Windburn Wind Farm Limited

Windburn Wind Farm EIA Report

Technical Appendix 7.1: LVIA and Visualisation Methodology

Report
Prepared by LUC
April 2025

Windburn Wind Farm Limited

Windburn Wind Farm EIA Report
Technical Appendix 7.1: LVIA and Visualisation Methodology

Version	Status	Prepared	Checked	Approved	Date
1.	Final	LUC	LUC	LUC	11.04.2025

Bristol
Cardiff
Edinburgh
Glasgow
London
Manchester
Sheffield

landuse.co.uk

Land Use Consultants Ltd
Registered in England
Registered number 2549296
Registered office:
250 Waterloo Road
London SE1 8RD

100% recycled paper

Chapter 1
LVIA Methodology

Introduction

TA7.1.1 This appendix sets out the methodology used for Windburn Wind Farm (hereafter referred to as 'the proposed development') Landscape and Visual Impact Assessment (LVIA) and associated cumulative assessment contained in **Chapter 7: LVIA**, Volume 2 of the Environmental Impact Assessment Report (EIA Report).

TA7.1.2 The methodology for the production of accompanying visualisations was based on current good practice guidance as set out by NatureScot[1] unless stated otherwise. Detailed information about the approach to taking viewpoint photography, and Zone of Theoretical Visibility (ZTV) and visualisation production is provided at the end of this appendix.

TA7.1.3 Landscape and visual assessments are separate, although linked, processes. LVIA therefore considers the likely effects of a proposed development on:

- Landscape as a resource in its own right (caused by changes to the constituent elements of the landscape, its specific aesthetic or perceptual qualities and the character of the landscape); and
- Views and visual amenity as experienced by people (caused by changes in the appearance of the landscape).

TA7.1.4 The primary LVIA deals with landscape and visual effects separately against the current baseline. It is followed by an assessment of cumulative landscape and visual effects, which considers the effects against potential future baseline scenarios, where relevant.

Guidance

TA7.1.5 This methodology was developed by Chartered Landscape Architects (Chartered Members of the Landscape Institute (CMLI)) at Land Use Consultants Ltd (LUC), who have extensive experience in the assessment of landscape and visual effects arising from wind energy developments.

TA7.1.6 The methodology was developed primarily in accordance with the principles contained within the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)[2]. NatureScot cumulative guidance[3] also informs the approach to the assessment of cumulative landscape and visual effects in relation to onshore wind energy development. Other relevant guidance is listed in **Chapter 7.**

Scope of Assessment

TA7.1.7 LVIA considers physical changes to the landscape as well as changes in landscape character. It also considers changes to areas designated for their scenic or landscape qualities, and the visual impacts of a proposed development as perceived by people from routes, settlements and viewpoints.

TA7.1.8 All potentially significant landscape and visual effects (including cumulative effects) are examined, including those relating to construction and operation.

---

[1] Scottish Natural Heritage (2017) Visual Representation of Wind Farms Guidance, Version 2.2
[2] The Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, Routledge
[3] NatureScot (2021) Guidance: assessing the cumulative landscape and visual impact of onshore wind energy developments

TA7.1.9 Where it is judged that significant effects are unlikely to occur, the assessment of likely effects on some receptors is 'scoped out'.

Assessment Methodology

Study Area

TA7.1.10 The study area for LVIA is determined by the nature and scale of the development proposed and the nature of the study area (e.g. complex topography or extensive tree cover leading to visually enclosed areas may limit the extent of likely significant effects). A 40km radius study, in line with NatureScot guidance[4], was defined for this assessment. Where likely significant effects are anticipated to be localised, the assessment focusses on smaller study areas within 40km as appropriate.

Methodological Overview

TA7.1.11 The key steps in the methodology for assessing landscape and visual effects are as follows:

- The study area is defined, and the area over which the development would potentially be visible is established through the creation of an initial ZTV plan[5];
- The landscape of the study area is analysed, and landscape receptors identified, informed by desk and field-survey;
- The visual baseline is recorded in terms of the different receptors (groups of people) who may experience views of the development (informed by the initial ZTV) and the nature of their existing views and visual amenity;
- Potential assessment viewpoints are selected, as advocated by GLVIA3, to represent a range of different receptors and views, in consultation with statutory consultees:
  - *"**Representative viewpoints**, selected to represent the experience of different types of visual receptor, where larger numbers of viewpoints cannot all be included individually and where the significant effects are unlikely to differ – for example, certain points may be chosen to represent the views of users of particular public footpaths and bridleways;*
  - ***Specific viewpoints**, chosen because they are key and sometimes promoted viewpoints within the landscape, including for example specific local visitor attractions, viewpoints in areas of particularly noteworthy visual and/or recreational amenity such as landscapes with statutory landscape designations, or viewpoints with particular cultural landscape associations; and*
  - ***Illustrative viewpoints**, chosen specifically to demonstrate a particular effect or specific issues, which might, for example, be the restricted visibility at certain locations." (GLVIA3, Para 6.19, Page 109).*
- Likely significant effects on both the landscape as a resource and visual receptors are identified; and
- The level (and significance) of landscape and visual effects are judged with reference to the **nature of the receptor** (commonly described as the sensitivity of the receptor), which considers both susceptibility and value, and the **nature of the effect** (commonly described as the magnitude of change), which considers a combination of judgements including scale, geographical extent, duration and reversibility.

Direction of Effects

TA7.1.12 As required by the EIA Regulations[6], the assessment identifies the direction of effect as either being beneficial, adverse (also referred to as positive or negative) or neutral.

[4] Scottish Natural Heritage (2017) Visual Representation of Wind Farms Guidance, Version 2.2
[5] A bare ground ZTV indicates areas from where a development is theoretically visible, but does not account for screening from vegetation and/or buildings.
[6] Scottish Government (2017) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)

TA7.1.13 The direction of landscape, visual and cumulative effects (**beneficial**, **adverse** or **neutral**) is determined in relation to the degree to which the proposal fits with the existing landscape character or views, and the contribution to the landscape or views that the proposed development makes, even if it is in contrast to the existing character of the landscape or views.

TA7.1.14 With regard to wind energy development, whilst there is a broad spectrum of response from the strongly positive to the strongly negative, an assessment is required to take an objective approach. Therefore, to cover the 'maximum/worst case situation, likely landscape and visual effects (including cumulative effects) relating to commercial scale wind farms are generally assumed to be adverse (negative).

Method for Assessing Landscape Effects

TA7.1.15 As outlined in GLVIA3 "*An assessment of landscape effects deals with the effects of change and development on landscape as a resource*" (GLVIA3, Para 5.1, Page 70). Changes may affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

TA7.1.16 An assessment of landscape effects requires consideration of the nature of landscape receptors (sensitivity of the receptor) and the nature of the effect on those receptors (magnitude of change). GLVIA3 states that the nature of landscape receptors should be assessed in terms of the susceptibility of the receptor to the type of change proposed, and the value attached to the receptor. The nature of the effect on each landscape receptor should be assessed in terms of scale of effect, geographical extent, duration and reversibility.

TA7.1.17 These aspects are considered together to form a judgement regarding the overall significance of landscape effects (GLVIA3, Figure 5.1 Page 71). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Significance of Landscape Effects

TA7.1.18 The introduction of a development could affect the elements which make up the landscape, the aesthetic or perceptual aspects of the landscape or its distinctive character.

TA7.1.19 Landscape receptors are the constituent elements of the landscape, its specific aesthetic or perceptual qualities and the character of the landscape in different areas (GLVIA3, Para. 3.21, Page 36).

TA7.1.20 The sensitivity of landscape receptors should be assessed in terms of the susceptibility of the receptor to the type of change or development proposed, and the value attached to the landscape. The magnitude of change should be assessed in terms of the scale, geographical extent, duration and reversibility of the effect.

TA7.1.21 These aspects are considered together, to form a judgement regarding the overall significance of landscape effect (GLVIA3, Figure 5.1 Page 71). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Sensitivity of Landscape Receptors

TA7.1.22 The sensitivity of a landscape receptor to change is defined as **high**, **medium** or **low** and is based on weighing up professional judgements regarding susceptibility and value, as set out in the table below.

Table 7.1.1: Sensitivity of Landscape Receptors

	Higher		Lower
Susceptibility	Attributes that make up the character of the landscape offer very limited opportunities for the accommodation of change without key characteristics being fundamentally altered by wind energy development, leading to a different landscape character.	↔	Attributes that make up the character of the landscape are resilient to being changed by wind energy development.

	Higher		Lower
Value	Landscapes with high scenic quality, high conservation interest, recreational value, important cultural associations or a high degree of rarity. Areas or features designated at a national level e.g. National Parks or National Scenic Areas or key features of these with national policy level protection.	↔	Landscape of poor condition and intactness, limited aesthetic qualities, or of character that is widespread.

TA7.1.23 There may be a complex relationship between the value attached to a landscape and the susceptibility of the landscape to a specific change. Therefore, the rationale for judgements on the sensitivity of landscape receptors needs to be clearly set out for each receptor. Further information on the criteria is provided below. It should be noted that whilst landscape designations at an international or national level are likely to be accorded the highest value, it does not necessarily follow that such landscapes all have a high susceptibility to all types of change, and conversely, undesignated landscapes may also have high value and susceptibility to change (GLVIA3, Page 90).

Susceptibility of Landscape Receptors

TA7.1.24 Susceptibility is defined by GLVIA3 as *"the ability of the landscape receptor (whether it be the overall character or quality/condition of a particular type or area, or an individual element and/or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies"* (GLVIA3 paragraph 5.40).

TA7.1.25 A series of criteria are used to evaluate the susceptibility of Landscape Character Types (LCT) to wind energy development as set out in the table below. These criteria or aspects are drawn from a range of published sources relating to wind farm development, including SNH's Siting and Designing Windfarms in the Landscape[7] and GLVIA3.

Table 7.1.2: Landscape Susceptibility Criteria

	Aspects Indicating Reduced Susceptibility to Wind Energy Development		Aspects Indicating Greater Susceptibility to Wind Energy Development
Scale	Large scale	↔	Small scale
Landform	Absence of strong topographical variety, featureless, convex or flat	↔	Presence of strong topographical variety or distinctive landform features
Landscape pattern and complexity	Simple Regular or uniform	↔	Complex Rugged and irregular
Settlement and man-made influence	Presence of contemporary structures e.g. utility, infrastructure or industrial elements	↔	Absence of modern development
Skylines	Non-prominent /screened skylines Presence of existing modern man-made features	↔	Distinctive, undeveloped skylines Skylines that are highly visible over large areas or exert a large influence on landscape character Skylines with important historic landmarks

[7] Scottish Natural Heritage (2017) Siting and Designing Windfarms in the Landscape, Version 3a

	Aspects Indicating Reduced Susceptibility to Wind Energy Development		Aspects Indicating Greater Susceptibility to Wind Energy Development
Inter-visibility with adjacent landscapes	Little inter-visibility with adjacent sensitive landscapes or viewpoints	↔	Strong inter-visibility with sensitive landscapes Forms an important part of a view from sensitive viewpoints
Perceptual aspects	Close to visible or audible signs of human activity and development	↔	Remote from visible or audible signs of human activity and development

TA7.1.26 Landscape susceptibility is described as being **high**, **medium** or **low**.

Value of Landscape Receptors

TA7.1.27 The European Landscape Convention advocates that all landscape is of value, whether it is the subject of defined landscape designation or not, "*The landscape is important as a component of the environment and of people's surroundings in both town and country and whether it is ordinary landscape or outstanding landscape*" (Explanatory Report to the European Landscape Convention, Page 6). The value of a landscape receptor is recognised as being a key contributing factor to the sensitivity of landscape receptors.

TA7.1.28 The value of landscape receptors is determined with reference to:

- Review of relevant designations and the level of policy importance that they signify (such as landscapes designated at international, national or local level); and/or
- Application of criteria that indicate value (such as scenic quality, rarity, recreational value, representativeness, conservation interests, perceptual aspects and artistic associations) as described in GLVIA3, paragraphs 5.44-5.47; and/or
- Aspects relating to landscape character and "*the value of individual contributors to landscape character, especially the key characteristics, which may include individual elements of the landscape, particular landscape features, notable aesthetic, perceptual or experiential qualities, and combinations of these contributors.*" (GLVIA3, Para 5.44, Page 89)

TA7.1.29 Internationally and nationally designated landscapes would generally indicate landscape of higher value whereas those without formal designation (such as a widespread or common landscape type without high scenic quality) are likely to be of lower value, bearing in mind that all landscapes are valued at some level. There is however variation across both designated and undesignated areas, and so judgements regarding value are also informed by fieldwork.

TA7.1.30 Landscape value is described as being **high**, **medium** or **low**.

TA7.1.31 Published landscape capacity or sensitivity studies[8] (where they exist) are reviewed to help inform the evaluation of sensitivity, in addition to desk-based research, fieldwork undertaken across the study area and professional judgement. This review includes an evaluation as to the relevance of the publication to the assessment being undertaken (e.g. consideration of the purpose and scope of the published studies and whether they have become out of date).

Magnitude of Landscape Change

TA7.1.32 The overall judgement of magnitude of landscape change is based on combining professional judgements on scale, geographical extent, duration and reversibility. Further information on the criteria is provided below.

[8] The Clackmannanshire Council (2015) Clackmannanshire Local Development Plan, Supplementary Guidance 2, Onshore Wind Energy, David Tyldesley And Associates (2010) Perth and Kinross Council Landscape Study to Inform Planning for Wind Energy, Final Report and Stirling Council (2015) Stirling Landscape Sensitivity and Capacity Study for Wind Energy Development, Update January 2015 were used to inform the evaluation of sensitivity of landscape character types.

Scale of Change

TA7.1.33 For landscape elements/features this depends on the extent of existing landscape elements that would be lost or changed, the proportion of the total extent that this represents, and the contribution of that element to the character of the landscape.

TA7.1.34 In terms of landscape character, this reflects the degree to which the character of the landscape would change as a result of removal or addition of landscape components, and how the changes would affect key characteristics.

TA7.1.35 The scale of the effect is described as being **large**, **medium**, **small**, or **barely perceptible**.

Geographical Extent of Effect

TA7.1.36 The geographical extent over which the landscape effect would arise is described as being **large** (scale of the landscape character type, or widespread, affecting several landscape types or character areas), **medium** (more immediate surroundings) or **small** (site level).

Duration of Effect

TA7.1.37 GLVIA3 states that "*Duration can usually be simply judged on a scale such as short term, medium term or long term*" (GLVIA3, Page 91). For the purposes of the assessment, duration is often determined in relation to the phases of the proposed development, as follows:

- **Short-term** effects are those that occur during construction, and may extend into the early part of the operational phase, e.g. construction activities, generally lasting 0-5 years;
- **Medium-term** effects are those that occur during part of the operational phase, generally lasting 5-10 years; and
- **Long-term** effects are those which occur throughout the operational phase (in this instance 30 years), e.g. presence of turbines, or are permanent effects which continue after the operational phase, generally lasting over 10 years.

TA7.1.38 Duration is also a relevant consideration for effects which are intermittent (for example lighting).

Reversibility of Effect

TA7.1.39 In accordance with the principles contained within GLVIA3, reversibility is reported as **reversible**, **partially reversible** or **irreversible** (i.e. permanent), and is related to whether the change can be reversed at the end of the phase of development under consideration (i.e. at the end of construction or at the end of the operational lifespan of the development).

TA7.1.40 Judgements on the magnitude of landscape change are recorded as **high**, **medium**, **low** or **barely perceptible** and are guided by the table below.

Table 7.1.3: Magnitude of Landscape Change

	Higher		Lower
Scale	Extensive loss of landscape features and/or elements, and/or change in, or loss of key landscape characteristics, and/or creation of new key landscape characteristics	↔	Limited loss of landscape features and/or elements, and/or change in or loss of some secondary landscape characteristics
Geographical Extent	Change in landscape features and/or character extending considerably beyond the immediate site and potentially affecting multiple landscape character types/areas	↔	Change in landscape features and/or character contained within or local to the immediate site and affecting only a small part of the landscape character type/area

	Higher		Lower
Duration	Changes experienced for a longer period e.g. 10 years or more Continuous	↔	Changes experienced for a shorter period e.g. up to 5 years Intermittent or occasional
Reversibility	Change to features, elements or character which cannot be undone or are only partly reversible after a long period	↔	A temporary landscape change which is largely reversible following the completion of construction, or decommissioning of the development

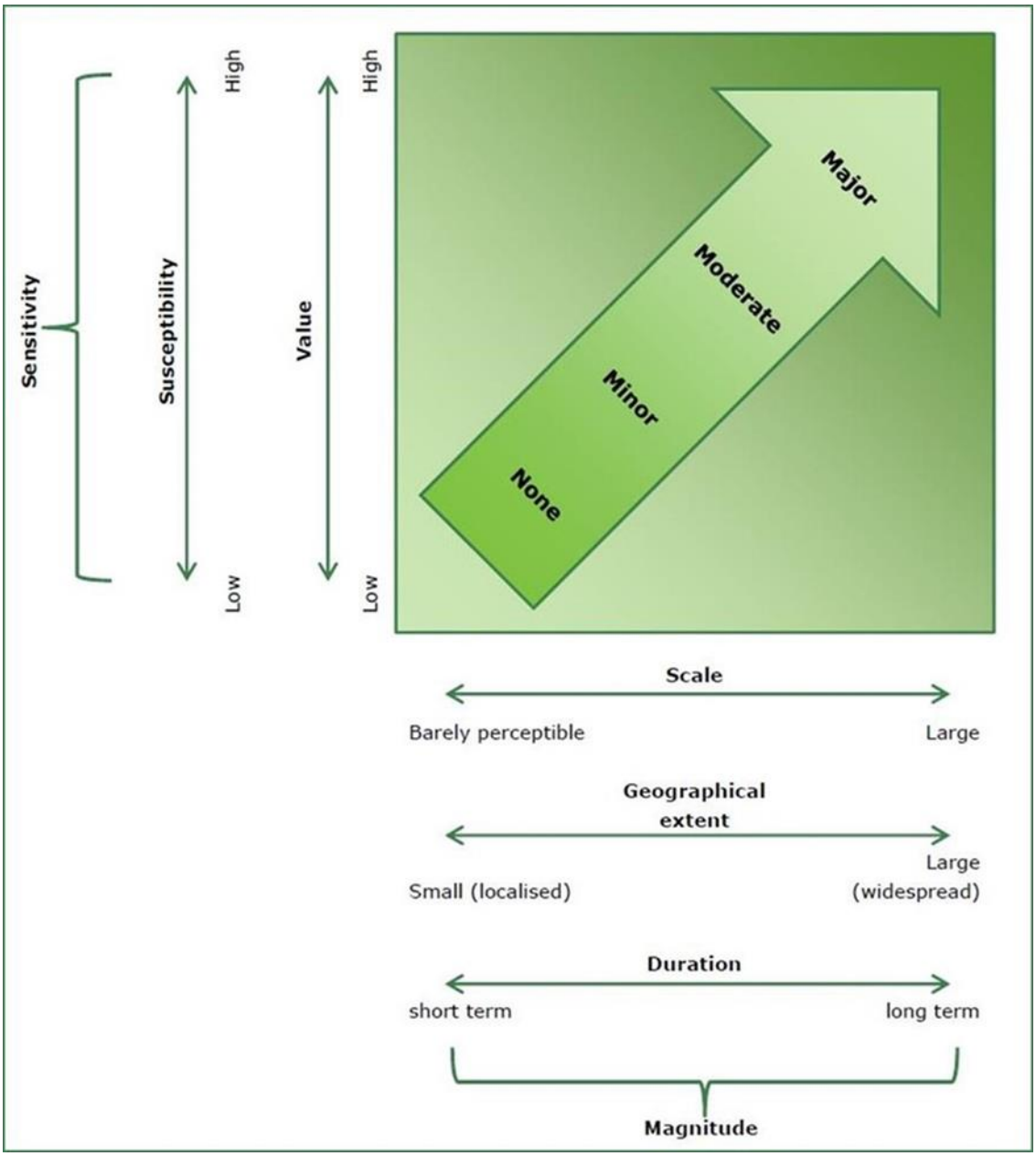
Judging Levels of Landscape Effect and Significance

TA7.1.41 The final step in the assessment requires the judgements of sensitivity and magnitude of change to be combined to make an informed professional assessment on the significance of each landscape effect (GLVIA3, Figure 5.1, Page 71).

TA7.1.42 Consideration of the relative importance of each aspect is made to feed into the overall decision. Levels of effect are identified as **negligible**, **minor**, **moderate** or **major** where all moderate and major effects are considered significant in the context of the EIA Regulations.

TA7.1.43 This determination requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the principles set out in **Diagram 7.1.1** below. As such, the conclusion on the level of effect is not always the same. A numerical scoring or rigid matrix-type approach, where the level of effect would be defined simply based on the level of sensitivity (nature of receptor) combined with the magnitude of change (nature of effect), is not considered appropriate.

Diagram 7.1.1: Judging Levels of Effect – Landscape or Visual (including cumulative)



Method for Assessing Visual Effects

Significance of Visual Effects

TA7.1.44 As outlined in GLVIA3 *"An assessment of visual effects deals with the effects of change and development on views available to people and their visual amenity"* (GLVIA3, Para 6.1, Page 98). Changes in views may be experienced by people at different locations within the study area including from static locations (normally assessed using representative viewpoints) and whilst moving through the landscape (normally referred to as sequential views, e.g. from roads and walking routes).

TA7.1.45 Visual receptors are individuals or groups of people who may be affected by changes in views and visual amenity. They are usually grouped by their occupation or activity (e.g. residents, motorists, recreational users) and the extent to which their attention is focused on the view (GLVIA3, Paras. 6.31-6.32, Page 113).

TA7.1.46 GLVIA3 states that the sensitivity of visual receptors should be assessed in terms of the susceptibility of the receptor to change in views and/or visual amenity and the value attached to particular views. The magnitude of change should be assessed in terms of the scale, geographical extent, duration and reversibility of the effect.

TA7.1.47 These aspects are considered together, to form a judgement regarding the overall significance of visual effect (GLVIA3, Figure 6.1, Page 99). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Sensitivity of Visual Receptor

TA7.1.48 The sensitivity of a visual receptor to change is defined as **high**, **medium** or **low** and is based on weighing up professional judgements regarding susceptibility and value, and each of their component considerations, as set out in the table below.

Table 7.1.4: Sensitivity of Visual Receptors

	Higher		Lower
Susceptibility	Viewers whose attention or interest is focused on their surroundings, including communities, individual residential receptors, people engaged in outdoor recreation, tourists/visitors to heritage assets or other attractions where views of surrounding area an important contributor.	↔	People whose attention is not on their surroundings (and where setting is not important to the quality of working life) such as commuters/people engaged in outdoor sports/people at their place of work.
Value	Views may be recorded in management plans, guide books, and/or which are likely to be experienced by large numbers of people.	↔	Views which are not documented or protected.

TA7.1.49 The sensitivity of visual receptors may involve a complex relationship between their susceptibility to change and the value attached to a view. Therefore, the rationale for judgements of sensitivity is clearly set out for each receptor in relation to both its susceptibility (to the type of change proposed) and the value of the view. Further information on the criteria is provided below.

Susceptibility of Visual Receptor

TA7.1.50 The susceptibility of visual receptors to changes in views/visual amenity is a function of the occupation or activity of people experiencing the view and the extent to which their attention is focused on views (GLVIA3, para 6.32). This is recorded as **high**, **medium** or **low**, and is informed by the table below.

Table 7.1.5: Susceptibility of Visual Receptors

High	Medium	Low
People whose attention or interest is focussed on their surroundings, including: ■ Communities where views contribute to the landscape setting enjoyed by residents; ■ Visitors to heritage assets or other attractions where views of surroundings are an important contributor to experience; and/or ■ Visitors to formal or promoted stopping places on scenic or tourist routes.	■ People engaged in outdoor recreation (including users of cycle routes, footpaths and public rights of way whose interest is likely to be partially focused on the landscape); ■ People travelling in vehicles on scenic routes and tourist routes, where attention is focused on the surrounding landscape, but is transitory; and/or ■ People at their place of work whose attention is focused on the surroundings and where setting is important to the quality of working life.	■ People travelling more rapidly on more major roads, rail or transport routes (not recognised as scenic routes); ■ People engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape; and/or ■ People at their place of work whose attention is not on their surroundings (and where setting is not important to the quality of working life).

Value of View or Visual Amenity

TA7.1.51 GLVIA3 also requires evaluation of the value attached to the view or visual amenity and relates this to planning designations and cultural associations (GLVIA3, Para. 6.37, Page 114).

TA7.1.52 Recognition of the value of a view is determined with reference to:

- Planning designations specific to views;
- Whether it is recorded as important in relation to designated landscapes (such as views specifically mentioned in the special qualities of a National Scenic Area);
- Whether it is recorded as important in relation to heritage assets (such as designed views recorded in citations of Gardens and Designed Landscapes (GDL) or views recorded as of importance in Conservation Area Appraisals); and
- The value attached to views by visitors, for example through appearances in guidebooks or on tourist maps, provision of facilities for their enjoyment and references to them in literature and art.

TA7.1.53 A designated viewpoint or scenic route advertised on maps and in tourist information, or which is a significant destination in its own right, such as a Munro summit, is likely to indicate a view of higher value. High value views may also be recognised in relation to the special qualities of a designated landscape or heritage asset, or may be a view which is familiar from photographs or paintings.

TA7.1.54 Views experienced from viewpoints or routes not recognised formally or advertised in tourist information, or which are not provided with interpretation or, in some cases, formal access, are likely to be of lower value.

TA7.1.55 Judgements on the value of views or visual amenity are recorded as **high**, **medium** or **low**.

Magnitude of Visual Change

TA7.1.56 The overall judgement of magnitude of visual change (nature of visual effect) is based on weighing up professional judgements on scale, geographical extent, duration and reversibility. Further information on the criteria is provided below.

Scale

TA7.1.57 The scale of a visual change depends on:

- 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, including the proportion of the view occupied by the proposed development;
- The degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and texture; and
- The nature of the view of the proposed development, in terms of the relative amount of time over which it would be experienced and whether views would be full, partial or glimpses.

TA7.1.58 All changes are assumed to be during winter, representing a 'maximum case effect' or 'worst case effect' scenario with minimal screening by vegetation and deciduous trees. Note that wireframes and ZTVs prepared to illustrate potential visual effects are calculated on the basis of bare ground and therefore demonstrate the maximum extent of visibility possible, in the absence of buildings or vegetation. Where forestry is present, consideration is given to felling regimes if levels of screening by forestry are likely to change notably during the lifetime of the proposed development.

TA7.1.59 In this assessment scale of visual change is described as being **large**, **medium**, **small** or **barely perceptible**.

Geographical Extent

TA7.1.60 The geographical extent of a visual change records the extent of the area over which the changes would be visible e.g. whether this is a unique viewpoint from where the proposed wind farm can be glimpsed, or whether it represents a large area from which similar views are gained. Geographical extent is described as being **large**, **medium** or **small**.

Duration

TA7.1.61 The duration of visual effects is reported as **short-term**, **medium-term** or **long-term**, as defined for the duration of landscape effects (see above). Duration is also a relevant consideration for effects which are intermittent (for example lighting).

Reversibility

TA7.1.62 Reversibility is reported as **irreversible** (i.e. permanent), **partially reversible** or **reversible**, and is related to whether the visual change can be reversed at the end of the phase of development under consideration (i.e. at the end of construction or at the end of the operational lifespan of the development). Operational visual effects are generally considered to be partially reversible as the decommissioning phase would remove turbines and most infrastructure at the end of the operational phase.

TA7.1.63 Judgements on the magnitude of visual effect are recorded as **high**, **medium**, **low** or **barely perceptible** guided by the table below.

Table 7.1.6: Magnitude of Visual Change

	Higher		Lower
Scale	A large visual change resulting from the proposed development is the most notable aspect of the view, perhaps as a result of the development being in close proximity, or because a substantial part of the view is affected, or because the development introduces a new focal point and/or provides contrast with the existing view and/or changes the scenic qualities of the view.	↔	A small or some visual change resulting from the proposed development as a minor or generally unnoticed aspect of the view, perhaps as a result of the development being in the distance, or because only a small part of the view is affected, and/or because the development does not introduce a new focal point or is in contrast with the existing view and/ does not change the scenic qualities of the view.

	Higher		Lower
Geographical Extent	The assessment location is clearly representative of similar visual effects over an extensive geographic area.	↔	The assessment location clearly represents a small geographic area.
Duration	Visual change experienced over a longer period, e.g. 10 years or more. Continuous Longer periods of time when travelling along a linear route	↔	Visual change experienced over a short period e.g. up to 5 years. Intermittent or occasional Shorter periods of time when travelling along a linear route
Reversibility	A permanent visual change which is not reversible or only partially reversible following decommissioning of the proposed development.	↔	A temporary visual change which is largely reversible following the completion of construction, or decommissioning, of the proposed development.

Judging the Level of Visual Effect and Significance

TA7.1.64 As for landscape effects, the final step in the assessment requires the judgements of sensitivity of visual receptor and magnitude of visual effect to be combined to make an informed professional assessment on the significance of each visual effect.

TA7.1.65 This determination requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the same principles as set out in **Diagram 7.1.1** above.

TA7.1.66 Consideration of the relative importance of each aspect is made to feed into the overall decision. Levels of visual effect are identified as **negligible**, **minor**, **moderate** or **major** where all moderate and major visual effects are considered significant in the context of the EIA Regulations. A numerical or rigid matrix-type approach, where the level of effect would be defined simply based on the level of sensitivity (nature of receptor) combined with the magnitude of change (nature of effect), is not adopted. As such, the conclusion on the level of effect is not always the same.

Cumulative Landscape and Visual Impact Assessment

TA7.1.67 The aim of a cumulative assessment in LVIA is to *"describe, visually represent and assess the ways in which a proposed windfarm would have additional impacts when considered together with other existing, consented or proposed windfarms"*[9] (NatureScot page 8, 2021).

TA7.1.68 The cumulative assessment therefore focuses on the **additional** cumulative change which may result from the introduction of a proposed development because of its interaction with other development. The cumulative assessment may also make reference to in-combination (also known as total) cumulative effects, where these have the potential to be significant. A cumulative assessment may also consider the potential interactions between different types of development (e.g. transmission infrastructure, other energy generation stations or other built development) if these are likely to result in similar landscape and visual impacts. No other types of development other than wind farms however are considered likely to give rise to significant landscape and visual cumulative effects within the LVIA Study Area and as such have not been considered within the cumulative assessment.

TA7.1.69 Cumulative landscape and visual effects are described separately, as for the primary LVIA.

[9] NatureScot (2021) Assessing the cumulative impact of onshore wind energy developments [online].

Differences Between the Primary LVIA and the Cumulative Assessment

TA7.1.70 Although both the primary LVIA and the cumulative assessment look at the effects of a proposed development on the landscape and on views, there are differences in the baseline against which the assessments are carried out.

TA7.1.71 For the primary LVIA, the baseline includes existing wind farms and other developments which are present in the landscape at the time of undertaking the assessment, which may be either operational or under construction (assuming it is well advanced and, in the case of wind farms, the turbines are already present). The presence of existing development has an influence on the assessment of effects on landscape character and the assessment of effects on views, for example in that the existing character may be influenced by wind turbines, and this characteristic might be intensified. The primary LVIA considers cumulative effects against the current baseline. For the cumulative assessment of potential future effects, the baseline is partially speculative and includes (in addition to existing wind farms):

- **Scenario 1:** Wind farms which have been granted planning consent but are not yet constructed (consented).
- **Scenario 2:** Submitted valid wind farm applications which are currently awaiting determination by the relevant consenting authority, including those at appeal.

TA7.1.72 A cut-off date of 19th March 2025 was applied for the inclusion of developments within the cumulative assessment.

TA7.1.73 As per GLVIA3[10], schemes at scoping are *"generally not considered in the assessment of cumulative effects because firm information on which to base the assessment is not available"* but *"there may be occasions where such schemes may be included in the assessment if the competent authority or consultation bodies consider this to be necessary"*. NatureScot's Assessing the Cumulative Impact of Onshore Wind Energy Developments[11] suggests that it may be appropriate to include schemes at scoping *"where clusters of development or "hotspots" emerge, or where proposals are adjacent to one another"*. Wind farms at scoping stage within the study area were reviewed, although none were considered to be relevant to the assessment based on the guidance above.

Types of Cumulative Effect

TA7.1.74 NatureScot's Assessing the Cumulative Impact of Onshore Wind Energy Developments[12] states that *"cumulative landscape effects can impact on either the physical fabric or character of the landscape, or any special values attached to it"*.

TA7.1.75 Three types of cumulative effects on visual amenity are considered in the assessment: combined, successive and sequential:

- **Combined effects** occur where a static viewer is able to view two or more wind farms from a viewpoint within the viewers' same arc of vision (assumed to be about 90 degrees for the purpose of the assessment);
- **Successive effects** occur where a static viewer is able to view two or more wind farms from a viewpoint, but needs to turn to see them; and
- **Sequential effects** occur when a viewer is moving through the landscape from one area to another, for instance when a person is travelling along a road or footpath, and is able to see two or more wind farms at the same, or at different times as they pass along the route. Frequently sequential effects occur where wind farms appear regularly, with short time lapses between points of visibility. Occasionally sequential effects occur where long periods of time lapse between views of wind farms, depending on speed of travel and distance between viewpoints.

[10] The Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, Routledge
[11] NatureScot (2021) Assessing the cumulative impact of onshore wind energy developments [online].
[12] NatureScot (2021) Assessing the cumulative impact of onshore wind energy developments [online].

Method for Assessing Cumulative Landscape Effects

TA7.1.76 The primary LVIA considers the introduction of a proposed development to a baseline which includes existing (operational) wind farms, or those that are already at an advanced stage of construction (i.e. they are present in the landscape). The cumulative assessment considers the potential future effects of the addition of the proposed development, against a landscape baseline that includes wind farms that may or may not be present in the landscape in the future, i.e. wind farms that are in the early stages of construction where turbines are not yet present, those that are consented but not yet built, and/or undetermined planning applications. The wind farms included in each scenario are assumed to be present in the landscape for the purposes of the assessment.

TA7.1.77 The scale of cumulative change focuses on:

- The pattern and arrangement of wind farms in the landscape or view, e.g. developments seen in one direction or part of the view (combined views), or seen in different directions (successive views in which the viewer must turn) or developments seen sequentially along a route;
- The relationship between the scale of the wind farms, including turbine size and number, and if wind farms appear balanced in views in terms of their composition, or at odds with one another;
- The position of the wind farms in the landscape, e.g. in similar landscape or topographical context;
- The position of the wind farms in the view, e.g. on the skyline or against the backdrop of land; or how the proposed development would be seen in association with another development (separate, together, behind etc.); and
- The distances between wind farms, and their distances from the viewer.

Significance of Cumulative Effects

TA7.1.78 As for the primary LVIA, judging the significance of cumulative landscape and visual effects requires consideration of the sensitivity and the magnitude of change on those receptors. The following sections set out the methodology applied for the assessment of cumulative effects for both landscape and visual receptors and explains the terms used.

Sensitivity

TA7.1.79 An assessment of cumulative landscape effects requires consideration of the sensitivity of the landscape receptors. This requires consideration of susceptibility and value, as detailed in the primary LVIA.

Magnitude of Cumulative Landscape Effects

TA7.1.80 As for the primary LVIA, the magnitude of cumulative landscape effect (nature of cumulative landscape effect) is based on combining professional judgements on scale, geographical extent, duration and reversibility. Judgements on the magnitude of cumulative landscape effect (nature of cumulative visual effect) are recorded as **high**, **medium** or **low**.

Scale

TA7.1.81 The scale of cumulative landscape change reflects the additional influence the proposed development has on the character of the area, assuming the other developments considered in the future baseline scenarios are already present in the landscape. This is influenced by:

- How the proposal fits with existing pattern of development, including the relationship to landscape character types and areas; and
- The siting and design of the proposed development in relation to other existing and proposed developments (including distance between wind farms, composition, size and scale).

Geographical Extent

TA7.1.82 The geographical extent over which the cumulative landscape change would be experienced is described as being large (scale of the landscape character type or widespread, affecting several landscape types or character areas), medium (immediate surroundings) or small (site level).

Duration and Reversibility

TA7.1.83 For the purpose of the cumulative landscape assessment, consideration of the judgements of the duration and reversibility of landscape effects are as recorded in the primary LVIA.

TA7.1.84 Judgements on the magnitude of cumulative landscape effect are recorded as **high**, **medium**, **low** or **barely perceptible**.

Levels of Cumulative Landscape Effect and Significance

TA7.1.85 The final step in the assessment of future cumulative landscape effects requires the judgements of sensitivity and magnitude of cumulative landscape effect to be combined to make an informed professional assessment on the significance of each cumulative landscape effect.

TA7.1.86 As for the primary LVIA, the levels of cumulative landscape effect are described as **negligible**, **minor**, **moderate** or **major** where moderate and major cumulative landscape effects are considered significant in the context of the EIA Regulations.

TA7.1.87 More significant effects are likely where:

- The proposed development extends or intensifies a landscape effect;
- The proposed development 'fills' an area such that it alters the landscape resource; and/or
- The interaction between the proposed development and other developments means that the total effect on the landscape is greater than the sum of its parts.

TA7.1.88 GLVIA3 states *"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. The emphasis must always remain on the main project being assessed and how or whether it adds to or combines with the others being considered to create a significant cumulative effect"* (GLVIA3, Para 7.28).

TA7.1.89 This determination of potential future cumulative landscape effects requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the same principles as set out in **Diagram 7.1.1** above.

Method for Assessing Cumulative Visual Effects

Sensitivity

TA7.1.90 The assessment of the significance of cumulative visual effects requires consideration of the sensitivity of the visual receptors. This requires consideration of susceptibility and value, as recorded in the primary LVIA.

Magnitude of Cumulative Visual Effects

TA7.1.91 The magnitude of cumulative visual effect (nature of cumulative visual effect) is based on combining professional judgements on scale; geographical extent; duration and reversibility. Judgements on the magnitude of cumulative visual effect (nature of cumulative visual effect) are recorded as **high**, **medium**, **low** or **barely perceptible**.

Scale

TA7.1.92 The scale of cumulative change to views depends on the additional influence the proposed development has on views assuming the other developments are already present in the landscape. This is influenced by:

- Whether the proposed development introduces development into a new part of the view so that the proportion of the developed part of the view increases;
- The relationship between the proposed development and other developments in terms of design, size and layout;
- The apparent visual relationship of developments to landscape character types and or landscape character areas; and/or
- In the case of magnitude of change to routes, the relative duration of views of development from routes, and whether these would be intermittent or continuous.

TA7.1.93 There has to be clear visibility of more than one development from any one place, or sequentially when moving along a route, of which one must be the proposed development, for there to be a combined or sequential cumulative effect.

Geographical Extent

TA7.1.94 The geographical extent of cumulative visual change refers to the extent of the area over which the changes would be visible e.g. whether this is a unique viewpoint from where the proposed wind farm can be glimpsed, or whether it represents a large area from which similar views are gained from large areas. Geographical extent is described as being **large**, **medium** or **small**.

Duration and Reversibility

TA7.1.95 For the purpose of the cumulative visual assessment, consideration of the judgements of the duration and reversibility of visual effects are as recorded in the primary LVIA.

Levels of Cumulative Visual Effect and Significance

TA7.1.96 The final step in the assessment of cumulative visual effects requires the judgements of sensitivity and magnitude of cumulative visual effect to be combined to make an informed professional assessment on the significance of each cumulative visual effect.

TA7.1.97 The evaluation of susceptibility, value, scale, geographical extent, duration and reversibility are considered together to provide an overall profile of each identified cumulative visual effect. An overview is taken of the distribution of judgements for each aspect to make an informed professional assessment of the overall level of each visual effect, drawing on guidance provided in GLVIA3. Levels of effect are identified as **negligible**, **minor**, **moderate** or **major** where moderate and major visual effects are considered significant in the context of the EIA Regulations.

TA7.1.98 More significant effects are likely where:

- The proposed development extends or intensifies a visual effect;
- The proposed development 'fills' an area such that it alters the view/ visual amenity;
- The interaction between the proposed development and other developments means that the total visual effect is greater than the sum of its parts; and/or
- The proposed development would lengthen the time over which effects are experienced (sequential effects).

TA7.1.99 The determination of cumulative visual effects requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. As for the primary assessment of landscape and visual effects, judgements are made on a case-by-case basis, guided by the same principles as set out in **Diagram 7.1.1** above.

Combined Cumulative Effects

TA7.1.100 GLVIA3 refers to the focus of cumulative LVIA being either *"additional effects of the main project under consideration, or on the combined effects of all the past, present and future proposals together with the new project."* (paragraph 7.18), but in doing so acknowledges that *"…assessing combined effects involving a range of different proposals at different stages in the planning process can be very complex. Furthermore the assessor will not have assessed the other schemes and cannot therefore make a fully informed judgement. A more comprehensive overview of the cumulative effects must rest with the competent authority*."

TA7.1.101 Therefore, this type of cumulative effect is only described where it is considered likely to be a relevant consideration in the determination of the proposed development. In considering the detailed cumulative landscape and visual effects set out in the LVIA, broad observations are made, where relevant, within the summary of effects. These relate to how the combined cumulative effects of multiple future developments may influence landscape character, views and visual amenity and designated landscapes.

Chapter 2
ZTV Mapping and Visualisation Methodology

Introduction

TA7.2.1 This section sets out the approach to the production of the figures and visualisations which accompany Chapter 7: Landscape and Visual Amenity. Figures referred to in this appendix are located in Volume 3a of the EIA Report and visualisations are included in Volumes 3b: Proposed Development Visualisations (NatureScot) and Volume 3c: Proposed Development Visualisations (NatureScot).

TA7.2.2 The methodology for the production of figures and visualisations was based on current good practice guidance from NatureScot[13] and the Landscape Institute[14], unless otherwise stated. Further information about the approach is provided below.

Data Sources

TA7.2.3 Data used for generating maps and visualisations:

- OS Terrain 50 mid-resolution height data (DTM) (50m grid spacing, 4 metres RMSE);
- OS Terrain 5 mid-resolution height data (DTM) (5m grid spacing, 2.5 metres RMSE);
- Ordnance Survey 1:50,000 raster data (to show surface details such as roads, forest and settlement detail equivalent to the 1:50,000 scale Landranger maps); and
- Ordnance Survey 1:250,000 raster data (to provide a more general location map).

Zone of Theoretical Visibility (ZTV) Mapping

TA7.2.4 Evaluation of the theoretical extent to which the wind farm would be visible was informed by establishing a ZTV, using specific computer software designed to calculate the theoretical visibility of the proposed turbines within its surroundings. ESRI's ArcPro 3.2.1 software was used to generate the ZTV. The tool calculates areas from which the turbine hubs and maximum blade tip height are potentially visible. This is performed on a 'bare ground' computer generated terrain model, which does not take account of potential screening by buildings or vegetation. The software uses raster[15] height data, but while it is displayed as continuous data (with each grid square referred to as a 'cell'), it assumes a single average height value for each cell. Therefore, any height variations across cells are not recognised.

TA7.2.5 The DTM used for the analysis is OS Terrain® 50 height data, obtained from Ordnance Survey in July 2023. The DTM data has not been altered (i.e., by the addition of local surface screening features) for the production of the ZTV. No significant discrepancies between the DTM and the actual topography around the study area were noted. The effect of earth curvature and light refraction was included in the ZTV analysis. A viewer height of 2m above ground level was used. As the model uses a 'bare ground' situation, it is considered to over-emphasise the extent of visibility of the proposed development and therefore represents a 'maximum potential visibility' scenario which is likely to be not possible in reality. The ZTV is used as a starting point in the assessment to provide an indication of theoretical visibility. This information was verified in the field.

TA7.2.6 The ZTV was calculated to show the potential number of turbines visible to maximum blade tip height (up to 149.9m) and maximum hub height (up to 81m). The ZTV showing where blade tips would be visible is provided in **Figures**

[13] Scottish Natural Heritage (2017) Visual Representation of Wind Farms, Version 2.2
[14] Landscape Institute (2019) Advice Note 01/11 Photography and photomontage in landscape and visual impact assessment
[15] Raster data is a matrix of cells (or pixels) which contain a value representing information.

7.2a-7.2c. The hub height ZTV is shown in **Figure 7.3a** and **Figure 7.3b**. Subsequent figures which include the ZTV make use of the ZTV which indicates visibility up to the top of the blade tips.

TA7.2.7 To prepare cumulative ZTVs to illustrate the cumulative visibility of the proposed development in conjunction with other wind farms, the ZTV to tip height of each wind farm was generated (based on the tip height of each turbine to an applicable maximum radius in accordance with the current guidance (SNH, 2017)[16]), and then combined with the proposed development ZTV (to a 40km radius). The cumulative ZTVs are colour coded to distinguish between areas where the proposed development is predicted to be visible (either on its own, or in conjunction with other wind farms), and areas where other wind farms would be visible, but the proposed development would not be.

Viewpoint Photography

TA7.2.8 The photography is undertaken in accordance with guidance from SNH (now NatureScot)[17] and the Landscape Institute[18]. The focal lengths used are in accordance with recommendations contained in guidance and are stated on the figures. Photography was undertaken by LUC between 2022 and the end of 2023. A Nikon D750/D600 full frame sensor digital single lens reflex (SLR) camera, with a fixed 50mm focal length lens, was used to undertake photography from all viewpoint locations.

TA7.2.9 A tripod with vertical and horizontal spirit levels was used to provide stability and to ensure a level set of adjoining images. A panoramic head was used to ensure the camera rotated about the no-parallax point of the lens in order to eliminate parallax errors[19] between the successive images and enable accurate stitching of the images. The camera was rotated through a full 360˚ at each viewpoint.

TA7.2.10 The location of each viewpoint and information about the conditions was recorded in the field in accordance with NatureScot (SNH, 2017) and LI guidance (2019).

TA7.2.11 Weather conditions and visibility were considered an important aspect of the field visits for the photography. Where possible, visits were planned around clear days with good visibility. Viewpoint locations were visited at times of day to ensure, as far as possible, that the sun lit the scene from behind, or to one side of the photographer. South facing viewpoints can present problems particularly in winter when the sun is low in the sky. Photography opportunities facing into the sun were avoided where possible to prevent the wind turbines appearing as silhouettes. Adjustments to lighting of the turbines were made in the rendering software to make the turbines appear realistic in the view under the particular lighting and atmospheric conditions present at that time the photography was taken.

Visualisations

TA7.2.12 Wirelines are computer generated line drawings which show outlines of the proposed turbines and the bare earth topography, which means that they show a maximum-case scenario where no screening is provided by structures, trees or other built development. Photomontages are computer generated images of the proposed development modelled into the actual baseline photography and therefore show screening elements. Wirelines and photomontages are assessment tools and are not a substitute for site visits. They do not convey turbine movement and are representative of particular views, but cannot represent visibility at all locations.

Photographic Stitching, Wirelines and Photomontages

TA7.2.13 Photographic stitching software PTGui© 12.27 was used to stitch together the adjoining frames to create panoramic baseline photography. A selection of identical control points was created within each of the adjoining frames to increase the level of accuracy when stitching the 360° panoramic photography.

TA7.2.14 The software package ReSoft© WindFarm version 5 was used to create a digital terrain model (DTM), using a combination of from OS Terrain® 5 (out to 40km) and OS Terrain® 50 (from 60 - 80km) height data. The DTM includes the site, viewpoint locations and all landform visible within the baseline photography. Turbine and viewpoint

[16] Scottish Natural Heritage (2017) Visual Representation of Wind Farms, Version 2.2
[17] Scottish Natural Heritage (2017) Visual Representation of Wind Farms, Version 2.2
[18] Landscape Institute (2019) Advice Note 01/11 Photography and photomontage in landscape and visual impact assessment
[19] Parallax is the difference in the position of objects when viewed along two different lines of sight. In the case of a camera this would occur if the rotation point of the lens was not constant and would result in stitching errors in the panorama.

location coordinates were entered. It should be noted that, in some viewpoints, OS Terrain 5 DTM data does not show smaller scale changes in topographic data, as evident in the baseline photography. Photomontages were constructed to show the candidate turbine with the specified tip and hub height. A default viewer height of 1.5m above ground level was set in the ReSoft© software, however on limited occasions this viewer height was increased by a small increment to achieve a closer match between the terrain data and photographic landform content[20]. For one viewpoint, VP8 – Alloa Tower, the view height was increased to replicate the viewing experience from the top of the tower.

TA7.2.15 Wind farm layouts included within the cumulative assessment were added to the ReSoft© WindFarm model.

TA7.2.16 The 90 degree baseline daytime photographic images were imported into ReSoft© WindFarm software. From each viewpoint the wireline views of the landform model with the proposed turbines were carefully adjusted to obtain a match. Fixed features on the ground such as buildings and roads were located in the model and used as markers to help with the alignment process where necessary. Each view was rendered taking account of the sunlight and the position of the sun in the sky at the time the photograph was taken. Blade angle and orientation adjustments were also made to represent a realistic situation.

TA7.2.17 The exported renders were imported into Adobe Photoshop© where they were aligned and combined with the baseline photography. Turbines or sections of turbines which were located behind foreground elements in the photograph were masked (removed) to create the photomontage.

TA7.2.18 The software package Blender, version 4.2© was used for adding the access tracks and other ancillary features, where visible from viewpoints within 10 km of the outermost turbines. Infrastructure was also modelled into Viewpoint 10: B827, approximately 11.3 km from the nearest turbine, due to the open and elevated views afforded towards the proposed development from this location. These elements were informed by infrastructure data either imported as a GIS shapefile or modelled in 3D to their specified dimensions and positioned within a DTM created from the same OS Terrain 5 data used for the turbine alignment and renders. Views were rendered and exported images composited with the turbine renders and photographs to create the photomontages.

TA7.2.19 Finally, where applicable, the images were converted from Cylindrical Projection to Planar Projection using PTGui© 12.27 software.

Figure Layout

TA7.2.20 The printed figures for the viewpoints produced in accordance with NatureScot requirements are presented in Volume 3b of the EIA Report.

TA7.2.21 Adobe InDesign© software was used to present the figures. The dimensions for each image (printed height and field of view) are in accordance with NatureScot requirements. Photography information and viewing instructions are provided on each page where relevant.

TA7.2.22 The elongated A3/A1 width format pages for each viewpoint are set out as follows. This follows NatureScot visualisation standards:

- The first A3/A1 page contains two maps. The first (on the left) shows the cumulative context of the site on an OS 1:250,000 scale map. The second map (on the right) shows an OS 1:50,000 scale map showing the viewpoint location, direction of the 90˚ baseline photography, wireline views and 53.5˚ photomontage view. Wind turbine locations for the proposed development are also shown when visible in the map view;
- The following page contains 90˚ baseline photography and wireline to illustrate the wider landscape and visual context. These are shown in cylindrical projection and presented on an A1 width page. Additional pages in the same format are provided where relevant to illustrate wider cumulative visibility up to 360˚; and
- The subsequent two pages contain a 53.5˚ wireline and photomontage. These images are both shown in planar projection and presented on an A1 width page.

[20] An altered height above ground level was used for where local topography did not match the wireframes due to data resolution.