area. The ZTVs, show the number of turbines (blade tips) that are theoretically visible around the study area (based on the maximum blade tip heights as described in the EIA Report). The Hub Height ZTVs, show the number of turbine hubs theoretically visible in the study area (hub heights are derived from the turbine rotor and hub height dimensions listed in the EIA Report). When used in conjunction with the Blade Tip ZTV, the Hub Height ZTV provides an indication of the degree to which the wind turbines may be visible.

11.3 There are limitations in this theoretical production, and these should be considered in the interpretation and use of the ZTVs:

- unless stated otherwise, the ZTVs illustrate the 'bare ground' situation, and do not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility;
- the ZTVs are based on theoretical visibility from 2 m above ground level;
- the ZTVs are based on a 5 m data grid (OS Terrain 5), therefore relatively small changes in elevation may not be accounted for;
- the Blade Tip ZTV does not indicate the decrease in visibility that occurs with increased distance from the Proposed Development. The nature of what is visible from 3 km away would differ markedly from what is visible from 10 km away, although both are indicated on the Blade Tip ZTV has having the same level of visibility; and
- there is a wide range of variation within the visibility shown on the ZTV, for example, an area shown on the Blade Tip ZTV as having visibility of large numbers of turbines may gain views of the smallest extremity of blade tips, or of many full turbines. This can make a considerable difference in the effects of the Proposed Development on that area. The Hub Height ZTV should be used in conjunction with the Blade Tip ZTV to provide an indication of the degree to which the wind turbines are visible.

11.4 These limitations mean that while the ZTV is used as a starting point in the assessment, providing an indication of where the Proposed Development would theoretically be visible, the information drawn from the ZTV is checked in the field, to ensure that the assessment conclusions represent the visibility of the Proposed Development reasonably accurately.

11.5 The Horizontal Angle ZTV shows the horizontal field of view (in degrees) that may be affected by views of the turbines.

Methodology for baseline photography

11.6 The following photographic information is recorded in line with NatureScot and THC guidance:

- Date, time, weather conditions and visual range;
- GPS recorded 12 figure grid reference accurate to ~5-10 m;
- GPS recorded Above Ordnance Datum (AOD) height data;
- Use of a fixed 50 mm focal length lens is confirmed;

- Horizontal field of view (in degrees); and
- Bearing to target site.

11.7 The photographs used to produce the photomontages are taken at the agreed locations using Canon EOS 5D and 6D Digital SLR cameras, with a fixed lens and a full-frame (35 mm negative size) complementary metal oxide semiconductor (CMOS) sensor. The photographs are taken on a tripod with a pano-head at a height of approximately 1.5 m above ground.

11.8 GLVIA3 para 8.22 states – 'In preparing photomontages, weather conditions shown in the photographs should (with justification provided for the choice) be either: representative of those generally prevailing in the area; or taken in good visibility, seeking to represent a maximum visibility scenario when the development may be highly visible'.

11.9 In preparing photomontages for the LVIA, photographs have been taken in favourable weather conditions. Weather conditions shown in the photographs for all viewpoints have, where possible, been taken during periods of 'very good' or 'excellent' visibility conditions seeking to represent a maximum visibility scenario when the developments may be highly visible.

11.10 The night-time photography has been captured in low light conditions, when other artificial lighting (such as street lights and lights on buildings) is on, to show how the wind farm lighting would look compared to the existing baseline at night. In terms of how lighting is captured in visualisations, the main change in the latest version of the NatureScot guidance 'Visual Representation of Wind Farms' (Version 2.2, February 2017) is in paragraphs 174-177, which states: *'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'… 'We have found that approximately 30 minutes after sunset provides a reasonable balance between visibility of the landform and the apparent brightness of artificial lights, as both should be visible in the image.'* NatureScot also recognises the challenges of capturing nighttime photography and accept that some post photographic manipulation of images to provide a good representation is acceptable.

11.11 The photographs and other graphic material such as wirelines and photomontages used in the assessment are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what would be apparent to the human eye. A photomontage is a visualisation which superimposes an image of the Proposed Development upon a photograph or series of photographs. Photomontage is a widespread and popular visualisation technique, which allows changes in views and visual amenity to be illustrated and assessed, within known views of the 'real' landscape.

11.12 Visualisations that are produced to The Highland Council 'Visualisation Standards for Wind Energy Developments' (2016), (hereafter referred to as the THC visualisation guidance) provides the following statements of limitation:

- For panoramic images and photomontages, Section 3 of the THC visualisation guidance, Images for Landscape Assessment, request the following statement be included – '*The images contained on this page and the following page are not representative of scale and distance from the actual viewpoint and show the wind farm development in its wider landscape context only*'.

- For single frame images and photomontages, Section 4 of the THC visualisation guidance, Images for Visual Impact Assessment, request the following statement be included - *'when viewed at a comfortable arm's length (approx. 500mm), this printed image is representative of our detailed central vision, but is not representative of scale and distance.'*

11.13 NatureScot provides the following information on the limitations of visualisations that are produced according to the NatureScot guidance 'Visual Representation of Windfarms' (February 2017): *'Visualisations of wind farms have a number of limitations which you should be aware of when using them to form a judgement on a wind farm proposal. These include:*

- *a visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image;*
- *the images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate;*
- *a static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;*
- *the viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations;*
- *to form the best impression of the impacts of the wind farm proposal these images are best viewed at the viewpoint location shown;*
- *the images must be printed at the right size to be viewed properly (260mm by 820mm); and*
- *you should hold the images flat at a comfortable arm's length. If viewing these images on a wall or board at an exhibition, you should stand at arm's length from the image presented to gain the best impression.'*

11.14 To create the baseline panorama, the frames are individually cylindrically projected and then digitally joined to create a fully cylindrically projected panorama using Adobe Photoshop or PTGui software. This process avoids the wide-angle effect that would result should these frames be arranged in a perspective projection, whereby the image is not faceted to allow for the cylindrical nature of the full 360-degree Horizontal Field of View (HFOV) but appears essentially as a flat plane. Tonal alterations are made using Adobe software to create an even range of tones across the photographs once joined.

11.15 The photographs are also joined to create planar projection panoramas using PTGui software. These are used in the creation of the 53.5-degree field of view NatureScot photomontages and the 65.5-degree THC photomontages.

11.16 Wireline representations that illustrate the Proposed Development model set within a computer-generated image of the landform are used in the assessment to predict the theoretical appearance of the turbines. These are produced with Resoft WindFarm software and are based on OS terrain 5 terrain model. There are limitations in the accuracy of DTM data so that landform may not be picked up precisely and may result in turbines being more or less visible than is shown, however, the use of OS terrain 5 minimises these limitations. Where descriptions within the assessment identify the numbers of turbines visible this refers to the illustrations generated and therefore the reality may differ to a degree from these impressions.

11.17 Photomontages have been produced for the majority of views, again using ReSoft WindFarm software, to provide a more realistic image of the appearance of the Proposed Development. In most views these include the introduction of the turbines only as these are the elements

that create the greatest change in views and are likely to be most visible from the surrounding area. Where there is notable visibility of site infrastructure and where practical, this is shown in the photomontages and is generated using a combination of 3D software such as Topos, Visual Nature Studio, Sketchup and 3D Studio Max.

11.18 The baseline photographs and cumulative wireline visualisations shown for each viewpoint cover a 90-degree HFOV (or in some cases, up to 360-degree), which accords with NatureScot guidance. These are cylindrically projected images and should be viewed flat at a comfortable arm's length.

11.19 In the wirelines, the turbines are shown with the central turbines facing the viewer directly, with the full rotor diameter visible at its tallest extent. In the photomontages, the turbine rotors are shown with a random appearance with the central turbines facing the viewer directly. In the night-time photomontages, lights are shown as visible and without obstruction from turbine blades.

11.20 The photographs and other graphic material such as wirelines and photomontages used in this assessment are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what would be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.

11.21 The 53.5-degree field of view NatureScot photomontages and the 65.5-degree THC photomontages are prepared using a planar projected image and should also be viewed flat at a comfortable arm's length. These planar photomontage views do not always include a view of key existing windfarms in the view, and it is important therefore that the NatureScot 90 degree baseline panoramas provided are reviewed alongside these visualisations so that these existing windfarms are properly taken into account.

Night-time visualisations

11.22 Night-time visualisations are produced from key viewpoints, to visually represent visible aviation lighting at night. The lighting intensity shown will be both at 2,000 and 200 candela for the aviation lighting.

11.23 Night-time visualisations are produced using a combination of using Resoft's WindFarm software's aviation module software for positioning of the lights, 3D modelling software that can simulate lighting conditions, referencing existing lighting imagery and atmospheric conditions from the baseline photographs and professional judgement using photoshop.

11.24 The appearance of the lights in the night-time photomontages emulates how lights appear in the other parts of the baseline photographs. A light shown in a photograph tends to have a slight 'halo' (or bokeh) around it due to the way a camera lens renders out-of-focus points of light. This is not the way lights are seen in reality, as they tend to be much more defined as point sources. However, the proposed lighting will be shown in this way for consistency with the lights in the baseline photographs.