Mynydd Llanhilleth Wind Farm
Appendix 6A: Methodology
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1.1 This Appendix sets out the Landscape and Visual Impact Assessment approach used in **Chapter 6** of the Environmental Statement. The methodology herein forms the basis upon which the predicted landscape and visual impacts as a result of the Proposed Development have been derived.

1.2 Landscape and visual assessments are separate, though linked procedures. Landscape effects derive from changes in the physical landscape fabric which may give rise to changes in its character and how this is experienced. Visual effects relate to changes that arise in the composition of available views as a result of changes to the perception of the landscape, to people's responses to the changes and to the overall effects with respect to visual amenity.

Landscape Assessment

1.3 Landscape effects derive from changes in the physical landscape fabric that may give rise to changes in its character and how this is experienced. These effects need to be considered in line with changes already occurring within the landscape and which help to define the character of it.

1.4 Effects upon the wider landscape resource i.e. the landscape surrounding the Development, requires an assessment of visibility of the Development from adjacent landscape character areas, but remains an assessment of landscape character and not visual amenity.

Visual Assessment

1.5 The assessment of effects on visual amenity draws on the predicted effects of the Development, the landscape and visual context, and the visibility and viewpoint analyses, and considers the significance of the overall effects of the Development on the visual amenity of the main visual receptor types in the Study Area.

Identifying Landscape and Visual Receptors

1.6 The assessment seeks to identify the key landscape and visual receptors that may be affected by the changes proposed.

1.7 The assessment of effects on landscape as a resource in its own right draws on the description of the Development, the landscape context and the visibility and viewpoint analysis to identify receptors, which, for the Development may include, but not be limited to, the following:

- The landscape fabric of the Site;
- The key landscape characteristics of the local context;
- The 'host' landscape character areas that contains the Proposed Development (LANDMAP Aspect Areas and SLAs);
- The 'non-host' landscape character areas surrounding the host character area and may be indirectly affected by the Proposed Development (where relevant); and
- Landscape designations on a national, regional or local level (such as SLAs).

1.8 The locations and types of visual receptors within the defined study areas are identified from Ordnance Survey maps and other published information (such as walking guides), from fieldwork observations and from local knowledge provided during the consultation process. Examples of visual receptors may include, but not be limited to, the following:

- Settlements and private residences;
- Recreational users of designated landscapes;
- Users of Promoted Routes and National Trails;
- Users of local/regional cycle and walking routes;
- Those using local rights of way – walkers, horse riders, cyclists;
- Users of open spaces with public access;
- People using major (motorways, A and B) roads; and
- People using minor roads.

Assessment of Landscape and Visual Effects

1.9 The assessment of effects on the landscape resource includes consideration of the potential changes to those key elements and components that contribute towards recognised landscape character or the quality of designated landscape areas; these features are termed landscape receptors. The assessment of visual amenity requires the identification of potential visual

receptors that may be affected by the Development. As noted, following the identification of each of these various landscape and visual receptors, the effect of the Development on each of them is assessed through consideration of a combination of:

- Their overall sensitivity to the proposed form of Development, which includes the susceptibility of the receptor to the change proposed and the value attached to the receptor; and

- The overall magnitude of change that will occur - based on the size and scale of the change, its duration and reversibility.

1.10 The methodology for assessing landscape and visual effects used herein is based on the following best practice guidance:

- Guidelines for Landscape and Visual Impact Assessment – Third Edition (Landscape Institute and the Institute of Environmental Assessment, 2013);

- Using LANDMAP in Landscape and Visual Impact Assessments Guidance Note 46, Natural Resources Wales (2013);

- Designing Wind Farms in Wales, Design Commission for Wales (2014);

- Visual Representation of Wind Farms, Scottish Natural Heritage (Version 2.2) (2017);

- Guidance: Assessing the Cumulative;

- Impact of Onshore Wind Energy Developments, NatureScot (2021);

- Siting and Designing Windfarms in the Landscape, Scottish Natural Heritage (Version 3), (2017);

- Visual representation of development proposals, Landscape Institute Technical Guidance Note 02/17 (31 March 2017);

- Residential Visual Amenity Assessment (RVAA)-Technical Guidance Note 2/19: Landscape Institute, (15 March 2019); and

- Planning Guidance for Wind Turbine Development Landscape and Visual Impact Assessment Requirements, Heads of the Valleys Landscape Officers and Planners with support from The South Wales Landscape Liaison Group (2015).

1.11 Other reference documents used to understand the baseline position in landscape terms comprise published landscape character assessments appropriate to the Site's location and the nature of the Proposed Development.

1.12 The nature of landscape and visual assessment requires both objective analysis and subjective professional judgement. Accordingly, the following assessment is based on the best practice guidance listed above, information and data analysis techniques. It uses quantifiable factors wherever possible and subjective professional judgement where necessary and is based on clearly defined terms.

Defining Receptor Sensitivity

1.13 A number of factors influence professional judgement when assessing the degree to which a particular landscape or visual receptor can accommodate change arising from a particular development. Sensitivity is made up of judgements about the 'value' attached to the receptor, which is determined at baseline stage, and the 'susceptibility' of the receptor, which is determined at the assessment stage when the nature of the proposals, and therefore the susceptibility of the landscape and visual resource to change, is better understood.

1.14 Susceptibility indicates 'the ability of a defined landscape or visual receptor to accommodate the specific Proposed Development without undue negative consequences'[1]. Susceptibility of visual receptors is primarily a function of the expectations and occupation or activity of the receptor. A degree of professional judgement applies in arriving at the susceptibility for both landscape and visual receptors and this is clearly set out in the technical appendices to this assessment.

1.15 A location may have different levels of sensitivity according to the types of visual receptors at that location. Any one receptor type may be accorded different levels of sensitivity at different locations.

1.16 **Table EDP 1.1** provides an indication of the criteria by which the overall sensitivity of a landscape receptor is judged within this assessment and considers both value and susceptibility independently.

Table EDP 1.1: Landscape Receptor Sensitivity

Category	Landscape Receptor Value Criteria	Landscape Susceptibility to Change Criteria
Very High	Nationally/internationally designated/valued countryside and landscape features; strong/distinctive landscape characteristics; absence of landscape detractors.	Strong/distinctive landscape elements/ aesthetic/perceptual aspects; absence of landscape detractors; landscape receptors in excellent condition. Landscapes with clear and widely recognised cultural value. Landscapes with a high level of tranquillity.
High	Locally designated/valued countryside (e.g. Areas of High Landscape Value, Regional Scenic	Many distinctive landscape elements/ aesthetic/perceptual aspects; very few landscape detractors; landscape receptors

[1] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, Third Edition Page 158

Category	Landscape Receptor Value Criteria	Landscape Susceptibility to Change Criteria
	Areas) and landscape features; many distinctive landscape characteristics; very few landscape detractors.	in good condition. The landscape has a low capacity for change as a result of potential changes to defining character.
Medium	Undesignated countryside and landscape features; some distinctive landscape characteristics; few landscape detractors.	Some distinctive landscape elements/ aesthetic/perceptual aspects; few landscape detractors; landscape receptors in fair condition. Landscape is able to accommodate some change as a result.
Low	Undesignated countryside and landscape features; few distinctive landscape characteristics; presence of landscape detractors.	Few distinctive landscape elements/ aesthetic/perceptual aspects; presence of landscape detractors; landscape receptors in poor condition. Landscape is able to accommodate large amounts of change without changing these characteristics fundamentally.
Very Low	Undesignated countryside and landscape features; absence of distinctive landscape characteristics; despoiled/-degraded by the presence of many landscape detractors.	Absence of distinctive landscape elements/-aesthetic/perceptual aspects; presence of many landscape detractors; landscape receptors in very poor condition. As such landscape is able to accommodate considerable change.

1.17 For visual receptors, judgements of susceptibility and value are closely interlinked considerations. For example, the most valued views are those that people go and visit because of the available view – and it is at those viewpoints that their expectations will be highest and thus most susceptible to change. The overall sensitivity of visual receptors is rated in a two-step process that combines both susceptibility and value as indicated by the criteria in **Table EDP 1.2**.

Table EDP 1.2: Visual Receptor Sensitivity

Category	Visual Receptor Criteria
Very High	Designed view (which may be to or from a recognised heritage asset or other important viewpoint), or where views of the surroundings are an important contributor to the experience. Key promoted viewpoint e.g. interpretative signs. References in literature and art and/or guidebooks tourist maps. Protected view recognised in planning policy designation. Examples may include views from residential properties, especially from rooms normally occupied in waking or daylight hours; national public rights of way, e.g. National Trails and nationally designated countryside/landscape features with public access which people might visit purely to experience the view; and visitors to heritage assets of national importance.

Category	Visual Receptor Criteria
High	View of clear value but may not be formally recognised, e.g. framed view of high scenic value, or destination hill summits. It may also be inferred that the view is likely to have value, e.g. to local residents. Examples may include views from recreational receptors where there is some appreciation of the landscape, e.g. golf and fishing; local public rights of way, access land and National Trust land, also panoramic viewpoints marked on maps; road routes promoted in tourist guides for their scenic value.
Medium	View is not promoted or recorded in any published sources and may be typical of the views experienced from a given receptor. Examples may include people engaged in outdoor sport other than appreciation of the landscape e.g. football and rugby or road users on minor routes passing through rural or scenic areas.
Low	View of clearly lesser value than similar views experienced from nearby visual receptors that may be more accessible. Examples may include road users on main road routes (motorways/A roads) and users of rail routes or people at their place of work (where the place of work may be in a sensitive location). Also views from commercial buildings where views of the surrounding landscape may have some limited importance.
Very Low	View affected by many landscape detractors and unlikely to be valued. Examples may include people at their place of work, indoor recreational or leisure facilities or other locations where views of the wider landscape have little or no importance.

1.18 The tables above offer a template for assessing overall sensitivity of any landscape or visual receptor as determined by combining judgements of their susceptibility to the type of change or development proposed and the value attached to the landscape as set out at paragraph 5.39 of GLVIA 3rd Edition (2013). However, the narrative in this report may demonstrate that assessment of overall sensitivity can change on a case-by-case basis.

1.19 For example, a high susceptibility to change and a low value may result in a medium overall sensitivity, unless it can be demonstrated that the receptor is unusually susceptible or is in some particular way more valuable. A degree of professional judgement applies in arriving at the overall sensitivity for both landscape and visual receptors.

Magnitude of Change

1.20 The magnitude of any landscape or visual change is determined through a range of considerations particular to each receptor. The three attributes considered in defining the magnitude are:

- Scale of change;

- Geographical extent; and
- Duration and reversibility/proportion.

1.21 Receptor locations from which views of the Proposed Development are not likely to occur will receive no change and therefore no effect. With reference to the Zone of Theoretical Visibility (ZTV) and site survey, the magnitude of change is defined for receptor locations from where visibility of the Proposed Development is predicted to occur.

1.22 **Table EDP 1.3** provides an indication of the criteria by which the size/scale of change at a landscape or visual receptor is judged within this assessment.

Table EDP 1.3: Landscape and Visual Receptor Magnitude of Change Criteria

Category	Landscape Receptor Criteria	Visual Receptor Criteria
Very High	Total loss of or major alteration to key elements/features/characteristics of the baseline condition. Addition of elements which strongly conflict with the key characteristics of the existing landscape.	There would be a substantial change to the baseline, with the Proposed Development creating a new focus and having a defining influence on the view.
High	Notable loss or alteration to one or more key elements/features/characteristics of the baseline condition. Addition of elements that are prominent and may conflict with the key characteristics of the existing landscape.	The Proposed Development will be clearly noticeable and the view would be fundamentally altered by its presence.
Medium	Partial loss or alteration to one or more key elements/features/characteristics of the baseline condition. Addition of elements that may be evident but do not necessarily conflict with the key characteristics of the existing landscape.	The Proposed Development will form a new and recognisable element within the view which is likely to be recognised by the receptor.
Low	Minor loss or alteration to one or more key elements/features/characteristics of the baseline landscape. Addition of elements that may not be uncharacteristic within the existing landscape.	The Proposed Development will form a minor constituent of the view being partially visible or at sufficient distance to be a small component.
Very Low	Barely discernible loss or alteration to key elements/features/characteristics of the baseline landscape. Addition of elements not uncharacteristic within the existing landscape.	The Proposed Development will form a barely noticeable component of the view, and the view whilst slightly altered would be similar to the baseline situation.

Category	Landscape Receptor Criteria	Visual Receptor Criteria
Imperceptible	In some circumstances, changes at representative viewpoints or receptors will be lower than 'Very Low' and changes will be described as 'Imperceptible'. This will lead to negligible effect.	

1.23 **Table EDP 1.4** provides an indication of the criteria by which the geographical extent of the area affected is adjudged within this assessment.

Table EDP 1.4: Geographical Extent Criteria

	Landscape Receptors	Visual Receptors
Largest ↕ Smallest	Large scale effects influencing several landscape types or character areas.	Direct views at close range with changes over a wide horizontal and vertical extent.
	Effects at the scale of the landscape type or character areas within which the proposal lies.	Direct or oblique views at close range with changes over a notable horizontal and/or vertical extent.
	Effects within the immediate landscape setting of the site.	Direct or oblique views at medium range with a moderate horizontal and/or vertical extent of the view affected.
	Effects at the site level (within the development site itself).	Oblique views at medium or long range with a small horizontal/vertical extent of the view affected.
	Effects only experienced on parts of the site at a very localised level.	Long range views with a negligible part of the view affected.

1.24 The third, and final, factor, in determining the predicted magnitude of change is duration and reversibility. Duration and reversibility are separate but linked considerations. Duration is judged according to the defined terms set out below, whereas reversibility is a judgement about the prospects and practicality of the particular effect being reversed in, for example, a generation. The categories used in this assessment are set out below.

Duration:

- Long term (20 years+);
- Medium to long term (10 to 20 years);
- Medium term (5 to 10 years);
- Short term (1 year to 5 years); and
- Temporary (less than 12 months).

Reversibility:

- Permanent with unlikely restoration to original state, e.g. major road corridor, power station, urban extension etc.;
- Permanent with possible conversion to original state, e.g. agricultural buildings, retail units;
- Partially reversible to a different state, e.g. mineral workings;
- Reversible after decommissioning to a similar original state, e.g. wind energy development; and
- Quickly reversible, e.g. temporary structures.

Significance of Effect

1.25 The purpose of the Environmental Impact Assessment (EIA) process is to identify the significant environmental effects (both beneficial and adverse) of development proposals. Schedule 4 to the EIA Regulations specifies the information to be included in all environmental statements, which should include a description of:

"The likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development."

1.26 In order to consider the likely significance of any effect, the sensitivity of each receptor is combined with the predicted magnitude of change to determine the significance of effect, with reference also made to the geographical extent, duration and reversibility of the effect within the assessment. Having taken such a wide range of factors into account when assessing sensitivity and magnitude at each receptor, the significance of effect can be derived by combining the sensitivity and magnitude in accordance with the matrix in **Table EDP 1.5**.

Table EDP 1.5: Level of Effects Matrix

Overall Sensitivity	**Overall Magnitude of Change**				
	Very High	**High**	**Medium**	**Low**	**Very Low**
Very High	**Substantial**	**Major**	**Major/ Moderate**	**Moderate**	Moderate/ Minor
High	**Major**	**Major/ Moderate**	**Moderate**	Moderate/ Minor	Minor
Medium	**Major/ Moderate**	**Moderate**	Moderate/ Minor	Minor	Minor/ Negligible
Low	**Moderate**	Moderate/ Minor	Minor	Minor/ Negligible	Negligible
Very Low	Moderate/ Minor	Minor	Minor/ Negligible	Negligible	Negligible/ None

1.27 Each effect is described and evaluated individually through the combination of all of the relevant factors and assessed as either significant or not significant. For landscape and visual effects, those effects identified at a substantial, major, major/moderate or moderate level (bold type within matrix above) are generally considered to be significant and those effects assessed at a moderate/minor, minor, minor/negligible or negligible level are considered to be not significant.

1.28 The parameters identified for the evaluation of effects follows recommendations for the assessment of visual effects, in guidance published by Scottish Natural Heritage[2] (now NatureScot), which states:

"The…matrix of three classes on each axis producing 9 cells, only 3 of which are typically judged as significant, is in our view simplistic and unrefined and quite unsuitable as a tool for widespread use. In particular it implies a degree of certainty about a very restricted definition of significance that we do not believe is justified. Expanding a 3 x 3 (9 cells) matrix to 4 x 4 (16 cells) or even 5 x 5 (25 cells) is much more representative of the diversity of size and sensitivity found in visual impact assessment."

1.29 Although not current guidance, we feel an expanded matrix is helpful alongside professional judgement.

1.30 In certain cases, where additional factors may arise, a further degree of professional judgement may be applied when determining whether the overall change in the view will be significant or not and, where this occurs, this is explained in the assessment. For example, in cases where a moderate/minor effect is experienced by a high or very high sensitivity receptor, this may be considered to be significant. Where this occurs, further explanation is given.

[2] Scottish Natural Heritage (2002) Visual Assessment of Windfarms Best Practice, Scottish Natural Heritage Commissioned Report F01AA303A

Definition of Effects

1.31 Taking into account the levels of effect described above, and with regard to effects being either adverse or beneficial, the table below represents a description of the range of effects likely at any one receptor.

Table EDP 1.6: Definition of Effect

Effect	Definition
Substantial	Effects which are in complete variance to the baseline landscape resource or visual amenity.
Major	Effects which result in noticeable and fundamental alterations to the landscape resource or visual amenity.
Moderate	Effects which result in noticeable but non-fundamental alterations to the baseline landscape resource or visual amenity.
Minor	Effects which result in slight alterations to the landscape resource or visual amenity.
Negligible	Effects which result in barely perceptible alterations to the landscape resource or visual amenity.
None	No detectable alterations to the landscape resource or visual amenity.

1.32 Effects can be adverse (negative), beneficial (positive) or neutral. The landscape effects will be considered against the landscape baseline, which includes published landscape strategies or policies if they exist. Changes involving the addition of large-scale, man-made objects are typically considered to be adverse as they are not usually actively promoted as part of published landscape strategies. Accordingly, the assessment of landscape effects as a result of these aspects of the Development will be assumed to be adverse, unless otherwise stated within the assessment.

1.33 Visual effects are more subjective as people's perception of development varies through the spectrum of negative, neutral and positive attitudes. In the assessment of visual effects, the assessor will exercise objective professional judgement in assessing the level of effects and, unless otherwise stated, will assume that all effects are adverse, thus representing the worst-case scenario.

Cumulative Landscape and Visual Impact Assessment (CLVIA)

1.34 CLVIA predicts and evaluates the likely significant landscape and visual effects that may result from the Proposed Development in combination with other wind farm development. The purpose of CLVIA "*is to describe, visually represent and assess the ways in which a proposed wind farm would have additional impacts when considered with other consented or proposed wind farms. It should identify the significant cumulative impacts arising from the proposed wind farm.*"

1.35 CLVIA follows the same broad method and approach used for LVIA as set out above, and the assessment itself follows the same principles for assessment which is in accordance with the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition[3] (GLVIA3).

1.36 In addition to GLVIA3, NatureScots' Guidance on Assessing the Cumulative Impact of Onshore Wind Energy Developments[4] has been used to inform the CLVIA. Based on NatureScots' guidance, two scenarios have been considered at a high level:

- Scenario A – The Proposed Development with Operational and Consented Schemes; and
- Scenario B - The Proposed Development with Operational and Consented + Schemes in Planning and in Scoping.

1.37 The CLVIA study area of slightly larger than 26km was agreed with Statutory Consultees during the scoping process. Wind farm developments within 27km of the nearest turbine proposed which are Operational, Consented, in Planning and/or in Scoping have been identified. Single turbines of 45m to tip or higher have been scoped in within 3km and turbines higher than 50m to tip have been considered within 27km.

1.38 There are variables on which assumptions must be based, such as the duration, design and number of turbines associated with other applications. Other applications in planning and in scoping are of course subject to change. The number size and distribution of arrays may vary. Secondly, other operational and consented developments under consideration in the cumulative LVIA are likely to be at various stages in their lifespan. The lifespan of the Proposed Development at operation is 30 years. The default position taken by the assessor to make a judgement on the levels of effect therefore considers that the Proposed Development and the other applications would have a similarly long-term duration to demonstrate worst case. In reality, the timescales of operational, consented, application in planning and those in scoping would vary considerably.

1.39 ZTVs have been mapped for both scenarios and these are based on the blade tip ZTV (180m), which is worst case. The extent of visibility of other windfarms in combination with the Proposed Development has been clipped to the Proposed Development's ZTV, as the basis of this evaluation only considers areas from with the Proposed Development is itself visible, and how many wind farms developments it is visible in combination with.

1.40 Potential cumulative effects on landscape character and on visual amenity have been considered separately.

1.41 With respect to landscape character, NatureScot (2021) outlines that as well as impacts on the physical fabric (and of greater consequence to landscapes beyond that of the Site), cumulative impacts on landscape character arise when "*two or more developments introduce new features*

[3] Landscape Institute and the Institute of Environmental Management and Assessment, (2013). Guidelines for Landscape and Visual Impact Assessment. 3rd edition. London. Routledge.
[4] NatureScot, (2021). Guidance: Assessing the Cumulative Impact of Onshore Wind Energy Developments. (Accessed Online).

into the landscape", where changes may occur to "*such an extent that they create a different landscape character type, in a similar way to large scale afforestation*". Given the complexity of the landscape, the amount of landscape receptors within 27km, and the scale of the Study Area (over 80km sq.), a pragmatic approach has been employed to consider the pattern and relationships of applications within the Study Area in general with respect to landscape character. A high-level assessment then specifically focusses on the character areas of the Brecon Beacon's National Park. The BBNP ranges from within 5km to beyond 27km of the Site, it is situated east, north-east, north and north-west, therefore, it is also representative of potential cumulative landscape effects from a range of distances and directions.

1.42 With respect to visual amenity, 360-degree wireframes have been prepared from each of the 30 Photoviewpoints assessed in the LVIA. However, A degree of pragmatism is advised by NatureScot "*to limit the number of viewpoints to those which are likely to provide useful information to inform decision making*". It is accepted that where significant impacts have been judged a result of the Proposed Development alone, an assumption can be made that significant cumulative impacts would also be found. Therefore, the focus of the CLVIA PVP assessment describes and assesses the likely cumulative visual impact on those LVIA PVPs with Not Significant effects reported where the Proposed Development alone has been assessed.

1.43 Typically, the level of effect ascribed for Not Significant impacts is a Moderate/Minor level of effect, or less. With respect to LVIA, there are instances where the assessor has used professional judgement to elevate levels of effect to Significant were deemed appropriate but where this occurs, justification is given.

1.44 NatureScot guidance elaborates on two types of views for consideration in CLVIA, and this is quoted below:

"***Combined*** *visibility occurs where the observer is able to see two or more developments from one viewpoint. Assessments should consider the combined effect of all wind farms which are (or would be) visible from relevant viewpoints. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).*

Sequential *impacts occur when the observer has to move to another viewpoint to see different developments. Sequential impacts should be assessed for travel along regularly-used routes like major roads, railway lines, ferry routes, popular paths, etc. The magnitude of sequential effects will be affected by speed of travel and distance between viewpoints."*

1.45 As with LVIA, the nature of a cumulative impact may also be described as direct/indirect, temporary/permanent, adverse or neutral. The probability of a cumulative effect occurring may also be described (probable, likely or uncertain/unknown).

Photomontage Methodology

1.46 Photographs were captured using a Canon 5d Mk III full-frame camera with a 50mm fixed focal length lens. A tripod with a gradated head is used and photographs are taken every 15 degrees. Photographs are taken either portrait or landscape depending on the field of view required.

1.47 In some cases, particularly when shots are required to be taken close to a proposal that is tall, a 20mm lens will be used.

1.48 Centimetre accurate GPS equipment is used to log the camera position to OS GB15. The GPS also records level aOD. GPS and other survey equipment is used to collect data on items within shot which may be used to anchor the computer model into the photograph. The accuracy of this data can be to within 10mm.

1.49 To prepare a photomontage, photographs are stitched using cylindrical processing Adobe Photoshop software and the following steps are taken:

- The panoramic views are imported into Resoft Windfarm software;
- Details of the various windfarms required are imported into the software;
- A viewpoint is set up using the co-ordinates taken with the GPS;
- The wireline terrain is matched to the photograph using various Locators. These Locators' positions are obtained using Promap. The terrain and horizon are also used to position the view;
- The wireline and rendered turbines are exported from Windfarm;
- Photoshop is used to mask the turbines behind trees etc where required; and
- The final image is saved as a high-quality JPEG.

Cumulative Photomontages

1.50 For the production of Cumulative photomontages, the same approach is taken as described above with the cumulative windfarms mapped and rendered.

Night Photography and Visualisations

1.51 Night photography was taken from the same location as the PVPs using the recorded GPS data. Photography was captured at different exposure levels and the most representative light level was used.

1.52 Photography was stitched, where possible, using the same methodology as for Photomontages. In cases where this was not possible due to lack of light variation, the photos were stitched manually by overlaying them with day views. All night views are then overlayed with the daytime view to ensure the views were an accurate match.

1.53 Aviation light positions were modelled using Autodesk 3ds Max and rendered using VRay. A standard value of 300W was used for the lights taken from technical specifications. The rendered lights were matched over the stitched night photography.

1.54 It should be noted that producing lighting images is, by its nature, subjective. Atmospheric conditions at altitude, the way the camera sensor interprets pinpoints of light, dust on the lens, exposure times, aperture size and the optics of the lens can all affect how lighting is perceived by the camera.

Zone of Theoretical Visibility

1.55 As part of the scoping and analysis for this assessment, data processing has been undertaken to produce ZTV plans. A ZTV represents areas from which a site or object(s) within a site are theoretically visible. It is calculated using topographical data, observer height information (average human eye height), height of the site or object(s), and location points of site or object(s). The data that has been used to create ZTVs for the purpose of this project is as follows:

- Topographical data: OS Terrain 5[5] (Digital Terrain Model (DTM), up to 5km) and OS Landform Panorama DTM ASCII XYZ[6] (up to 26km);
- Observer height: 1.6m;
- Site/object height: 0m (site), 122m (proposed turbine hub height), 180m (proposed turbine blade tip height); and
- Site/object location: Even and regular distribution of points across the site, points at the location of each proposed turbine.

1.56 The above data was processed using a geographical information system (GIS) resulting in the production of a variety of ZTV maps used as part of the assessment. The following were produced:

- ZTV of site as existing (using OS Landform Panorama and 0m site height);
- ZTV of Proposed Turbine Hubs across a 5km radius (using OS Terrain 5 and 122m object height);

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[6] Contains public sector information licensed under the Open Government Licence v3.0

- ZTV of Proposed Turbine Hubs across 15km and 26km radiuses (using OS Landform Panorama and 122m object height);
- ZTV of Proposed Turbine Blade Tips across a 5km radius (using OS Terrain 5 and 122m object height); and
- ZTV of Proposed Turbine Blade Tips across 15km and 26km radiuses (using OS Landform Panorama and 122m object height).

1.57 The ZTV provides a representation of where a site or Proposed Development (Wind Turbines) may be visible from. In the instances listed above, DTM data has been used. This provides aOD (above Ordinance Datum) data based on the landform only and does not include built form or vegetation. It is for this reason, therefore, that ZTV produced using DTM is based on the 'worst case' scenario.

Cumulative Zone of Theoretical Visibility

1.58 For the purposes cumulative assessments, ZTV plans have been created to represent the theoretical visibility of the Proposed Development in combination with other wind farm developments identified within the scope parameters agreed at scoping.

1.59 Data was processed to produce a ZTV for each cumulative wind farm development. This data was then converted into a binary format. Each ZTV produced was then combined to produce data on the quantity of cumulative sites that could be theoretically visible alongside the Proposed Development from any point with the Study Area. The final output was clipped to the Proposed Development ZTV to blade tip.

1.60 The following data was used in production of the cumulative ZTV plans:

- Topographical data: OS Landform Panorama;
- Observer height: 1.6m;
- Site/object height: e.g. Site contours, hub height or blade tip height[7]; and
- Site/object location: Turbine location points.

[7] Blade tip data gathered from Planning Authorities and Welsh Government planning portals