LLŶR FLOATING OFFSHORE WIND PROJECT

Llŷr 1 Floating Offshore Wind Farm

Environmental Statement

Volume 6: Appendix 23A – Seascape, Landscape and Visual Impact Assessment (SLVIA) Methodology

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FLOVENTIS ENERGY

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Acronyms and abbreviations

Acronym or abbreviation	Definition	Acronym or abbreviation	Definition
CAA	Civil Aviation Authority	OS	Ordnance Survey
cd	Candela	SLVIA	Seascape, Landscape and Visual Assessment
DTM	Digital Terrain Model	SNH	Scottish Natural Heritage (now known as NatureScot)
GLVIA	Guidelines for Landscape and Visual Impact Assessment	WTG	Wind Turbine Generator
HAT	Highest Astronomical Tide	ZTV	Zone of Theoretical Visibility
NRW	Natural Resources Wales		

Glossary of project terms

Term	Definition
The Applicant	The developer of the Project, Llŷr Floating Wind Limited
Array	All wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s).
Array Area	The area within which the wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure will be located
Floventis Energy	A joint venture company between Cierco Ltd and SBM Offshore Ltd of which Llŷr Floating Wind Limited is a wholly owned subsidiary.
Landfall	The location where the offshore export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays (TJB).
Llŷr 1	The proposed Project, for which the Applicant is applying for Section 36 and Marine Licence consents. Including all offshore and onshore infrastructure and activities, and all project phases.
Marine Licence	A licence required under the Marine and Coastal Access Act 2009 for marine works which is administered by Natural Resources Wales (NRW) Marine Licensing Team (MLT) on behalf of the Welsh Ministers.
Offshore Development Area	The footprint of the offshore infrastructure and associated temporary works, comprised of the Array Area and the Offshore Export Cable Corridor, as defined, that forms the offshore boundary for the S36 Consent and Marine Licence application
Offshore Export Cable	The cable(s) that transmit electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OfECC)	The area within which the offshore export cable circuit(s) will be located, from the Array Area to the Landfall.

Term	Definition
Onshore Development Area	The footprint of the onshore infrastructure and associated temporary works, comprised of the Onshore Export Cable Corridor and the Onshore Substation, as defined, and including new access routes and visibility splays, that forms the onshore boundary for the planning application.
Onshore Export Cable(s)	The cable(s) that transmit electricity from the landfall to the onshore substation
Onshore Export Cable Corridor (OnECC)	The area within which the onshore export cable circuit(s) will be located.
proposed Project	All aspects of the Llŷr 1 development (i.e. the onshore and offshore components).
Onshore Substation	Located within the Onshore Development Area, converts high voltage generated electricity into low voltage electricity that can be used for the grid and domestic consumption.
Section 36 consent	Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works.

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23-A- SLVIA METHODOLOGY

23.1 Introduction

1. Llŷr Floating Wind Ltd (hereafter the Applicant) is proposing to develop the Llŷr 1 Floating Offshore Wind Farm (hereafter referred to as the proposed Project), located approximately 35 km off the coast of Pembrokeshire in the Celtic Sea.
2. The proposed Project is a test and demonstration wind farm development, comprising up to 10 wind turbine generators (WTGs) with a rating of between 14 MW and 19 MW per turbine and associated infrastructure. The proposed Project will make landfall at Freshwater West before connecting into the national grid network at Pembroke Dock power station.
3. This Appendix provides details of the approach and methodology used for the Seascape, Landscape and Visual Impact Assessment (SLVIA) for the offshore elements of the proposed Project set out in **Chapter 23 – Seascape, Landscape and Visual**.
4. Seascape/landscape and visual effects are interrelated to one another but are assessed separately in line with good practice. Seascape and landscape character effects relate to changes to both the physical elements of the seascape/landscape and the perceptual aspects and qualities which contribute to its distinctive character. Visual effects relate to changes to views experienced by people through the addition and/or removal of elements.
5. The SLVIA focuses on likely significant effects that may arise as a result of the proposed Project, both on its own and also in combination with other existing and proposed wind farms.

23.2 Guidance

6. The methodology has been developed by Chartered Landscape Architects and has been informed by the principles set out in good practice guidance coupled with professional experience of undertaking SLVIAs for wind farms. The principal guidance documents which have informed the methodology include:

    - Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute, and Institute of Environmental Management & Assessment (2013) (GLVIA);
    - Assessing landscape value outside national designations, Technical Guidance Note 02/21, Landscape Institute (2021);
    - LANDMAP Guidance Note 46: Using LANDMAP in Landscape and Visual Impact Assessments, Natural Resources Wales (NRW) (2016)
    - Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance (Stage 1 to 3), NRW (2019);
    - Siting and Designing Wind Farms in the Landscape, Guidance, Version 3a, Scottish Natural Heritage (SNH) (2017);
    - Assessing the Cumulative Impact of Onshore Wind Energy Developments, SNH (2021);
    - Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report, Department of Trade and Industry (2005); and
    - Visual Representation of Wind Farms, Version 2.2, SNH (2017),

23.3 Technical Scope

7. The SLVIA aims to identify the likely significant seascape, landscape and visual effects of the proposed Project.
8. When considering the potential changes that future development may have on the seascape and landscape, it is necessary to identify those key elements of the seascape or landscape

which make it distinctive. Seascape and landscape effects arise from changes to the physical components of the seascape/landscape, its character and how this is experienced.

9. In relation to 'visual effects', visual amenity can be described as the appreciation or pleasantness of the views people enjoy of their surroundings and as such includes a degree of subjectivity. The visual assessment determines the degree of anticipated change to views and visual amenity that would occur as a result of the proposed Project, based on professional judgement. The visual assessment considers both fixed views from static locations and sequential views experienced from key recreational routes.

10. Seascape, landscape and visual effects can be positive (beneficial), neutral or negative (adverse). The seascape, landscape and visual resource of an area can be affected both directly and indirectly. GLVIA (page 36, paragraph 3.22) requires consideration of landscape and visual effects as follows:

11. '*…thought must be given to whether the likely significant landscape and visual effects can result directly from the development itself (direct effects) or from consequential change resulting from the development (indirect and secondary effects); are additional effects caused by the proposed development when considered in conjunction with other proposed developments of the same or different types (cumulative effects); are likely to be short term or to carry on over a longer period of time; are likely to be permanent or temporary, in which case their duration is important; are judged to be positive (beneficial) or negative (adverse) in their consequences for landscape or for views and visual amenity*'.

12. The proposed Project includes medium intensity aviation obstruction lighting on the nacelle of the WTGs, in line with Civil Aviation Authority (CAA) requirements. Aviation lighting has the potential to contribute to seascape, landscape and visual effects and as such the assessment findings include consideration of potential change experienced during the daytime and at night. Judgements related to the influence of visible lighting at night are informed by technical lighting information coupled with qualitative assessments based on an understanding of the night-time baseline. **Appendix 23D – Night-time Visual Assessment** provides background information related to the requirements for aviation lighting and an overview of the approach taken for the proposed Project. Further information on aviation lighting is provided in **Chapter 27 – Aviation and Radar**.

13. The SLVIA also considers potential cumulative effects of the proposed Project with other onshore and offshore wind farms. Cumulative effects arise from the additional changes brought about by one development in conjunction with those of one or more similar developments. Other wind farm developments that are operational, are under construction, have been granted planning consent or are subject to a planning application have been identified for inclusion in the cumulative assessment. In addition, a nearby scoping stage project (Valorous) has been included at the request of NRW. The cumulative assessment considers potential effects on seascape and landscape receptors, static viewpoint locations and potential sequential effects on the Pembrokeshire Coast Path.

23.4 Temporal Scope

14. Levels of seascape, landscape and visual change can differ from one stage of the project to the next and therefore it is necessary to consider potential effects at each phase. The type and duration of the landscape and visual effects considered in this assessment fall within three main phases, as described below.

23.4.1. Construction Phase

15. Construction stage effects relate to changes that are temporary in nature and of a short duration (up to a maximum of 24 months), and may include the following:

- Potential temporary physical change arising from construction of the proposed Project on the landscape resource; and
- Potential temporary change to seascape or landscape character or visual amenity within the wider Study Area as a result of visibility of construction activities or the proposed Project during construction.

16. For the purposes of this assessment, proposed permanent structures, including WTG, are not included within the construction stage assessment as potential impacts of the partially constructed structures are considered to be similar to, but less than, the completed structures which are assessed as part of the operational phase, as described below. At this stage the assessment therefore relates to the temporary construction activities, boats and machinery which are only present in the construction phase.

23.4.2. Operational Phase

17. Operation stage effects relate to longer term changes anticipated to occur during the operational lifespan of the proposed Project, which is proposed to be 30 years. Operational stage seascape, landscape and visual effects may occur as a result of the following:

- Potential change to perceptual aspects of seascape and landscape character and designations and to views and visual amenity resulting from introduction of up to 10 WTGs with a maximum hub height of 177 m and blade tip height of 325.5 m above sea level; and
- Potential cumulative change resulting from the proposed Project in combination with other existing, consented and proposed onshore and offshore wind farms, upon the seascape, landscape and visual resource of the Study Area.

18. The LVIA is based on the maximum blade tip and hub heights as this is considered to represent the 'worst case' scenario. In reality the hub heights may be lower to facilitate a larger rotor diameter/blade length, within the stated maximum parameters. Aviation obstruction lighting would be provided on each of the WTGs, as described in **Appendix 23D – Night-time Visual Assessment**. Infra-red aviation lighting may also be required but as this type of lighting is not visible to the naked eye it is not considered within the SLVIA.

23.4.3. Decommissioning

19. Effects arising from the process and activities associated with decommissioning have been considered but are not assessed in detail as they are of a similar nature to construction issues (in reverse), but would be less intrusive, of a smaller scale and shorter duration. Decommissioning effects would be temporary and of a short duration (anticipated period of 12 months).

23.5 Study Area

20. The Study Area for the SLVIA has been defined on the basis of the maximum parameters of the proposed Project, mapping and desk-based research and modelling, professional judgement and good practice guidance, including *Visual Representation of Wind Farms* (SNH, 2017).

21. Initial desk-based research included review of mapping and a range of publications in order to identify potentially sensitive seascape, landscape and visual receptors. Analysis of potential

visibility of the proposed WTGs was then undertaken, including through the use of Zone of Theoretical Visibility (ZTV) mapping and wirelines based on a 3D digital terrain/topographical model. This modelling and analysis involved consideration of WTGs with a maximum height of 325.5m above sea level based on Highest Astronomical Tide (HAT) across the full extent of the Array Area.

22. The extent of the Study Area has been defined as 45 km from the outermost proposed WTGs. It is acknowledged that there may be potential visibility of the proposed Project beyond 45 km in certain conditions. However, the Study Area extent is considered to be the outer limit of potential for significant seascape, landscape and visual effects. The extent of the Study Area has been agreed in consultation with NRW and Pembrokeshire Coast National Park Authority.

23.6 Assessment Process

23. The SLVIA have been undertaken in accordance with the approach and principles set out in GLVIA and with reference to the guidance listed in **Section 23.2**, above.

24. The assessments have been undertaken based on the following main steps:

- Establishment of the baseline,
- Appreciation of the proposed Project, and
- Assessment of effects.

23.6.1. Establishment of the Baseline

25. A baseline study has been undertaken through a combination of desk-based research and site appraisal in order to establish the existing conditions of the seascape, landscape and visual resources of the Study Area.

26. The seascape and landscape baseline study identifies landscape designations and distinct seascape and landscape character units within the Study Area and describes their key characteristics and special qualities. The visual baseline aids in the identification of potential visual receptor locations and provides a description of the nature of the existing views.

23.6.2. Appreciation of the Proposed Project

27. In order to be able to accurately assess the full extent of likely effects on seascape and landscape character and visual amenity it is essential to develop a thorough and detailed knowledge of the proposed Project. This includes a comprehensive understanding of its location, nature and scale and is achieved through a review of drawings, computer modelling and on-site appraisal. The SLVIA includes consideration of all offshore elements of the proposed Project as detailed in **Chapter 04: Description of the Proposed Project**.

28. The final locations of the proposed WTGs within the Array Area will be determined as part of the detailed design process undertaken post consent. This process will consider available guidance on design of wind farms, including:

- Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance (Stage 2), NRW (2019); and
- Siting and Designing Wind Farms in the Landscape, Guidance, Version 3a, SNH (2017).

29. The SLVIA is based on an indicative layout consisting of the maximum number of WTGs (10) with a maximum blade tip height of 325.5m and hub height of 177m from sea level at HAT. The WTGs have been positioned to extend across the full Array Area and therefore occupy the maximum horizontal field of view, while seeking to achieve a relatively balanced layout from

the majority of the viewpoint locations. This represents a reasonable worst case approach based on the identified maximum parameters. Assessment of Effects

30. The landscape and visual assessments seek to identify, predict, and evaluate the significance of potential effects upon seascape and landscape characteristics and established views. The assessments are based on an evaluation of the sensitivity to change and the magnitude of impact for each identified seascape, landscape or visual receptor. For clarity and in accordance with good practice, the assessment of potential effects on seascape and landscape character and visual amenity, although closely related, are undertaken separately.

31. The initial stage of assessment involved a process of desk and field-based survey to refine the scope of the detailed assessment in order to ensure a proportionate approach, focused on potential significant effects. This process involved preparation and analysis of ZTV calculations to determine the extent of potential visibility of the proposed Project. Those receptors located fully or predominantly outside the extent of the ZTV were then scoped out of the assessment. The remaining receptors were then subject to a preliminary assessment in order to identify those with the potential for significant effects and therefore taken forward to detailed assessment. An explanation and reasoned justification are provided for any receptors scoped out at the preliminary assessment stage.

32. The prominence of the WTGs in the landscape or view would vary according to the prevailing weather conditions. The assessments have been carried out assuming the 'worst case' scenario, namely on a clear, bright day in winter, when neither foreground deciduous foliage nor haze can interfere with the clarity of the view obtained. Determining the potential worst case in respect of the aviation lighting is more complex as the lighting operates at different intensities depending on the atmospheric conditions. In clear conditions (visibility greater than 5 km) when the lighting is theoretically more likely to be visible it would be operating on a lower intensity mode, 10% of that of the peak intensity. Conversely when the atmospheric conditions result in visibility of less than 5 km the lighting would be operating at the peak intensity mode but would often be at least partially obscured by cloud. The assessments are undertaken by considering the theoretical, but unlikely, worst case of the lights operating at full intensity during clear visibility, with indication of the more realistic scenario that when lights are visible they would be operating at the lower intensity mode or would be at least partially obscured by cloud. Further details on the influence of weather and angle of view in relation to aviation lighting is provided in **Appendix 23D – Night-time Visual Assessment**.

33. GLVIA places a strong emphasis on the importance of professional judgement in identifying and defining the significance of seascape, landscape and visual effects. This SLVIA has been undertaken by Chartered Landscape Architects and professional judgement has been used in combination with structured methods and criteria to evaluate value, susceptibility, sensitivity, magnitude, and significance of effect.

23.7 Method of Assessment

23.7.1. Seascape and Landscape Sensitivity to Change

34. The sensitivity of a seascape and landscape to change varies according to the nature of the existing resource and the nature of the proposed changes which may result from the proposed Project. The sensitivity of the seascape or landscape receptor is a combination of the value (undertaken as part of the baseline study) and the susceptibility to change of the receptor to the specific type of development being assessed.

35. Seascape and landscape value is frequently addressed by reference to international, national, regional, and local designations, determined by statutory bodies and planning agencies.

Absence of such a designation does not necessarily imply a lack of quality or value. Factors such as accessibility and local scarcity can render areas of nationally unremarkable quality, valuable as a local resource. The evaluation of seascape and landscape value is informed by the Landscape Institute TGN 02/21 and GLVIA page 84, paragraph 5.28 / Box 5.1, and has been undertaken considering the following factors and classified as very high, high, medium, low or negligible with evidence provided as to the basis of the evaluation:

- Natural heritage – extent to which a seascape/landscape has clear evidence of ecological, geological, geomorphological, or physiographic interest which contribute positively to the seascape/landscape.
- Cultural heritage – extent to which a seascape/landscape has clear evidence of archaeological, historical or cultural interest which contribute positively to the seascape/landscape.
- Quality and condition - the measure of the physical state of the seascape/landscape including the overall intactness and the condition of individual elements.
- Association - extent that connections with notable people, events and the arts contribute to the perception of the seascape/landscape receptor.
- Distinctiveness – a measure of the strength of identity and expression of characteristics, presence of distinct, rare or unusual features and contribution to character or identity of a settlement.
- Recreation - the extent of recreational opportunities and activities where appreciation of the seascape/landscape is important to the experience/enjoyment.
- Scenic quality - the level of visual and sensory appeal of the seascape/landscape.
- Perceptual aspects - the extent that the seascape/landscape receptor is recognised for its perceptual qualities (e.g. wildness, tranquillity and/or dark skies).
- Functional – extent to which the seascape/landscape performs a clearly identifiable and valuable function, particularly in the healthy functioning of the seascape/landscape.

36. The five-point scale outlined in **Table 23A-1** has been used to help inform the judgements of seascape or landscape value for each receptor.

Table 23A-1. Seascape and landscape value criteria

Level	Criteria description
Very High	A nationally designated seascape/landscape and/or a seascape/landscape in very good condition, exceptional scenic quality, very high recreational opportunities, a very high degree of distinctiveness, with very strong perceptual aspects and/or very important natural and cultural heritage features and functional qualities.
High	A locally or nationally designated seascape/landscape and/or a seascape/landscape in good condition with few detracting features, high scenic quality and including good recreational opportunities, a high degree of distinctiveness, with strong perceptual aspects and/or important natural and cultural heritage features and functional qualities.
Medium	A locally designated seascape/landscape and/or a seascape/landscape in reasonable condition and scenic quality and which may include some detracting features, recreational opportunities, a degree of distinctiveness, recognisable perceptual aspects and/or locally important natural and cultural heritage features and functional qualities.

Level	Criteria description
Low	An undesignated seascape/landscape and/or seascape/landscape containing few if any notable elements/features, of poor condition or containing several detracting features and limited aesthetic qualities. Seascapes/landscapes which have limited recognised associations, natural and cultural heritage features and/or functional qualities
Negligible	An undesignated and largely degraded seascape/landscape containing no notable positive elements/features and multiple detracting features and very limited aesthetic qualities. No or very limited recognised associations, natural and cultural heritage features and/or functional qualities.

37. GLVIA explains the susceptibility to change, as '*the ability of the landscape receptor (whether it be the overall character or quality / condition of a particular landscape type or area, or an individual element and / or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed Project without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*' (page 88, paragraph 5.40). The more susceptible the receptor is to the type of change proposed, the greater is its sensitivity.

38. With reference to wind farms, it is generally accepted that large scale, simple seascapes or landscapes are less susceptible to change than smaller scale, more intimate or complex seascapes and landscapes. The five-point scale outlined in **Table 23A-2** has been used to help inform the judgments of landscape susceptibility.

Table 23A-2. Seascape and landscape susceptibility criteria

Level	Criteria description
Very High	Small scale, intimate or complex seascape/landscape with no existing context of similar development, and with physical and/or perceptual attributes considered intolerant of even minor change of the type proposed without fundamentally altering key characteristics.
High	Small to medium scale, enclosed or complex seascape/landscape with little existing context of similar development, and with physical and/or perceptual attributes considered largely intolerant of change of the type proposed without fundamentally altering key characteristics.
Medium	Medium scale, more open or less complex seascape/landscape with some context of similar development, and with physical and/or perceptual attributes considered tolerant to some degree of change of the type proposed without fundamentally altering key characteristics.
Low	Large scale, simple seascape/landscape with or without existing context of similar development, and with physical and/or perceptual attributes considered tolerant of a large degree of change of the type proposed without fundamentally altering key characteristics.
Negligible	Large scale, simple seascape/landscape with notable existing context of similar development, and with physical and/or perceptual attributes considered tolerant of extensive change of the type proposed without fundamentally altering key characteristics.

39. The sensitivity of the seascape/landscape to change is determined by employing professional judgement to combine and analyse the identified value and susceptibility and is defined with reference to the criteria outlined in **Table 23A-3**.

Table 23A-3. Seascape and landscape sensitivity criteria

Level	Criteria description
Very High	Seascape/landscape characteristics or features with no ability to absorb change without fundamentally altering their present character, e.g. within a nationally designated landscape which is an outstanding example of a well-cared for seascape/landscape or set of features and with no influence of existing development.
High	Seascape/landscape characteristics or features with some ability to absorb change without fundamentally altering their present character, e.g. within a nationally designated landscape or a good example of well cared for seascape/landscape or set of features and which may be locally influenced by development.
Medium	Seascape/landscape characteristics or features with some ability to absorb change without fundamentally altering their present character, e.g. within a locally designated landscape or a landscape with characteristics or elements of local importance and/or with a context of existing development.
Low	Seascape/landscape characteristics or features which are tolerant of a large degree of change without determent to their present character, e.g. an undesignated seascape/landscape with limited local value or an example of a degraded landscape or set of features.
Negligible	Seascape/landscape characteristics or features which are tolerant of extensive change without determent to their present character, e.g. an undesignated seascape/landscape with no apparent value or an example of a wholly degraded landscape or set of features.

23.7.2. Visual Sensitivity to Change

40. Visual sensitivity to change is defined through appraisal of the viewing expectation of the viewer/receptor and their susceptibility to change and the value of the existing view as identified in the baseline.

41. The value of the view is an appraisal of the value attached to views and is often informed by the appearance on Ordnance Survey (OS) or tourist maps and in guidebooks, literature or art or identified in policy. Value can also be indicated by the provision of parking or services, signage, and interpretation. The nature and composition of the view and its scenic quality is also an indicator.

42. It is important to note that the absence of view recognition does not preclude local value, as a view may be important as a resource in the local or immediate environment due to its relative rarity or local importance.

43. The five-point scale outlined in **Table 23A-4** has been used to help inform the judgements of value of the view for each receptor location.

Table 23A-4. Visual value criteria

Level	Criteria description
Very High	Views protected by designation and/or are nationally recognised or iconic view of the Welsh landscape, promoted on maps and in guidebooks or with very strong cultural associations, and/or very high scenic qualities.
High	Regionally or locally recognised view which may be promoted as a visitor destination or route in due to the scenic quality or strong cultural associations and with few, if any, detracting elements.

Level	Criteria description
Medium	Locally recognised view, or unrecognised but pleasing and well composed view, unlikely to be promoted for scenic qualities or cultural associations and/or including some detracting elements.
Low	Views which are not documented or protected, with minimal or no cultural associations and no facilities and/or interpretation. Views that exhibit low scenic qualities relating to content and composition of the view.
Negligible	View primarily defined by composition of negative features and elements.

44. The susceptibility of visual receptors is a function of the occupation or activity of people experiencing the view and the extent to which their attention or interest is focussed on the view and the visual amenity they experience at a particular location. For example, residents in their home, walkers whose interest may tend to be focused on the landscape or a particular view, or visitors at an attraction where views are an important part of the experience, may indicate a higher level of susceptibility. Whereas receptors occupied in outdoor sport where views are not important or at their place of work could be considered less susceptible to change. Visual susceptibility has been determined with reference to the five-point scale set out in **Table 23A-5**.

Table 23A-5. Visual susceptibility criteria

Level	Criteria description
Very High	Receptors for which the view is of primary importance and the principal reason for being at that location and includes no existing context of similar development. Receptors are likely to notice even minor change.
High	Receptors for which the view is important and contributes to the reason for being at that location and may include some existing context of similar development. Receptors likely to be tolerant of minor change.
Medium	Receptors for which the view is important but not the primary focus and may include some existing context of similar development. Receptors tolerant of some change.
Low	Receptors for which the view is incidental or unimportant and may or may not include context of existing development. Receptors tolerant of a high degree of change.
Negligible	Receptors for which the view is irrelevant and entirely unrelated to the purpose of being at that location. Receptors tolerant of extensive change.

45. Visual sensitivity to change is determined by employing professional judgement to combine and analyse the identified value and susceptibility and is defined with reference to the criteria outlined in **Table 23A-6.**

Table 23A-6. Visual sensitivity criteria

Level	Criteria description
Very High	Iconic and highly valued and well composed view with no detracting features, where receptors would notice even minor change, e.g. visitors to nationally recognised or promoted scenic viewpoints.
High	Highly valued impressive or well composed view with few detracting features, where receptors would notice change, e.g. residents in dwellings or users of outdoor recreational facilities on recognised national cycling or walking routes, within nationally designated landscapes.

Level	Criteria description
Medium	A valued view which generally represents a pleasing composition with some detracting features, tolerant of a degree of change, e.g. users of transport routes, orientated towards the proposed Project, likely to be travelling for other purposes than just the view.
Low	Incidental and unimportant or poorly composed view with numerous detracting elements, tolerant of a large degree of change, e.g. people engaged in activities or travelling for purposes other than the view.
Negligible	Unimportant view defined by negative features and elements and tolerant of extensive change e.g. people engaged in work activities indoors.

23.7.3. Seascape and Landscape Magnitude of Impact

46. Magnitude of impact refers to the extent to which the proposed Project would alter the existing characteristics of the seascape or landscape. It is an expression of the size or scale of change to the seascape or landscape, the geographical extent of the area influenced, distance from the receptor and the duration and reversibility of the change. The variables involved are described below:

- Whether the effect changes the key characteristics of the seascape/landscape which are integral to its distinctive character;
- The extent of existing seascape/landscape elements that would be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the seascape/landscape;
- The extent to which aesthetic or perceptual aspects of the seascape/landscape are altered either by removal of existing components or by addition of new ones;
- The geographic area over which the seascape/landscape impacts would be felt (within the Array Area, the Offshore Development Area, the immediate setting of the Array Area or Offshore Development Area or at the scale of the seascape/landscape character area);
- The distance from the seascape/landscape receptor and the influence this has on the level of change experienced; and
- The duration of the impact (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

47. An overall assessment of the magnitude of impact resulting from the proposed Project on the seascape or landscape receptor is made combining the above judgements using evidence and professional judgement. The levels of magnitude of impact are described as being high, medium, small or negligible with reference to the criteria outlined in **Table 23A-7**.

Table 23A-7. Seascape and landscape magnitude of impact criteria

Level	Criteria description
High	Large alteration to the seascape/landscape receptor, with impact to an extensive area or unique and important characteristics. May be longer term impacts, permanent or reversible.
Medium	Partial alteration to the seascape/landscape receptor, with impact to a wide area or several key characteristics. May be medium to long term impacts, permanent or reversible.

Level	Criteria description
Small	Slight alteration to the seascape/landscape receptor or may impact a restricted area and/or few key characteristics. May be short to medium term impacts, permanent or reversible.
Negligible	Little or no perceptible change to the seascape/landscape characteristics.

23.7.4. Visual Magnitude of Impact

48. The magnitude of visual impact resulting from the proposed Project at any particular viewpoint or receptor is based on the size or scale of change in the view, the geographical extent of the area influenced, the distance from the receptors and its duration and reversibility. The variables involved are described below:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the proposed Project;
- The degree of contrast or integration of any new features or changes in the form, scale, composition and focal points of the view;
- The nature of the view of the proposed Project, in relation to the amount of time over which it would be experienced and whether views would be full, partial or glimpses;
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the proposed Project, and the extent of the area over which the changes would be visible; and
- The duration of the impact (short-term, medium-term or long-term) and the reversibility of the impact (whether it is permanent, temporary or partially reversible).

49. An overall assessment of the magnitude of impact resulting from the proposed Project on the view is made combining the above judgements using evidence and professional judgement. The levels of magnitude of impact are described as being high, medium, small or negligible with reference to the criteria outlined in **Table 23A-8**.

Table 23A-8. Visual magnitude of impact criteria

Level	Criteria description
High	Introduction of highly incongruous development which would result in considerable change, affecting a wide extent of the view and becoming a prominent or dominant feature. Likely to occupy the foreground of the view and may be longer term, permanent or reversible.
Medium	Introduction of new development or elements which would result in noticeable change to a wide and important part of the view, distracting from the existing focus. Likely to be in the middle ground and may be medium to long term, permanent or reversible.
Small	Introduction of new development or elements which would result in a slight change to a limited part of the view, unlikely to distract from the existing focus. Likely to be in the middle or background and may be short to long term, permanent or reversible.
Negligible	Barely perceptible or not discernible change to the view.

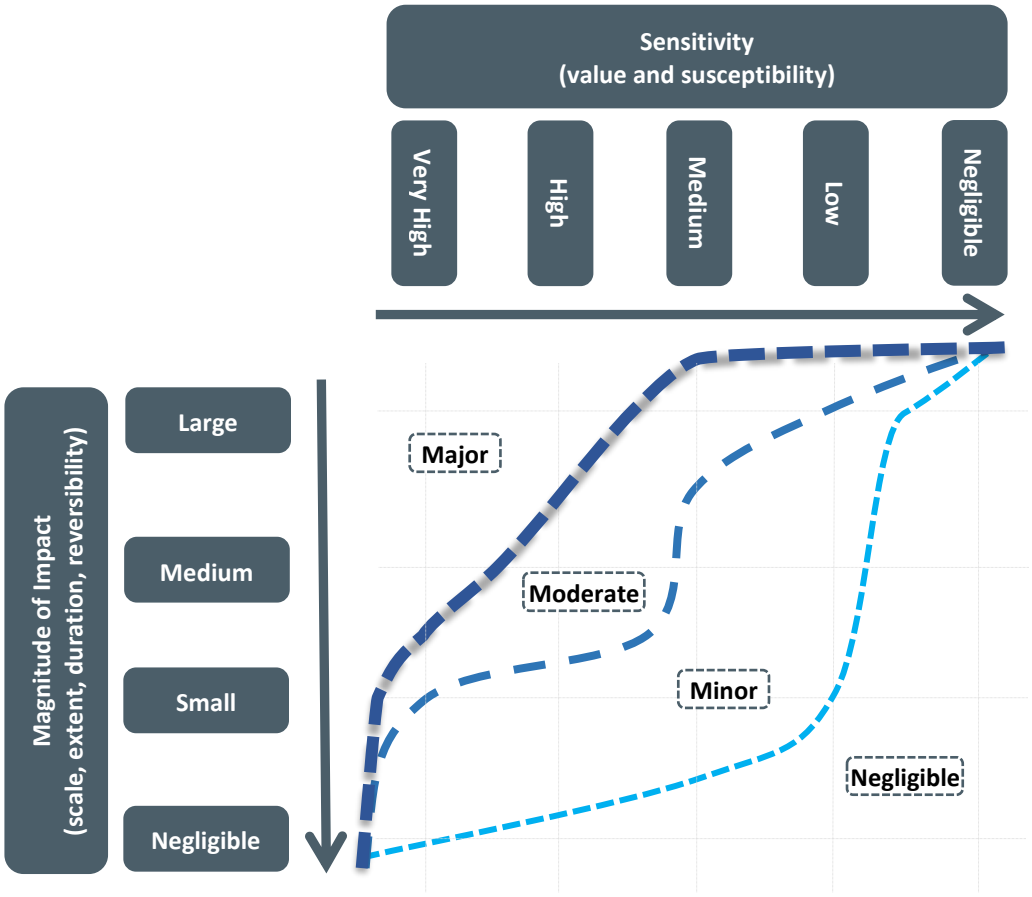
23.7.5. Significance of Seascape, Landscape and Visual Effects

50. Determination of the significance of seascape, landscape and visual effects has been undertaken by employing professional judgement and experience to combine and analyse the magnitude of impact against the identified sensitivity of the receptor.

51. The seascape and landscape assessment takes account of direct and indirect change on existing key physical and perceptual characteristics and evaluate the extent to which these would be lost or modified, in the context of their importance in determining the existing baseline character.

52. The visual assessment considers likely changes to the visual composition, including the extent to which new features would distract or screen existing elements in the view or disrupt the scale, structure, or focus of the existing view.

53. The below diagram provides an indication of how sensitivity and magnitude are considered together to inform the determination of the significance of effect.



54. Levels of effect significance are described on a scale ranging from major to negligible, with reference to the criteria set out in **Table 23A-9**. Assignment of significance is carried out with consideration of embedded mitigation measures. For the purposes of this assessment, moderate and major levels of effect are defined as significant, and where relevant additional mitigation measures may be required, whilst negligible or minor effects are defined as not significant.

Table 23A-9. Categories of seascape/landscape and visual significance of effect

Level	Description of seascape/landscape effect	Description of visual effect
Major	Highly noticeable change affecting key characteristics of a very highly sensitive seascape/landscape, resulting in a fundamental change to its character.	Considerable change affecting a large extent of a very highly sensitive view and becoming a dominant feature.

Level	Description of seascape/landscape effect	Description of visual effect
Moderate	Noticeable change affecting some key characteristics in a highly sensitive seascape/landscape or very noticeable change in a medium sensitivity seascape/landscape, resulting in a change to the overall impression of its character.	Noticeable change affecting an important part of a highly sensitive view or a wider extent of a medium sensitivity view, becoming prominent or detracting from the existing focus.
Minor	Small change affecting few characteristics in a medium to highly sensitive seascape/landscape or noticeable change to a less sensitive seascape/landscape, resulting in a limited or localised change to the impression of its character.	Small change affecting a limited and/or unimportant part of a medium to highly sensitive view or an important part of a less sensitive view, unlikely to distract from the existing focus.
Negligible	Very little change from baseline conditions, resulting in a barely distinguishable or indistinguishable change.	Where there is no discernible improvement or deterioration in the existing view.

55. For the purposes of this assessment, moderate and major levels of effect are defined as significant, and where relevant additional mitigation measures may be required, whilst negligible or minor effects are defined as not significant.

23.8 Method of Night-time Assessment

56. The proposed Project includes medium intensity aviation obstruction lighting on the nacelle of each of the proposed WTGs, in line with Civil Aviation Authority (CAA) requirements. Aviation lighting has the potential to contribute to seascape, landscape and visual effects and as such is considered in the SLVIA.

57. Potential impacts related to identified dark sky characteristics are considered as part of the overall judgements of potential effects of the proposed Project on seascape and landscape character. Specific night-time assessment is therefore focused on potential visual effects resulting from the aviation lighting on the proposed WTGs.

58. The assessment of night-time visual effects resulting from the proposed visible aviation lighting follows the same key steps as that of daytime assessment, considering the value and susceptibility, sensitivity and magnitude, leading to an overall judgement of the level and significance of effects. However, it is important to note that the night-time sensitivity of visual receptors is likely to vary from that experienced during the day.

59. Certain aspects which contribute to daytime value of the view, such as the composition and its scenic quality, are generally less relevant to night-time when the detail and features within the view are less apparent. The popularity of a viewpoint during the day may also be very different to night-time. Value of the view at night therefore focuses on provision of facilities and/or recognition specific to night-time enjoyment, for example through identification as a dark sky discovery site. **Table 23A-10** provides guidance on the approach to determination of value of the view at night.

Table 23A-10. Night-time visual value criteria

Level	Criteria description
Very High	Views from recognised and/or promoted dark sky viewing locations, such as a Dark Sky Discovery Site*.

Level	Criteria description
High	Views from a location not specifically recognised as a night-time viewpoint but located within an area where dark skies are promoted, and people are likely to frequent at night.
Medium	Views from a location not recognised as a night-time viewpoint or within an area where dark skies are promoted, but from which there if good potential to appreciate the night sky.
Low	Views from other locations with little or no appreciation of the night sky and/or night time views.
Negligible	View at night heavily influenced or defined by existing light sources with little or no appreciation of the night sky.

* Dark Sky Discovery Sites are '*a nationwide network of places that provide great views and which are accessible to everyone. They have been nominated by local groups and organisations as their top local spot to see the stars*'.

60. Visual susceptibility, which is largely a function of the activity of the receptors and the extent to which their attention is focused on the view, is also likely to vary between daytime and night-time conditions. In some cases, for example residents in their home, susceptibility would remain broadly similar between day and night-time. Those undertaking activities which require darkness, such as stargazing would be of higher susceptibility. Whereas, for other types of receptors, such as those travelling by road or ferry, views at night are likely to be less important than in daytime conditions, reducing the susceptibility to change. **Table 23A-11** provides guidance on approach to determination of visual susceptibility at night.

Table 23A-11. Night-time visual susceptibility criteria

Level	Criteria description
Very High	Receptors at locations where the night-time view is of primary importance, such as those stargazing at Dark Sky Discovery Sites.
High	Receptors for which the night-time view is important and contributes to the reason for being at that location.
Medium	Receptors at locations where the night-time view may be important but not the primary focus and / or the existing view is influenced to some degree by lighting.
Low	Receptors at locations where the night-time view is incidental or unimportant, such as road users, cyclists and ferry passengers and / or the existing view is influenced to a moderate degree by lighting.
Negligible	Receptors for which the night-time view is irrelevant and entirely unrelated to the purpose of being at that location and / or the existing view is influenced to a high degree by lighting.

61. In relation to magnitude of impact, many of the factors such as scale, distance, duration and extent remain relevant, although in the night-time assessment are focused solely on the visible aviation lighting rather than the WTGs which would be less apparent. The degree of contrast or integration also remains relevant. However, it is evaluated in relation to the level and nature of existing light sources present within the view, rather than other features which may contribute to the composition of the view during the day but are not readily apparent at night.

62. Weather can also have a strong influence on the impression of change resulting from aviation lighting. In addition, the time of year influences the likelihood of experiencing dark skies and hence lighting effects, with fewer hours of darkness and hence aviation lighting, in summer.

63. The proposed lighting would be fitted with sensors to monitor the surrounding atmospheric conditions. When fair conditions (visibility greater than 5 km in all directions) are present the lighting would automatically switch to a lower intensity mode, 10% of the peak intensity, in line with CAA policy guidance.

64. It is also important to note that appreciation of night-time views, and particularly those relating to dark skies, is greatest in fair weather conditions with the absence of clouds. In these conditions the proposed aviation lighting would operate within the lower intensity mode, reducing the impression of change. This would be similar for views of sunset, although in these conditions contrast of the aviation lighting with the background would also be reduced, further limiting the impression of change.

23.9 Method of Cumulative Assessment

65. The approach used to determine cumulative effects has drawn on Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2021). This states that *'Cumulative impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together'*.

66. The assessment of cumulative effects follows a similar process to that described above, first identifying and describing the baseline, followed by an assessment of the magnitude of impact and significance of effect.

23.9.1. Cumulative Baseline

67. The cumulative baseline includes other onshore and offshore wind farms that are either operational, consented/under construction or for which a consent application has been submitted and is not yet determined or is under appeal. Wind farms at EIA Scoping or pre-application stages are not generally included unless specifically requested by consultees as they are subject to change during the design process and as such are regarded as not sufficiently finalised to contribute to the assessment of cumulative effects.

68. An initial long list of potential cumulative projects was identified through desk study of planning applications and submissions. This list was then refined through initial analysis and modelling in order to identify a short list of cumulative projects for inclusion in the detailed assessment. The short list of projects includes those onshore and offshore wind farm schemes located within the 45 km Study Area (as agreed with NRW) and with the potential to contribute to a cumulative effect with the proposed Project. Existing wind turbines located immediately adjacent to the Study Area have also been included as part of the existing baseline. The remaining projects on the long list were scoped out due to the distance from the proposed Project, lack of available information and/ or being of an unrelated type of development.

69. The cumulative situation changes frequently as applications are made, determined or withdrawn. Layouts of wind farms for which applications have been submitted may also change prior to being constructed. For the purposes of assessment, therefore, it is necessary to determine a cut-off date when the Development Sites to be included in a cumulative assessment are 'frozen' in terms of layout and status. The cut-off date for information considered by this cumulative assessment was 31st October 2023 and any changes in the cumulative situation after this date are not assessed. The details of cumulative wind farms (such as individual turbine locations) to be included in the assessment have been compiled from known wind farm planning applications. No detailed consideration is given to the

lifespan of existing wind farms as it is anticipated that the proposed Project would be constructed before the consent of these wind farms expires and they are decommissioned.

70. In line with good practice (SNH, 2021) consideration is given to a series of different cumulative scenarios that relate to various different combinations of wind farm status.

71. The consideration of existing operational wind farms is incorporated within the assessment of existing baseline conditions and the resulting effects described within the non-cumulative seascape, landscape and visual assessments. Three further scenarios are considered within the cumulative assessments, as follows:

- Scenario 1: The cumulative effects of the proposed Project introduced into a baseline which includes wind farms which have been consented in addition to existing operational schemes;
- Scenario 2: The cumulative effects of the proposed Project introduced into a baseline which includes wind farms at the application stage, in addition to consented and existing operational schemes; and
- Scenario 3: The cumulative effects of the proposed Project introduced into a baseline which includes select scoping stage schemes in addition to those at application stage, consented or existing and operational.

23.9.2. Magnitude of Cumulative Impact

72. The cumulative assessment focuses on the potential change and impacts resulting from the addition of the offshore elements of the proposed Project to that experienced in the identified cumulative scenarios. However, an overview of potential total cumulative impacts of the proposed Project in combination with the identified cumulative projects is also provided.

73. Cumulative seascape, landscape and visual effects may result from additional changes to the baseline landscape or visual resources, as a result of the proposed Project, in conjunction with other wind turbine developments.

74. It is important to note that cumulative effects may vary from the effects of the proposed Project considered in isolation. For example, it is possible for a scheme to have effects that are judged of relatively high significance on a particular receptor when taken on its own, but when considered together with the effects of other developments the additional cumulative effect of the scheme may be lower.

75. The cumulative seascape/landscape magnitude of effect and cumulative visual magnitude of effect is determined with reference to the criteria set out in **Table 23A-7** and **Table 23A-8** and include the following considerations:

- The number of visible existing and/or potentially visible proposed wind developments;
- The distance to existing and/or proposed wind developments;
- The direction and/or distribution of existing and proposed wind developments; and
- The seascape or landscape setting, context and/or degree of visual coalescence of existing and proposed wind developments.

23.9.3. Significance of Cumulative Effects

76. Determination of the significance of cumulative seascape, landscape and visual effects has been undertaken by employing professional judgement to combine and analyse the cumulative magnitude of effect against the identified sensitivity to change. It should be noted that the cumulative assessment is the result of the addition of the proposed Project to the identified cumulative scenario.

77. The significance of cumulative landscape and visual effects are described with reference to the criteria set out in **Table 23A-12**. For the purposes of this assessment, effects of moderate or greater are considered to be 'significant' in relation to the EIA Regulations.

Table 23A-12. Categories of cumulative seascape/landscape and visual significance of effect

Level	Description of seascape/landscape effect	Description of visual effect
Major	The addition of the proposed Project into the cumulative scenario would result in wind turbines in the seascape/landscape becoming a dominant and character defining feature.	The addition of the proposed Project to the cumulative scenario would result in a very noticeable increase in wind turbines to the extent whereby they would become a dominating or obstructive feature within the view.
Moderate	The addition of the proposed Project into the cumulative scenario would result in wind turbines becoming locally dominant or characteristic but would not result in them becoming a character defining feature.	The addition of the proposed Project to the cumulative scenario would result in a noticeable increase in wind turbines to the extent whereby they would become prominent but would not dominate or obstruct the view.
Minor	The addition of the proposed Project into the cumulative scenario would not result in a noticeable change to key seascape/landscape characteristics.	The addition of the proposed Project to the cumulative scenario would result in a perceptible increase in wind turbines but not to the extent that they would become a prominent feature in the view.
Negligible	The addition of the proposed Project, into the cumulative scenario would not result in any discernible change to key seascape/landscape characteristics.	The addition of the proposed Project to the cumulative scenario would not result in any discernible increase in the appearance of wind turbines in the view.

23.10 The Influence of Weather

78. Wind direction and turbine yaw angle affects visibility of the turbine rotors and blades. The turbine rotors would be facing towards the prevailing wind direction most of the time. Consequently, viewers at certain locations would experience differing levels of visual change because of the proportion of the full sweep of the rotor that would be most often visible.

79. Weather and prevailing atmospheric conditions can have an influence on the visibility and impression of wind turbines, particularly from more distant locations. Changeable visibility in this region of Wales is common due to its coastal location. A review of average visibility data for the Milford Haven weather station suggests that frequency of visibility >35 km would be less than 33%, frequency of excellent visibility (>40 km) would be less than 24%, and frequency of visibility >50 km less than 10.5%. It is therefore likely that visibility of the proposed WTGs would be more limited, and the resulting magnitude of impact would be lower that stated in the assessment, for the majority of the time.

80. Atmospheric conditions can also have a strong influence on the visibility of aviation lighting. As described in **Appendix 23D – Night-time Visual Assessment** and in line with CAA guidance the proposed aviation lights would operate at two different intensity levels depending on the prevailing conditions. In periods or low visibility, where atmospheric conditions limit visibility to 5 km or less, the lights would be operated at peak intensity (2000 candela (cd) at source). In these conditions visibility of the lights is often likely to be restricted by cloud. In periods where atmospheric conditions result in visibility of 5 km, or greater, the lights would operate in a lower intensity mode, equivalent to 10% of the peak intensity (200 cd at source). A review

of average visibility data for the Milford Haven weather station suggests that frequency of visibility of 5 km or greater would be more than 93%, and as such aviation lighting is likely to be operating at the lower intensity mode for the majority of the time it is on.

81. The assessment adopts a 'worst case' approach to daytime effects which assumes clear weather conditions and excellent visibility (>40 km as defined by the Met Office). In relation to night-time effects a worst case approach is taken, highlighting the theoretical, but unlikely, scenario of the lights operating at peak intensity in clear conditions, and qualifying this with the more likely scenario of the lights operating in the lower intensity mode during clear conditions, and higher intensity mode in poorer conditions.

23.11 Assumptions and Limitations of the Assessment

82. The duration of all operational effects is assumed to be long-term (30-year operational lifespan) and theoretically reversible upon decommissioning. This is not repeated for every receptor but is considered as part of the judgement of magnitude of change.

83. Using a precautionary approach, and although some people may consider wind farms to be beneficial, all likely seascape, landscape and visual effects identified are judged to be adverse.

84. ZTVs, wirelines and photomontages have been provided as part of the SLVIA. These are graphic tools intended to aide understanding of the assessment reporting and therefore should be read in conjunction with the assessment text and should be viewed in the field and with an understanding of their inherent limitations. Details of the use and limitations of these graphic tools are provided in **Section 23.12**, below.

85. The final locations of the proposed WTG within the Array Area will be determined as part of the detailed design process undertaken post consent. The SLVIA is therefore based on an indicative layout which represents a reasonable worst case approach based on the identified maximum parameters, including number, height and location of WTGs.

86. The assessment considers potential change resulting from the addition of visible aviation lighting on each of the proposed WTGs. It was not possible to visit all receptor locations, and particularly those which are more remote, at night and therefore the night-time baseline described is informed by daytime observations and from targeted night-time survey focused on locations where receptors are more likely to experience views at night.

87. It is proposed that the WTGs would be installed on the floating platform at a nearby port facility and/or nearby sheltered waters prior to being towed to the Array Area. The final stages of the platform assembly, prior to the WTG integration are also undertaken at the same local port(s) whenever possible (i.e., if facilities are determined sufficient to support this work). If not fabricated at the assembly location, the WTG and substructure components would be transported by sea to the assembly port. The location for assembly of WTGs and platforms would be confirmed at a later stage. As a result, the installation port and fabrication of the WTGs has not been considered in detail in this assessment. However, it is anticipated that potential temporary effects relating to these elements would be minimised through siting within an existing port and/or industrial setting.

88. The cumulative situation changes frequently as applications are made, determined, or withdrawn. Layouts for wind farms at scoping and application stages may also change prior to being constructed. For the purposes of the cumulative assessment, it is therefore necessary to determine a cut-off date when the sites to be included are assumed to be frozen in terms of layout and status. The cut-off date for information considered in the cumulative assessment was 31 October 2023 and any changes in the cumulative situation after this date are not assessed.

89. The cumulative assessment focuses on potential cumulative effects relating to the main permanent structures and other associated features of each cumulative wind farm development. A higher level assessment of potential cumulative effects of construction and decommissioning is provided due to the high level of uncertainty of the timing of construction activities for each cumulative wind farm development.

90. Assessment of night-time impacts of aviation lighting focuses on potential visual effects from agreed night-time viewpoint locations. There is generally lower appreciation of seascape and landscape character at night when physical characteristics are less apparent. However, the seascape and landscape character assessment considers potential effects of aviation lighting on dark sky characteristics, where relevant.

23.12 Visual Representation Methodology

91. The following provides details of the production and limitation of the graphic material produced in support of the seascape, landscape and visual assessments. It should be noted that they are tools to aide in understanding of the assessment and are not used to determine the potential significance of effects.

23.12.1. Zone of Theoretical Visibility

92. The ZTV defines the effective boundaries within which views of the proposed Project could potentially be obtained. ZTVs have been prepared using specialist computer software, ArcGIS. This produces an analysis of a computer-based model that uses landform as the key determinant of availability or obstruction of view.

93. The landform model is based on points at 5 m intervals derived from OS Terrain 5 Digital Terrain Model (DTM) tiles. The ZTVs are calculated to a distance of 50 km to provide context to the 45 km Study Area and are based on a viewer height of 1.8 m above ground level and take account of the curvature of the earth. It should be noted that the computer model does not take into account surface features such as trees or woodland, buildings and other structures or local landform which can vary the ZTV locally and therefore the ZTV is not representative of visual effects in itself.

94. ZTVs also do not allow for the decrease in visibility that occurs with an increase in distance. Furthermore, it is important to note that there can be a wide variation in visibility shown in a ZTV, with views from different locations within the same colour banding ranging from only the tips of blades to full WTGs. Nevertheless, the ZTV is a valuable tool in assisting with the identification of areas of potential visual impact. However, they must be verified in the field and used in conjunction with other visualisations to determine the actual extent of potential visibility.

95. A range of ZTV diagrams have been produced to aid in the assessment of effects and support the written report. The following provides a brief description of these ZTVs:

- **Volume 5: Figures 23.8a and 23.8b** provide ZTVs calculated from the blade tip at its highest point (i.e. the maximum height of the WTGs, 325.5m above sea level at HAT). **Volume 5: Figure 23.8a** is provided on 1:250,000 mapping to provide an overview and **Volume 5: Figure 23.8b** is provided on 1:50,000 mapping across 3 sheets to allow a more detailed indication of potential visibility. The ZTV shown in these figures are calculated beyond the 45 km Study Area to provide context;
- **Volume 5: Figures 23.9a and 23.9b** provide ZTVs calculated from the maximum hub height of the WTGs (177 m above sea level at HAT). **Volume 5: Figure 23.9a** is provided on 1:250,000 mapping and **Volume 5: Figure 23.9b** on 1:50,000 mapping. The ZTV shown in both figures are calculated beyond the 45 km Study Area to provide context;

- **Volume 5: Figure 23.10a and 23.10b** provide aviation lighting ZTVs, calculated from the hub height of each of the proposed WTGs on which a medium intensity aviation light would be included. **Volume 5: Figure 23.10a** is provided on 1:250,000 mapping and **Volume 5: Figure 23.10b** on 1:50,000 mapping. It is important to note that the ZTV does not take account of the influence of distance and atmosphere on potential visibility of lighting;

96. **Volume 5: Figures 23.12 to 23.15** provide cumulative ZTVs, comparing the potential visibility of the proposed Project and identified cumulative wind farms. **Volume 5: Figure 23.12** indicates theoretical visibility of the proposed Project and existing operational schemes. **Volume 5: Figure 23.13** indicates theoretical visibility of the proposed Project and cumulative schemes within cumulative scenario 1. **Volume 5: Figure 23.14** indicates theoretical visibility of the proposed Project and cumulative schemes within cumulative scenario 2. **Volume 5: Figure 23.15** indicates theoretical visibility of the proposed Project and cumulative schemes within cumulative scenario 3; and

97. **Volume 5: Figures 23.16 to 23.18** provides cumulative lighting ZTVs, comparing the potential visibility of aviation lighting on the proposed Project and similar medium intensity (2000 cd) aviation lighting proposed as part of the cumulative projects in each scenario.

23.12.2. Visualisation

98. The visual assessment is supported by a series of visualisations from each of the visual assessment viewpoint locations. Visualisations include baseline panoramas, wireline diagrams and photomontages and have been produced in accordance with Visual Representation of Wind Farms (SNH, 2017).

99. The photography used to produce the baseline panoramas and photomontages have been taken using a Canon EOS Digital camera with a 50 mm fixed lens, mounted on a tripod at a height of approximately 1.5 m above ground level. The camera has a full frame (35 mm negative size) sensor as per good practice guidance. The photography at each location consists of a series of overlapping photographs, taken at 15 - 20° intervals. Photography for night-time visualisations were captured at approximately 30mins intervals from twilight to darkness to give an impression of the baseline at different stages of darkness. Night-time photographs are taken from the same position as corresponding day time photographs to allow direct comparison.

100. Baseline panoramas showing the existing view and wirelines have been produced for the majority of viewpoints. Two viewpoints (Viewpoint 03: Pembroke-Rosslare Ferry, and Viewpoint 15: Beacon Hill, Lundy Island) include a wireline only, with no baseline photograph, an approach that was agreed in consultation with NRW. In many instances the cumulative baseline panorama consists of more than one image, presented in separate 90° segments. The baseline panoramas are intended to show the existing view and provide landscape and visual context to each viewpoint. Due to the wide angle of view the baseline panoramas are shown in cylindrical projection. The wirelines also help to indicate the potential visibility of other identified cumulative developments.

101. A second baseline image covering a 53.5° horizontal field of view have also been provided for the majority of the viewpoints, at the request of NRW. The 53.5° baseline images are presented in planar projection to allow comparison with corresponding wireline and photomontage images.

102. Wireline drawings covering a 53.5° horizontal field of view have also been produced for each viewpoint. Wirelines are based on a Digital Terrain Model and as such depict a bare-ground representation of the topography and landform of the view. Wirelines therefore indicate the

theoretical visibility of the proposed Project without the screening effect of vegetation or buildings. These wirelines are presented in planar projection to provide a consistent representation of the wind farm.

103. Photomontage images with a 53.5° horizontal field of view have been provided for the majority of the assessment viewpoints. The two exceptions are Viewpoint 03: Pembroke-Rosslare Ferry, unsuitable for photomontage due to being on a moving ferry, and Viewpoint 15: Beacon Hill, Lundy Island located in excess of 56 km from the nearest proposed WTG.

104. Specialist panorama stitching software was used to combine the individual photographic frames into panoramas and perform the geometric conversion to a cylindrical projection. The alignment of frames was hand checked in Adobe Photoshop.

105. Matching computer-generated wirelines are then constructed using specialist software (ReSoft© WindFarm) based upon the recorded viewpoint and camera details and the geometries of the proposed WTG. The wirelines are generated using a digital terrain model derived from the OS Terrain-5 5m DTM data. A perspective match is achieved between the computer-generated wirelines and the photographs by making careful adjustments until all major features in the image align as accurately as possible with the data available. Where appropriate, objects in the landscape such as dwellings, field boundaries, roads or electricity pylons were used as additional markers.

106. Each view is then rendered, taking into account of the conditions in the photograph and sun position at the time and date the photograph was taken. WTG blades are shown face-on towards the location of the viewpoint to provide a worst-case view, and at random angles to represent a more realistic situation. The rendered WTGs are then carefully blended into the baseline photograph and sections of WTGs which would appear behind foreground features are masked to create the photomontage image. Rendering of the WTGs is based on an off-white/light grey colour as is common practice. It is understood that additional red markings may be required on the WTG rotor blades for aviation safety. The precise details of these have not yet been determined and as such have not been included in the visualisations. It is not considered that the markings would alter the visibility or visual impacts of the turbines given the considerable distance they are located offshore, away from the viewpoints.

107. Night-time photomontages are produced in a similar way but with an additional process to model and render the aviation lighting. The software uses analysis of photography of an existing red aviation light coupled with a number of other factors including the distance and elevation/ angle of view relative to the light position and lighting manufacturer supplied details to calculate the size and provide a representation of the light from the specific viewpoint location. It is important to note that the representation of the aviation lighting in the photomontages is based on how it would appear within a photograph taken at night, in line with NatureScot guidance. This allows comparison with other existing light sources which may be present within the baseline night-time panorama. However, it results in the light in the photomontage appearing to have a more intense and lighter coloured centre, graduating to a darker red edge. In reality, the naked eye would see the aviation lighting as a consistent red colour, therefore appearing less intense than shown in the photomontages. In addition, the human perception of light intensity over distance follows an inverse square relationship, meaning that as the distance increases, the light must spread out over a larger surface and the surface brightness decreases.

108. Each of the visualisation images are then imported into page layout software where the final information, annotation and drawing frames are applied to create the final figures. The sizes of all images are presented in accordance with SNH guidance.

109. There are a number of limitations with visualisations of wind farms that should be considered and acknowledged when using them to help inform a judgement on a proposed wind farm proposal. These include:

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

23.13 REFERENCES

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