Appendix 14-1 – LVIA Methodology

Proposed Glenora Wind Farm

1. LVIA METHODOLOGY

1.1 Scope and Definition of Landscape and Visual Impact (LVIA) Study Area

For the purposes of assessments throughout Chapter 14, where the 'Proposed Development Site' or 'the site' is referred to, this relates to the primary study area for the Proposed Development, as shown delineated in green on the LVIA Baseline map (Appendix 14-4), and throughout Chapter 14 as the 'EIAR Site Boundary'.

The Guidelines for Landscape and Visual Impact Assessment 3rd Edition - GLVIA3 (LI & IEMA, 2013) guidance refers to the identification of the area of landscape that is to be covered while assessing landscape and visual effects. The guidelines state:

> *"The study areas should include the site itself and the full extent of the wider landscape around it which the Proposed Development may influence in a significant manner."*

Landscape and visual baseline mapping and viewpoint selection are based on wider study areas referred to as the 'LVIA Study Area'. The geographical parameters for this LVIA were determined by desktop study, survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards, such as:

- *Appendix 3* of the '*Wind Energy Development Guidelines for Planning Authorities*: published by the Department of Environment, Heritage and Local Government, (2006) - Hereafter referred to as the 'WEDGs (DoEHLG, 2006)';
- *The Guidelines for Landscape and Visual Impact Assessment 3rd Edition*, Landscape Institute & IEMA, (2013) - Hereafter referred to as 'GLVIA3 (LI, & IEMA, 2013)'

The distance at which a ZTV is set from a proposed wind farm development usually defines the parameters of the LVIA Study Area. The LVIA Study Area was chosen as 20 kilometres for landscape and visual effects as is suggested by guidance:

> *'For blade tips in excess of 100m, a Zone of Theoretical Visibility radius of 20km would be adequate' (WEDGs Page 94, (DoEHLG, 2006); Page 152, Draft WEDGs (DoHPLG, 2019))*

Through experience conducting LVIA for other wind energy development projects, the assessment team determined that no significant effects on landscape character are likely to arise beyond distances of 15km from the proposed turbines. Therefore, a LVIA Study Area of 15km is deemed appropriate for effects on landscape character in relation to the assessment of effects upon designated Landscape Character Areas.

Furthermore, on the basis of desk studies and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards, the following topic areas have been scoped out of the assessment:

- Effects on landscape and visual receptors that have minimal or no theoretical visibility (as predicted by the ZTV) and/or very distant visibility, and are therefore unlikely to be subject to significant effects;
- Effects on designated landscapes beyond a 20km radius from the Proposed Development, from where it is judged that potential significant effects on key characteristics and/or special qualities, or views are judged unlikely to occur;

- Effects on landscape character and designated Landscape Character Areas beyond a 15km radius from the Proposed Development, where it is judged that potential significant effects on landscape character are unlikely to occur;
- Effects on visual receptors beyond a 20km radius from the Proposed Development, where it is judged that potential significant effects are unlikely to occur;
- Cumulative landscape and visual effects beyond a 20km radius from the Proposed Development, where it is judged that potential significant cumulative effects are unlikely to occur;

Essential Aspects of the Proposed Development from an LVIA Perspective

The term 'proposed turbines' or 'Proposed Development turbines' refers to the 22 No. turbines proposed as part of the Proposed Development. Best practice guidance for LVIA (GLVIA3, 2013) states that::

> *"It is important to make sure that the project description provides all the information needed to identify its effect on particular aspects of the environment. For LVIA, it is important to understand, from the project description, the essential aspects of the scheme that will potentially give rise to its effect on the landscape and visual amenity."*

The tall, vertical nature of the proposed turbines make them the most prominent elements of the Proposed Development from a landscape and visual perspective and have the most potential to give rise to significant landscape and visual effects. In this regard, the proposed turbines are deemed to be the 'essential aspect' of the Proposed Development which will give rise to effects on the landscape and visual amenity and therefore a primary focus of the LVIA conducted in Chapter 14.

Other components of the Proposed Development are not deemed to be as visually prominent as the proposed turbines, however, they have the potential to give rise to localised landscape and visual effects. Although not the primary focus of the LVIA, these elements are given due consideration throughout Chapter 14.

1.2 Guidelines

While the legislation and general guidance on Environmental Impact Assessment is set out in Chapter 1 of this report only guidance specifically pertaining to the Landscape and Visual Impact are outlined below.

Ireland signed and ratified the European Landscape Convention (ELC) in 2002, which introduces a pan-European concept which centres on the quality of landscape protection, management and planning. The Department of Arts, Heritage and the Gaeltacht has published a National Landscape Strategy for Ireland in 2015. The Strategy aims to ensure compliance with the ELC and contains six main objectives, which include developing a national Landscape Character Assessment and Developing Landscape Policies.

In 2000, the Department of the Environment and Local Government published 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities', which recommended that all Local Authorities adopt a standardised approach to landscape assessment for incorporation into Development Plans and consideration as part of the planning process. However, this DoEHLG 2000 guidance remains in draft form.

The landscape and visual impact assessment was primarily based on the *Guidelines for Landscape and Visual Impact Assessment, Third Edition* or GLVIA3 (The Landscape Institute/Institute of Environmental Management and Assessment, UK, 2013). A range of other guidelines also inform the preparation of this landscape and visual impact assessment, which include:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022);
- Wind Energy Development Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government, 2006);
- Draft Revised Wind Energy Development Guidelines (Department of Housing, Planning and Local Government, 2019);
- Visual Representation of Development Proposals (Landscape Institute Technical Guidance Note 06/19, 2019);
- Visual Assessment of Wind Farms: Best Practice (Scottish Natural Heritage, 2002);
- Visual Representation of Wind Farms: Version 2.2 (Scottish Natural Heritage, 2017).
- Siting and Designing Wind Farms in the Landscape, Version 3a (Scottish Natural Heritage, 2017);
- Assessing the Cumulative Landscape and Visual Impact of Onshore Wind Energy Developments. (Scottish Natural Heritage, 2012; & Nature Scot, 2021);
- Photography and photomontage in landscape and visual impact assessment (Landscape Institute Advice Note 01/11, 2011);
- Spatial Planning for Onshore Wind Turbines – natural heritage considerations (Scottish Natural Heritage, 2015);

1.3 Visibility Mapping: Zone of Theoretical Visibility (ZTV)

The Zone of Theoretical Visibility (ZTV) represents the area over which a development can theoretically be seen and is based on a Digital Terrain Model (DTM), overlaid on a map base. A DTM refers to the way in which a computer represents a piece of topography in three dimensions as a digital model. ZTV maps provide the following information:

- Indicates broad areas where visibility of a wind energy development is most likely to occur;
- How much of the wind energy development is likely to be visible (using different coloured bands for different numbers of turbines);
- The extent and pattern of visibility.

Production of ZTV maps is usually one of the first steps of Visual Impact Assessment, helping to inform the selection of the Study Area in which impacts will be considered in more detail and the identification of sensitive vantage points (Visual Representation of Wind Farms, Scottish Natural Heritage, 2017).

1.3.1 Limitations of ZTV Mapping

The Scottish Natural Heritage guidelines referred to above acknowledge the following limitations inherent to the use of theoretical visibility mapping:

- The ZTV presents a 'bare ground' scenario, i.e. visibility of the Proposed Development in a landscape without screening structures or vegetation. This includes trees, hedgerows, buildings and small-scale landform or ground surface features. The ZTV also does not take into account the effects of weather and atmospheric conditions, and therefore can be said to represent a 'worst-case' scenario, that is where the wind farm could potentially be seen given no intervening obstructions and favourable weather conditions.
- The ZTV indicates areas from where a wind farm may be theoretically visible, but cannot show how it will look, nor indicate the nature or magnitude of visual impacts. The visibility of the turbines will decrease with the distance from which they are viewed, but this is not accounted for in the ZTV. Figure 1-1 below provides an illustration of the differences in view relative to the distance from a turbine.

Figure 1-1 The effect of distance on visibility of wind turbines (Illustrative Purposes Only)

- A ZTV is only as accurate as the data on which it is based. It is not easy to test the accuracy of a ZTV in the field, although some verification will occur during the assessment of photomontage imagery captured from viewpoints.
- In order to handle large areas of terrain, the DTM data is based on information that does not allow detail to be distinguished below a certain level. There are also differences in the way that the software package 'interpolates' between heights in the calculations made.

1.3.2 ZTV Methodology

The ZTV maps presented in the EIAR show visibility of the proposed wind farm using the half blade height of the wind turbines as points of reference. The maps also show the visibility of the proposed wind farm in addition to visibility of other existing and permitted wind farms in the area. The area covered by the ZTV maps in Chapter 14 have a radius of 20 kilometres from the outer-most proposed turbines.

ZTV maps assume a worst-case or 'bare ground' scenario, i.e. no land-cover. They represent visibility of the proposed wind farm in the absence of all natural and manmade features from the landscape, including vegetation, houses and other buildings. In reality, such features will restrict or limit visibility of the wind turbines, due to the screening effects of vegetation, for example forestry and road-side hedgerows and trees, and buildings, particularly within towns and villages.

Separate colour bands are used on each ZTV map to indicate the number of turbines which will potentially be visible to half blade i.e. only half a blade might be visible over the topography as opposed to seeing a full turbine. The legend on each map shows the number of theoretically visible turbines for each corresponding colour, which are as follows:

- Orange: 1-5 turbines visible
- Teal: 6-10 turbines visible
- Yellow: 11-15 turbines visible
- Navy: 16-22 turbines visible

1.3.3 On-Site Visibility Appraisals

The ZTV does not account for localised undulations in topography and other screening factors, and actual visibility is often far less than is indicated by the ZTV. Whilst the ZTV is a useful tool to aid analysis of likely visibility of turbines and screen out areas where impacts will not occur. The LVIA in Chapter 14 was also informed by visibility appraisals conducted from sensitive receptors throughout the LVIA Study Area during site visits conducted during in 2021, 2022 and 2023.

Establishing visibility on the ground was assisted by the TrueViewVisuals software, which is an iPad-based Augmented Reality tool to help real-time visualisation of a project live on the ground before it is built. The likely visibility of the Proposed Development was appraised from receptors where the ZTV indicates theoretical visibility, this included an analysis of visibility towards the proposed turbines from

the local road network immediately surrounding the site during an exercise called a 'Route Screening Analysis'.

1.3.4 Route Screening Methodology - Roads

In order to comprehensively demonstrate the varying characteristics of the screening existent on roads proximate to the Proposed Development Site and to record the actual visibility in comparison to the theoretical visibility, a methodology was developed. This is termed 'Route Screening Analysis' and it was undertaken from all roads within a five-kilometre radius of the proposed turbines that have theoretical visibility indicated by the ZTV map.

Route Screening Analysis as its name suggests considers the actual visibility of the proposed wind farm from surrounding roads. Within 5km of the Proposed Development, the area generally comprises upland forested areas, agricultural land, a network of trees and hedgerows, and settlements. In order to get a clearer understanding of visibility and screening, and to bridge the gap for the assessor between the computer-generated ZTV maps and the actual nature of visibility in the study area, Route Screening Analysis was undertaken.

Every public road was driven within 5 km radius of the proposed turbines. The extent of roadside screening was recorded digitally on a tablet/GPS device as the route is driven. In addition, dashcam video footage was recorded along the routes to allow later confirmation of mapping, and to methodically record the views along the route. All routes were driven slowly. Using the GPS within the tablet device and custom-built data collection application, screening was logged as one of three categories:

The categories were as follows:

- Little/No Screening – mainly open and with some very light vegetation.
- Intermittent/Partial Screening – light deciduous roadside vegetation and vegetation with short gaps which would allow intermittent or partial views.
- Full Screening – vegetation which is dense enough to block views e.g. coniferous forestry.

The Route Screening Analysis surveys were conducted in December 2021. Screening between the wind farm site and the relevant side of the road was recorded. In cases where the road travels directly in the direction of the proposed wind farm, screening of the lowest classification was recorded (least amount of screening). Great care was taken to ensure recording of screening accounted for seasonal variation, particularly the condition of deciduous vegetation (lack of leaves and growth) in winter months. The screening data was then mapped and validated against the dashcam footage.

1.4 Photomontage Visualisations

Photomontages are visualisations that superimpose an image of a proposed development upon a photograph or series of photographs from a specific location termed 'viewpoint'. They are intended as graphical representations of how a proposed development will appear in the existing landscape and are used as a tool in the LVIA process. A series of photomontages have been prepared as part of this assessment and are presented in a separate volume -*The Volume 2 Photomontage Booklet* submitted as part of this EIAR.

The following two guidance documents are considered the industry benchmark for producing photomontages (SNH, 2017 specifically for wind energy developments) and were the standards adhered to during the production of photomontages for the Volume 2 Photomontage Booklet:

- *Visual Representation of Development Proposals*: Landscape Institute Technical Guidance Note 06/19, Landscape Institute (2019)

- Hereafter referred to as: 'LI TGN 06/19 (2019)'
- *Visual Representation of Wind Farms*: Version 2.2 (Scottish Natural Heritage, 2017)
  - Hereafter referred to as: 'SNH Guidance (2017)'

The verified photomontages produced for this EIAR are classified as Type 4 Visualisations in the LI TGN 06/19 (2019). The proposed turbines modelled in the photomontages are proportionately scaled within a topographic model from the specific locations where the photographic imagery is captured – 'Viewpoints'. The turbines and topographic model are then carefully positioned and scaled within the landscape view presented in each photomontage (to 90° and 53.5° horizontal fields of view – as prescribed by Guidance (SNH Guidance (2017); LI TGN 06/19, (2019)). The modelling of turbines in the topographical model (wireline) is generated by software using input co-ordinates of the turbine locations, viewpoint locations and the specific turbine specifications of the turbines presented.

The views presented in the photomontage booklet include a range of different distances and geographic perspectives and the images used for photomontages represent a range of differing atmospheric conditions. Although it is not reasonable to control the weather, all images were captured when weather was sufficient to enable clear and long-ranging visibility in the direction of the Proposed Development from selected viewpoints.

The proposed turbines can appear differently in the landscape depending on factors like time of day, weather conditions, and observer location. The photomontages produced aim to realistically represent the Proposed Development while considering the turbines' contrast against the backdrop of the sky and landscape. The turbines presented in the photomontages have been coloured in such a way that ensures sufficient contrast for purposes of visual impact assessment whilst balancing the intention to present the photomontages as life like visualisations.

1.4.1 Photomontage Viewpoint Selection

The viewpoints or photo locations were selected following guidance contained in guidance such as the WEDGs (DoEHLG, 2006), the GLVIA3 (LI & IEMA, 2013) and SNH Guidance (2017). The selection of photo locations is designed to give a representative range of views of the Proposed Development.

Viewpoints, the photo locations from which the photomontages are produced, were chosen after compiling the Visual Baseline (section 14.5 of Chapter 14). The main purpose of establishing the visual baseline is to identify the key visual receptors that should be considered for viewpoint selection. To this end the following were identified in the LVIA Study Area:

- Designated Scenic Routes and Scenic Views
- Settlements
- Recreational Routes and Tourist Destinations
  - Waymarked Walking Routes
  - Cycle Routes
  - Scenic Drives
  - Tourist Routes
- Viewing Points (e.g. marked on OS Maps)
- Transport Routes

These visual receptors are listed in tables within Section 14.5 of Chapter 14 under the sections identified above along with theoretical visibility at those locations indicated by the ZTV maps. After all key visual receptors are identified, a Visual Receptor Preliminary Assessment is carried out to eliminate the visual receptors for the following reasons:

- No or very limited theoretical visibility indicated on the ZTV map for the visual receptor.

- Designated views and scenic routes as well as OSi Viewing Points that are not directed towards the Proposed Development.
- Visual receptors visited on site, where views towards the turbines were either entirely screened or substantially screened and distance from the Proposed Development site would mitigate any visual effects.

Establishing visibility on the ground was assisted by the TrueViewVisuals software, which is an iPad-based Augmented Reality tool to help real-time visualisation of a project live on the ground before it is built.

All other key visual receptors were selected as viewpoint locations. In addition, viewpoints were selected in close proximity to the proposed turbines, where turbines are likely to be most visible and hence visual effects may be greatest.

Viewpoints were chosen having regard to the SNH Guidance (2017) which advises that a range of views should be shown at a range of distances and aspects, as well as at varying elevations and showing both where the development will be completely visible as well as partially visible. Consideration was also given to ensure that photomontages captured other wind farm developments in the LVIA Study Area in order to assess cumulative landscape and visual effects.

1.4.1.1 Photomontage Limitations

Photographs, and therefore photomontages, are subject to a range of limitations, as stated in *'Visual Assessment of Wind Farms'* (Scottish Natural Heritage, 2014):

- Visualisations provide a tool for assessment that can be compared with an actual view in the field; they should never be considered as a substitute to visiting a viewpoint in the field.
- Neither photographs nor visualisations can replicate a view as seen in reality by the human eye.
- Visualisations are only as accurate as the data used to construct them.
- Visualisations can only represent the view from a single location at a particular time and in particular weather conditions.
- Static visualisations cannot convey the effect of turbine blade movement.

Although the scale, siting and geometry of photomontages are based on technical data, the other qualities of the image are open to judgements. The guidance also notes that interpretation of visualisations also needs to take into account additional information including variable lighting, movement of turbine blades, seasonal differences and the movement of the viewer through the landscape. However, accepting these limitations, the SNH guidelines state that photomontages are useful tools in the Visual Impact Assessment of wind turbines.

Furthermore, with regard to the representation of cumulative visual effects, other existing, permitted and proposed turbines are also shown in the photomontages. The representation of existing turbines relies on photographs taken on site, while permitted and proposed turbines are images of turbines superimposed into the image. As such there can be a discrepancy in the lighting and sharpness between these two different representations.

Photomontages are 2D representations of 3D views and thus cannot convey the perspective and depth of view of seeing the actual objects with the naked eye. One of the areas that this limitation affects cumulative visual effects is where proposed turbines are proposed to be located in front or behind existing or permitted turbines. In the field this physical separation may be obvious, while on the photomontage the turbines may appear as one wind farm.

1.4.1.2 Photomontage Presentations

The photomontage visuals contained in the Volume 2 Photomontage Booklet are devised to be viewed at arm's length. The existing views, photomontages and wireline views are panoramas presented on banner sheets of paper at A1. More specifically, the horizontal field of view presented in the visualisations are spread across 84.1cm, the equivalent of the maximum horizontal field of an A1 sheet of paper. In line with best practice guidance for the production of photomontages for wind energy development (SNH, 2017 and LI TGN, 06/19, 2019) the A1 banners present the Proposed Development enlarged to fit within a 53.5º horizontal field of view.

The viewpoints presented in the accompanying Photomontage Booklet show several views from each viewpoint location. These include:

1. **Overview Sheet** – Viewpoint details include location description, grid reference distance from nearest turbine and technical data in relation to photography. Three maps at varies scales show the viewpoint location. A 120-degree existing view image without any proposed and permitted turbine. Existing turbines visible in the landscape may appear within the image and the horizontal extent of the 90-degree and 53.5-degree image to be presented in subsequent images is also framed.
2. **Existing View at 90º** – A 90-degree existing view image without any proposed or permitted turbines and a matching wireline image of the same view which includes any existing turbines visible in the landscape. If turbines are already existing in the landscape (e.g. the Existing Owenninny1 & 2 Wind Farms), these are visible in the photographic imagery and are rendered in the wireline view.
3. **Proposed Photomontage with Cumulative at 90º** – Showing a 90-degree photomontage image with the proposed wind farm and all other existing, permitted and proposed wind farms within the view. A matching wireline image shows the turbines of all proposed, permitted and existing wind farms individually coloured and labelled for ease of identification.
4. **Proposed Photomontage with Cumulative at 53.5º** – Showing a photomontage image of the proposed turbines and any existing, permitted and proposed turbines in a 53.5-degree horizontal field of view.
5. **Proposed Wireline with Cumulative at 53.5º** - Showing a wireline image of the proposed turbines and any existing, permitted and proposed turbines in a 53.5-degree horizontal field of view. The proposed turbines and any other existing permitted and proposed wind farms are individually coloured and labelled for ease of identification.

1.5 Landscape and Visual Impact Assessment Methodology

In line with the GLVIA3 Guidance (LI & IEMA, 2013), the potential impacts on landscape and visual receptors are assessed separately. This section details the methods used to determine the likely significant effects of the Proposed Development on landscape receptors and then the likely significant effects of the Proposed Development on visual receptors.

1.5.1 Assessing Landscape Effects

The methodology for assessing landscape effects uses qualitative methods in order to arrive at an impact assessment, which is based on the Landscape and Landscape Assessment Guidelines (DoELG, 2000) as well as the GLVIA3 (LI & IEMA, 2013), and the WEDGs (DoEHLG, 2006) were also taken into account.

Landscape effects can be described as changes which affect the landscape as a resource. This includes how the proposal will affect the elements that make up the landscape, as well as the aesthetic and

perceptual aspects and its landscape character. Landscape effects also relate to changes in the structure of the landscape. Under the GLVIA3 (LI & IEMA, 2013), the assessment of likely significant effects on landscape receptors includes a judgement on both the sensitivity of the receptor as well as magnitude of the change.

1.5.1.1 Identification of Landscape Receptors

The Landscape Baseline (Section 14.4 of Chapter 14) reports relevant policy pertinent to the LVIA and a description of the receiving landscape of the Proposed Development Site and its wider setting. As well as establishing the key sensitivities and key characteristics of the baseline landscape, this part of the LVIA focusses on identifying the key sensitive landscape receptors that are assessed later in Chapter 14. The Landscape Baseline is broken down into the following sections:

- **Landscape Designations and Policy Context** - Policy setting pertaining to the location and nature of the Proposed Development site from a landscape perspective based on:
  - Mayo County Development Plan 2022-2028 (MCDP)
  - Landscape Appraisal of County Mayo
- **Landscape Character of the Proposed Development Site** - A description of the physical landscape and characteristics of the site and its immediate landscape setting, this includes the following considerations:
  - Landscape characteristics based upon findings from a site visit conducted in 2021.
  - A review of the WEDGs (DoEHLG, 2006) and Draft WEDGs (DoHPLG, 2019) and siting guidance relating to the landscape characteristics of the Proposed Development site.
  - An appraisal of landscape value and the susceptibility of landscape receptors to change, and a determination of landscape sensitivity
- **Landscape Character of the wider LVIA Study Area** - A description of landscape in a wider setting including the identification of designated Landscape Character Areas (LCAs) located within 15 km of the Proposed Development based upon:
  - Mayo County Development Plan 2022-2028 (MCDP)
  - Landscape Appraisal of County Mayo

After all landscape receptors are identified, a Landscape Receptor Preliminary Assessment is carried out to eliminate the landscape receptors, where no or very limited theoretical visibility has been indicated on the ZTV map. All other landscape receptors were selected for further assessment of landscape effects.

The assessment of landscape effects considers landscape sensitivity balanced with the magnitude of the effect to determine the significance of effects. Mitigating factors are then taken into consideration to arrive at a residual landscape effect. Residual landscape effects are graded upon an 'impact assessment classification of significance' scale, as defined by the Environmental Protection Agency of Ireland (EPA, 2022), included in Table 1-5 below.

1.5.1.2 Assessing Landscape Sensitivity

Landscape Sensitivity, which is described in the GLVIA (2013) as a combination of the landscape's susceptibility to change as well as the value attached to the landscape receptor.

Susceptibility to change can be described as the ability of the landscape receptor (either the overall character, quality of the landscape or a particular landscape feature) to accommodate the Proposed Development without undue consequences for the maintenance of the baseline (existing) landscape and/or the aims of landscape planning policies and strategies. Table 1-1 below presents differing description criteria for susceptibility to change.

Table 1-1 Description criteria for Landscape susceptibility to change

Susceptibility of landscape receptor to change	Description and example criteria
High	Landscape receptors where the overall character of the landscape receptor or the nature of the individual landscape receptor causes it to have a high susceptibility to change considering its inherent characteristics and where the landscape receptor has a low ability to accommodate the proposed change without undue consequences for the maintenance of its landscape character, and/or its quality or condition, and/or its particular aesthetic and perceptual aspects, and where such change is not in compliance with planning policies/strategies
Medium	Landscape receptors where the overall character of the landscape receptor or the nature of the individual landscape receptor causes it to have a medium susceptibility to change considering its inherent characteristics and where the landscape receptor has a moderate ability to accommodate the proposed change without undue consequences for the maintenance of its landscape character, and/or its quality or condition, and/or its particular aesthetic and perceptual aspects, with consideration given to planning policies/strategies.
Low	Landscape receptors where the overall character of the landscape receptor or the nature of the individual landscape receptor causes it to have a low susceptibility to change considering its inherent characteristics and where the landscape receptor has a strong ability to accommodate the proposed change without undue consequences for the maintenance of its landscape character, and/or its quality or condition, and/or its particular aesthetic and perceptual aspects, and where such change may be in compliance with planning policies/strategies

Landscape value is a combination of values which are assessed in the landscape baseline, combining any formal landscape designations, and, where there are no designations, judgements based on individual elements of the landscape receptor, for example particular landscape features, notable aesthetic, perceptual or experiential qualities, and combination of these contributors. In addition, it is noted that the GLVIA3 Guidance states that "*there should not be over-reliance on designations as the sole indicator of value*", and the assessments of landscape value undertaken in Chapter 14 include consideration of various elements that contribute to landscape value of specific receptors, using best practice standards and professional judgement. Where this occurs, landscape value will be judged based on clearly stated criteria. Table 1-2 below presents differing description criteria for landscape value.

Table 1-2 Description criteria for landscape value

Value attached to Landscape elements	Description and example criteria
High	Landscape receptors forming part of designations (e.g. areas of amenity, scenic routes/views) in the development plan, or at a national or international level, or landscape receptors not designated but where the receptor is judged to be of equivalent value using clearly stated criteria including wildness, naturalness, very strong cultural heritage or natural heritage associations and/or very high recreational value.
Medium	Landscape receptors where value is not formally designated but are of value as good examples of high quality, intact landscapes or landscape features and are deemed to be of relatively high scenic quality. Landscapes or landscape receptors that contain some rare elements, include areas or features which are wild or have a sense of naturalness, strong cultural associations or which have recreational value.
Low	Landscapes that are not formally designated and considered as modified. Areas which do not have particularly scenic qualities, do not include rare elements or landscape features and do not have strongly evident cultural or heritage associations.

In combining the assessment of the landscape value of a landscape receptor with the susceptibility to change of that receptor, it is noted here that a judgement of high landscape value does not necessarily imply that this receptor has a high susceptibility to change, and it is emphasised that this relationship can be complex. The combination of these, which determines the landscape sensitivity, is undertaken using professional judgement with the rationale for judgements clearly explained in the description of the assessment of effects or in the baseline study. On this basis landscape receptors have been assigned one of the four following sensitivity ratings:

- Very High
- High
- Medium
- Low

No table is provided for the description of these different classifications of landscape sensitivity as the relationship between susceptibility to change and landscape value is inherently complex and not suitable to concise definitions. It is noted that sensitivity classifications are generally guided by local and national planning policy, particularly for Landscape Character Units and County Policy in relation to these, as well as County Wind Energy Policy. However, it is noted that in cases where local variations in landscape receptors merit a smaller scale focused assessment that may differ from the policy this is undertaken using professional judgement and is clearly explained in the main body of the report.

1.5.1.3 Assessing Magnitude of Change in the Landscape

The magnitude of change in each landscape character area is a combination of the visual presence - size and scale - of the change, the extent of the area to be affected, and the duration and reversibility of the effect. The magnitude of change for each landscape character area was assessed using the definitions outlined in Table 1-3 below.

Table 1-3 Magnitude of Landscape Change Assessment Criteria

Magnitude of Change	Description
Substantial	Where a landscape will experience the loss of key landscape features or the introduction of uncharacteristic additions over a large area. The changes to the landscape are prominent and large in scale. The level of change has an effect on the overall landscape character. The effects are likely long term and may be irreversible.
Moderate	A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not affect key characteristics. The effects could be long to medium term and/or partially reversible.
Slight	The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Negligible	A change affecting smaller areas of landscape character including the loss of some landscape elements or the addition of features or elements which are either of low value or hardly noticeable. The effects could be short term and/or reversible.

1.5.1.4 Landscape Effects Assessment Matrix

Table 1-5 below shows the significance of landscape effects, arrived at by combining the landscape receptor sensitivity and the magnitude of change classifications. Landscape receptor sensitivity is shown in the left-hand first column and magnitude of landscape change is shown in the first row at the top of the table. This table is used as an indicative tool to assist in determining the significance of landscape effects. In different circumstances differing levels of mitigating factors may ultimately result in a different determination of the level of significance. The significance of a landscape effect is based on a balance between the sensitivity of the receptor and the magnitude of effect.

The significance of landscape effect is arrived at using a combination of the matrix shown in Table 1-4 below and the significance (EPA, 2022) definitions in Table 1-5. The significance of landscape effect was arrived at by combining the magnitude and sensitivity classifications, using the assessment matrix in Table 1-4 below, where landscape sensitivity is shown in the left-hand first column and magnitude of change is shown in the first row at the top of the table.

Table 1-4 Landscape Effects Assessment Matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Medium	Moderate	Moderate/Minor	Minor	Minor/Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA Guidance (2022) impact assessment classifications of significance, as outlined in Table 1-5 below.

Table 1-5 EPA Impact Assessment Significance Classification for Landscape Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2022) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

1.5.2 Assessing Visual Effects

Visual effects relate to changes in views and visual amenity of the surroundings of individuals or groups of people. These may result from changes in content and character of views as a result in changes to the landscape. The assessment of visual effects is based on views shown in photomontages and the potential visibility indicated by the ZTV maps as well as actual visibility determined on the ground during site visits.

It should be noted that in assessing visual effects, there are different types of visual effects:

- **Visual obstruction:** This occurs when there is an impact on a view which blocks the view.
- **Visual intrusion:** This occurs when there is an impact on a view but which does not block the view.

Due to the nature of the Proposed Development and the appearance of wind turbines, visual intrusion occurs more frequently than obstruction.

The significance of the effect on visual receptors is a combination of the sensitivity of the receptor as well as the magnitude of the change.

1.5.2.1 Visual Receptor Sensitivity

Visual Receptor Sensitivity depends on the occupation or activity of the people, as well the extent to which the attention is focused on views and visual amenity, according to the GLVIA3 Guidelines (LI & IEMA, 2013). Visual receptor sensitivity is assessed as either being Very High, High, Medium or Low, based on the definition of descriptions and examples set out in Table 1-6 below.

Table 1-6 Visual Receptor Sensitivity Assessment Criteria

Sensitivity of Visual Receptor(s)	Description
Very High	Included in this category are viewers that are primarily focused on views from this particular location, such as visitors to popular destinations identified for their outstanding views. Residents in close proximity who have primary views of a scenic quality in the direction of the development.
High	Includes viewers at designated views or landscapes. Viewers such as residents in close proximity to the development who have primary views that will be in the direction of the development that may not necessarily be of a particularly scenic quality; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes.
Medium	Includes viewers who may have some susceptibility to a change in view. Viewers such as residents in medium proximity but who do not have views focused in the direction of the Proposed Development or whose views are not of a particularly scenic quality; those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic. Local population centres are deemed to represent receptors of Medium sensitivity.
Low	Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.

Photomontage viewpoints are specific locations which are representative of key visual receptors. The photomontage assessment tables in Appendix 14-3 consider all receptors represented in the determination of the visual receptor sensitivity rating for each viewpoint. This determination takes a balanced approach considering the types, sensitivities, and quantities of visual receptors represented. The sensitivity rating given to each photomontage viewpoint in Appendix 14-3 considers both the susceptibility of the visual receptors represented as well as the value attached to the available views at that particular location.

1.5.2.2 Magnitude of Visual Change

The magnitude of the visual change resulting at each viewpoint is a combination of scale of the change, the extent of the area to be affected and the duration and reversibility of the effect, determined by reviewing the photomontage and wireline images for each viewpoint. The magnitude of change is determined in accordance with the definitions and descriptions included in Table 1-7 below.

Table 1-7 Magnitude of Visual Change Assessment Criteria

Magnitude of Change	Description
Substantial	Substantial change, where the proposals would result in large-scale, prominent or very prominent change, leading to substantial obstruction of existing view or complete change in character and composition of the baseline though removal of key elements or addition of uncharacteristic elements which may or may not be visually discordant. This includes viewpoints where the Proposed Development is fully or almost fully visible over a wide extent, at close proximity to the viewer. This change could be long term or of a long duration.
Moderate	The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Slight	The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Negligible	Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.

1.5.2.3 Visual Effects Assessment Matrix

Table 1-8 below shows a matrix for determining visual effects by combining the visual receptor sensitivity and the magnitude of change classifications. Visual receptor sensitivity is shown in the left-hand first column and magnitude of visual change is shown in the first row at the top of the table. This table is used as an indicative tool to assist in determining the significance of visual effects.

Table 1-8 Visual effects significance assessment matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Medium	Moderate	Moderate/Minor	Minor	Minor/Negligible

	Substantial	Moderate	Slight	Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA impact assessment classifications of significance, as outlined in Table 1-9 below.

Table 1-9 EPA Impact Assessment Significance Classification for Visual Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2022) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

1.5.2.4 Residual Visual Effect

After determining the significance of the visual effect using the above visual effects assessment matrix, mitigating factors are taken into consideration to arrive at the final residual effect. In some cases, mitigating factors merit a reduction in classification. LVIA mitigation is generally designed into the wind energy development as part of the iterative design process. In most instances, this mitigation is part of the final design of the Proposed Development (e.g. strategic siting of turbines), as well as strategic site selection. When this is the case, the mitigating factor and/or design measure is clearly reported within text of the Chapter and impact assessment Appendices (Appendix 14-2 & Appendix 14-3).

1.5.3 Determination of Residual Landscape and Visual Effects

The matrices and tables above are excellent tools to aid professional judgement in the determination of the significance of an effect. They are useful in that they provide a transparent, objective, structure to the process of balancing sensitivity and magnitude of change. In the context of the determination of visual effects, the formulaic process created by the use of the matrix above provides an indicative initial assessment, which is clearly demonstrated in the photomontage assessment tables in Appendix 14-3.

However, over-reliance on the formulaic process, which is heavily influenced by the definitions of sensitivity and magnitude of change contained in the tables above, can lead to a failure to properly account for the full range of circumstances and factors at play in the determination of the significance of an effect (see section 3.35, GLVIA3, LI & IEMA 2013). A wide range of factors, mitigating or otherwise, can factor into such a determination, and it is not possible to capture the complexity involved in balancing all considerations within the necessarily limited definitions contained in these tables. This then naturally results in circumstances whereby the process of the determination of significance using the formulaic method involved with the matrix shown in Table 1-8, for example, can result in misrepresentations of the significance of effects. It is only with professional judgement, and narrative descriptions of effect, that such complexity can be integrated into the determination of significance. Therefore, the formulaic methods based upon the matrix presented above is combined with professional judgement in the determination of significance. This is illustrated in Figure 1-2 below where the professional judgment of the competent expert is used to properly determine the significance of an effect taking all considerations into account.

A focus is placed upon the narrative description of effects (see section 3.36, GLVIA3, LI & IEMA, 2013) given the naturally subjective nature of the significance determination process, ensuring that the rationale for the overall judgement is clear (see sections 3.28-3.29, GLVIA3, LI & IEMA 2013). The comprehensive assessment of effects included in Chapter 14, Appendix 14-2, and Appendix 14-3 aims to provide a transparent and robust determination of residual landscape and visual effects utilising the graph in Figure 1-2 below in combination with a clear and logical narrative.

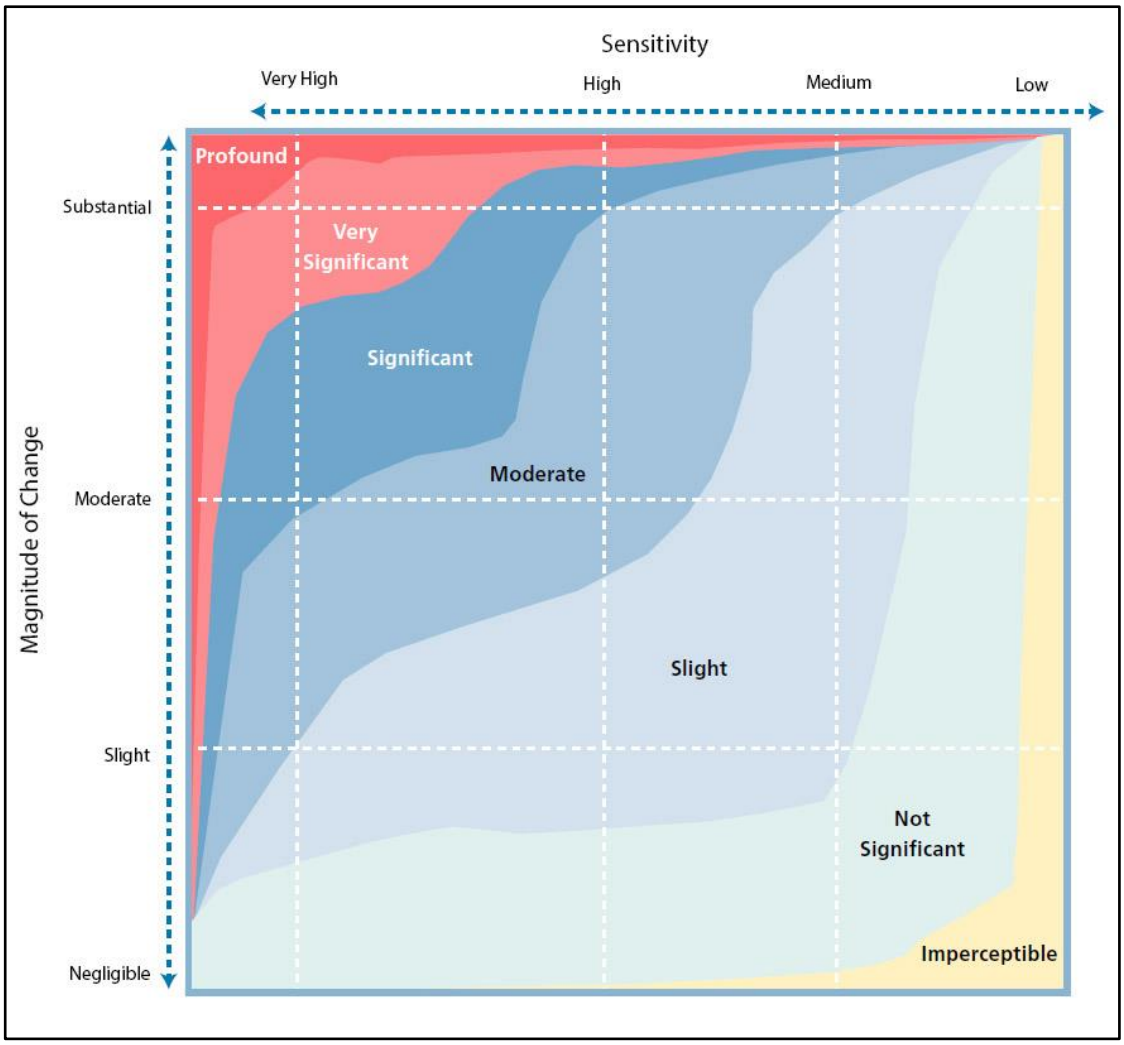

Figure 1-2 Effect Significance Graph (adapted from EPA Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2022)

1.5.4 Assessing Cumulative Landscape and Visual Effects

In terms of cumulative landscape and visual effects, other wind energy projects are of primary focus in Chapter 14, as only these would be described as very tall vertical elements in the landscape and therefore have greatest potential to give rise to significant cumulative effects.

The landscape of the site and its wider setting is a highly suitable area for the development of wind energy and consequently a variety of projects exist within differing stages of the wind farm life cycle (existing, permitted and proposed). Chapter 14 assesses the Proposed Development in combination with all *'likely future receiving environments'* (EPA, 2022) which includes all existing and permitted wind farm developments in the LVIA Study Area.

The landscape of the site and its wider setting is a highly suitable area for the development of wind energy and consequently a variety of projects exist within differing stages of the wind farm life cycle (existing, permitted and proposed). All wind farm developments in the LVIA Study Area are identified within one of the following categories:

- **Existing** – Existing wind energy developments currently operational in the baseline landscape at the time of conducting this LVIA;
- **Do-Nothing Scenario** - Permitted wind energy developments, permitted (consented) at the time of conducting this LVIA. These developments have a high probability of

being operational in a Do-Nothing Scenario – a potential future receiving landscape future receiving landscape.

- **Proposed** - All well-developed wind farm proposals with project specifications in the public domain at the time of conducting this LVIA. Cumulative effects between the Proposed Development and the other proposed developments within this category is more uncertain and is reliant on an outcome of the planning and consenting system.

These categories are a useful guide to enable understanding and structure when viewing the photomontage booklet and identification of other wind energy developments in Chapter 14 and the impact assessment appendices.

The effects reported both in the main chapter and within the assessment appendices (Appendix 14-2 - *LCA Assessment Tables*; Appendix 14-3 - *Photomontage Assessment Tables*) uses appropriate and logical narrative to discuss cumulative interactions between the Proposed Development and all other wind energy developments irrespective of which category they occur. Whilst the categories provide clarity in presentation of visuals considering the scope of potential development in this landscape, discussion of cumulative interactions on specific landscape and visual receptors is relative to the effects on that receptor and proportionate to the likelihood of significant landscape and visual effects occurring.

1.5.4.1 Cumulative Landscape Effects

The Nature Scot 2021 publication *Assessing the Cumulative Landscape and Visual Impact of Onshore Wind Energy Developments* identifies two principal areas of cumulative landscape effects, on the physical fabric of the landscape and on the landscape character, which state:

- *Cumulative effects on the **physical fabric** of the landscape arise when two or more developments affect landscape components such as woodland, dykes, rural roads or hedgerows. Although this may not significantly affect the landscape character, the cumulative effect on these components may be significant – for example, where the last remnants of former shelterbelts are completely removed by two or more developments.*
- *Cumulative effects on **landscape character** arise when two or more developments introduce new features into the landscape. In this way, they can change the landscape character to such an extent that they create a different landscape character type, in a similar way to large scale afforestation. That change need not be adverse; some derelict or degraded landscapes may be enhanced as a result of such a change in landscape character.*

Potential changes to the physical fabric outlined above are predominantly restricted to the Proposed Development site and the LCAs in which the site is located. Therefore, these landscape receptors will be assessed for cumulative landscape effects on the physical fabric of the landscape arising from the Proposed Development.

Cumulative effects on the landscape character will be assessed in the Landscape Character Areas (LCAs) that have theoretical visibility of the Proposed Development with particular emphasis on the LCA in which the proposed turbines will be located. Cumulative landscape effects are included in LCA Assessment Tables in Appendix 12-2 and summarised in the LVIA Chapter of the EIAR.

Error! Reference source not found. below taken from *Cumulative Impact of Wind Turbines on Landscape and Visual Amenity* (Carmarthenshire County Council, 2013) will be used to assign a current status of the LCAs (in a Do-Nothing Scenario) and whether the addition of the proposed turbines will change the status of any of the LCAs.

Table 1-10 Landscape types with regard to wind turbine development descriptions (Source Guidance on cumulative impact of wind turbines on landscape and visual amenity

	Landscape Status	Description
1	Landscape character area with no wind turbines	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
2	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s	Turbines are visible but are not at a scale, number, spacing or extent that makes them a defining/key characteristic. Turbines might be seen occasionally at close quarters but more often within background views.
3	Landscape character area with wind turbines	Turbines are located and visible and are at a scale and/or a spacing that makes them one of the defining/key characteristics. Turbines might be seen in the foreground, mid-ground or background. However, there would be other key characteristics which would be strong and there would be sufficient separation between turbines for views without turbines and other characteristics remaining dominant in these parts of the area.
4	Wind turbine landscape	Turbines are frequent and may include extensive wind farms and are the dominant, defining characteristic but there is separation between groups of turbines. However, within these areas wind turbines are likely to be visible.
5	Windfarm	Landscape fully developed as a wind farm with no clear separation between groups of turbines.

1.5.4.2 Cumulative Visual Effects

For this assessment, the Nature Scot (2021) definition of cumulative effects as additional changes caused by a Proposed Development in conjunction with other similar developments, is used, however, this assessment also considers other types of developments. The definition in the WEDGs (DoEHLG, 2006) defines cumulative impacts in terms of wind farms, as the perceived effect on the landscape of two or more wind energy developments visible from any one place.

The GLVIA (2013) and Nature Scot (2021) guidance also note that cumulative visual effects can be experienced **in combination**, where two or more developments are visible from one viewpoint, either **simultaneously** or **in succession** and these are considered in the assessment of visual effects from photomontage viewpoints in Appendix 14-3.

Another type of cumulative visual effect includes where two or more developments are seen **sequentially**, where a viewer moves to another viewpoint or along a transport or recreational route and sees the same or different developments. The photomontage viewpoints illustrate combined visibility and analysis of the photomontages, route screening, as well as site visits and field work undertaken enables sequential visibility to be assessed and reported in Chapter 14.

Chapter 6 of the WEDGs (DoEHLG, 2006) and the Draft WEDGs (DoHPLG, 2019) provides guidance in relation to '*Aesthetic Considerations in Siting and Design'* of wind energy developments. In relation to cumulative effects it reports the following:

- *"A landscape of complex landform and landcover provides a greater possibility of screening for more than one wind energy development;*
- *Similarity in the siting and design approach is preferred where a few wind energy developments are located in the same landscape character area, particularly within the same viewshed. However, an alternative approach where a particular aesthetic effect is sought may be acceptable.*
- *Different wind energy developments can appear as a single collective unit if located near each other.*
- *It is preferable to avoid locating turbines where they can be seen one behind another, when viewed from highly sensitive key viewpoints (for example, viewing points along walking or scenic routes, or from designated views or prospects), as this results in visual stacking and, thus, confusion. This may not be critical, however, where the wind energy development to the rear is in the distant background.*
- *Wind energy developments within relatively close proximity to one another, while in different landscape character contexts, may be so close as to be within the same visual unit and, therefore, should involve the same siting and design approach.*

The SNH 2017 publication *Siting and Designing Wind Farms in the Landscape* states that *'introducing turbines that are not similar in form, design, colour and scale may increase visual complexity and clutter'*.

Therefore, the cumulative assessment will concentrate on the following issues:

- Whether the proposed turbines increase the spatial extent of turbines in the view
- Whether the different wind energy developments can appear as a single collective unit or there is separation
- Whether 'visual stacking' occurs
- Whether the contrast of different size and design between different wind developments creates visual clutter.

As cumulative visual effects depend on the aspect from which the turbines will be seen various viewpoints were selected to give a thorough overview of the how the proposed turbines will appear in conjunction to existing, permitted and proposed turbines.

The assessment of cumulative effects was included in the viewpoint assessment tables in Appendix 14-3 and summarised in the LVIA Chapter of the EIAR – Chapter 14.