DublinArray
Generation for generations

EIAR Volume 4: Offshore Infrastructure Technical Appendices Appendix 4.3.15-1: SLVIA Methodology

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Dublin Array Offshore Wind Farm

Environmental Impact Assessment Report

Volume 4, Appendix 4.3.15-1 – SLVIA Methodology

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Acronyms

Term	Definition
ADO	Alternative Design Option
AOD	Above Ordnance Data
AONB	Area of Outstanding Natural Beauty
CAA	Civil Aviation Authority
CD	Candela
CEA	Cumulative Effects Assessment
DAHG	Department for Culture, Heritage and the Gaeltacht
DCCAE	Department of Communications, Climate Action and Environment
DHPLG	Department of Housing, Planning and Local Government
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EPA	Environment Protection Agency
ES	Environmental Statement
FoV	Field of View
GIS	Geographical Information System
GLVIA 3	Guidelines for Landscape and Visual Impact Assessment 3rd Edition
GW	Gigawatt
HAZ	High Amenity Zone
HVAC	High Voltage Alternating Current
IEMA	Institute of Environmental Management and Assessment
km	Kilometres
LAT/ mLAT	Lowest Astronomical Tide/ meters relative to Lowest Astronomical Tide
LCA	Landscape Character Area
LCT	Landscape Character Type
LI	Landscape Institute
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
MAC	Marine Area Consent
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs

Term	Definition
MLWS	Mean Low Water Springs
MSL	Mean Sea Level
MW	Megawatt
NP	National Park
NPWS	National Parks and Wildlife Service
O&M	Operations and maintenance
ORE	Offshore Renewable Energy
OSI	Ordnance Survey Island
OSP	Offshore Substation Platform
PVR	Principal Visual Receptor
ROI	Republic of Ireland
RSCA	Regional Seascape Character Area
RWE	RWE Renewables Ireland Ltd (a wholly owned subsidiary of RWE AG)
SAAO	Special Area Amenity Order
SAR	Search and Rescue
SCT	Seascape Character Types
SLVIA	Seascape, Landscape and Visual Impact Assessment
SNH	Scottish Natural Heritage (now known as NatureScot)
SPS	Significant Peripheral Structures
UK	United Kingdom
VNS	Visual Nature Studio
VP	Viewpoint
WTG	Wind turbine generator
ZTV	Zone of Theoretical Visibility

1 SLVIA Methodology

1.1 Introduction

1.1.1 The project-wide approach to the assessment methodology is set out in Volume 2, Chapter 3: EIA Methodology (hereafter referred to as EIA Methodology Chapter). This appendix describes the methodology used within the Seascape, Landscape and Visual Impact Assessment (SLVIA) of the Environmental Impact Assessment (EIA) for Dublin Array Offshore Wind Farm (hereafter referred to as Dublin Array).

1.1.2 Volume 3, Chapter 15: SLVIA of the EIAR (hereafter referred to as SLVIA Chapter) presents the findings of the assessment of the likely significant effects of the Dublin Array offshore infrastructure with respect to seascape, landscape and visual receptors. This SLVIA methodology has been structured as follows:

- 15.1 - Introduction
- 15.2 - Overview of SLVIA methodology
- 15.3 - Potential effects
- 15.4 - Guidance, data sources and site surveys
- 15.5 - Assessing seascape/ landscape effects
- 15.6 - Assessing visual effects
- 15.7 - Assessing turbine lighting visual effects
- 15.8 - Assessing cumulative seascape, landscape and visual effects
- 15.9 - Evaluation of significance
- 15.10 - Definition of effects
- 15.11 - Visual representations
- 15.12 – References

1.1.3 The SLVIA Chapter and this appendix is accompanied by the following figures.

- Volume 4, Appendix 3.15-3: SLVIA GIS Figures (hereafter referred to as SLVIA GIS Figures Appendix); and
- Volume 4, Appendix 3.15-4: SLVIA Visualisations (hereafter referred to as SLVIA Visualisations Appendix).

1.2 Overview of SLVIA methodology

Approach

1.2.1 The assessment has been undertaken in accordance with the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3), and other best practice guidance including the LI's 'Notes and Clarifications on Aspects of Guidelines for Landscape and Visual Impact Assessment Third Edition' (2024). An overview or summary of the SLVIA process is provided here and illustrated, diagrammatically in Figure 1.

1.2.2 The SLVIA assesses the likely effects that the construction and operation of Dublin Array on the seascape, landscape and visual resource, encompassing effects on seascape/landscape character, designated landscapes, visual effects and cumulative effects.

1.2.3 The SLVIA is based on the project description presented in Volume 2, Chapter 6: Project Description (hereafter referred to as Project Description Chapter).

1.2.4 The evaluation of sensitivity takes account of the value and susceptibility of the receptor to Dublin Array. This is combined with an assessment of the magnitude of change which takes account of the size and scale of the proposed change. By combining assessments of sensitivity and magnitude of change, a level of seascape, landscape or visual effect can be evaluated and determined. The resulting level of effect is described in terms of whether it is significant or not significant, and the geographical extent, duration and the type of effect is described as either direct or indirect; temporary or permanent (reversible); cumulative; and beneficial, neutral or adverse.

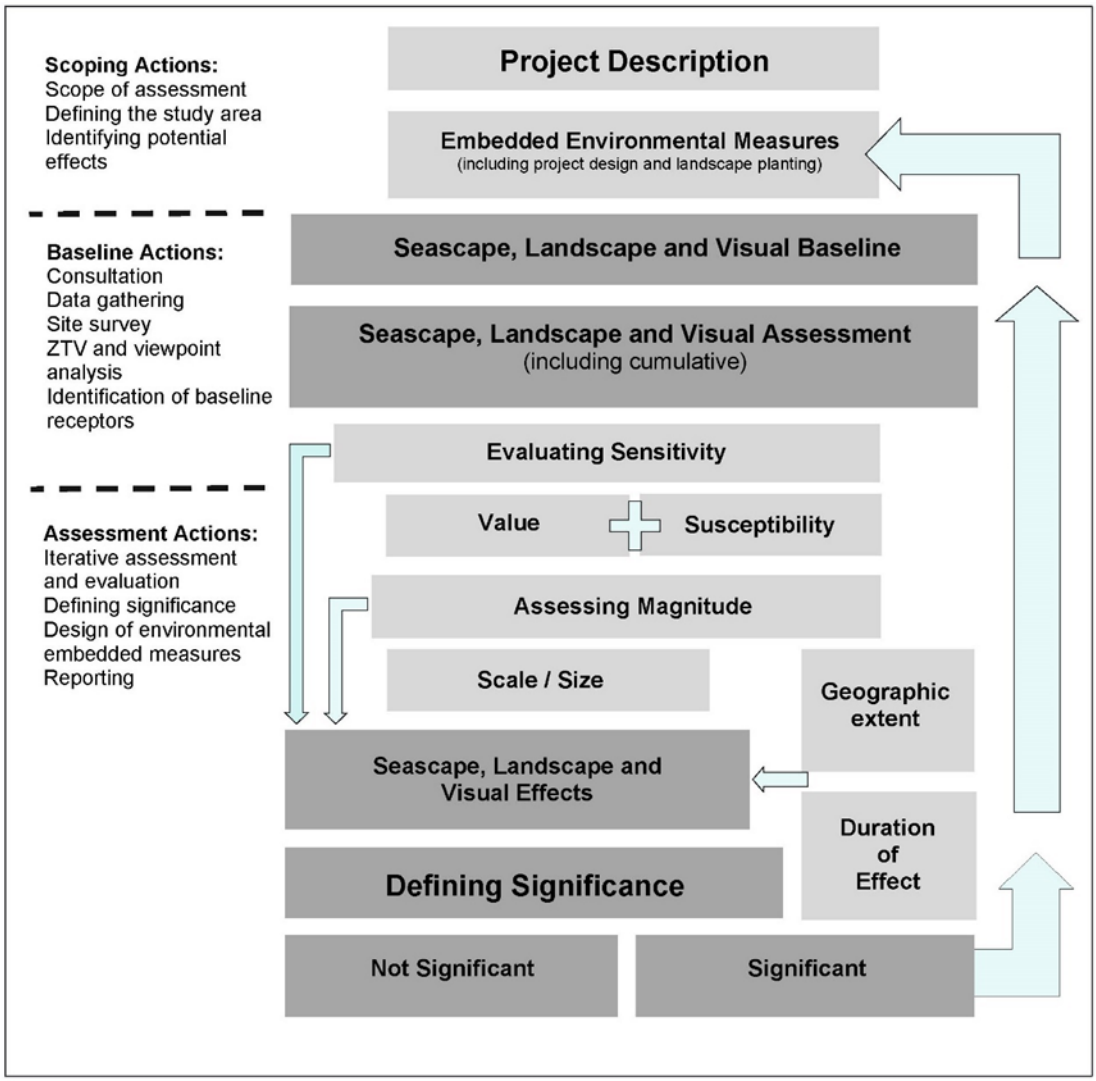

Figure 1 Overview of approach to SLVIA

1.2.5 The assessment has also considered the whole project or combined effects of the offshore and onshore elements of Dublin Array. These inter-related effects are assessed in Section 15.16 of the SLVIA Chapter. The assessment of cumulative effects likely to result from Dublin Array and other similar projects is presented in the SLVIA Chapter.

1.2.6 In each case an appropriate and proportionate level of assessment has been undertaken and consulted on at the scoping stage. The level of assessment may be 'preliminary' (requiring desk-based data analysis) or 'detailed' (requiring site surveys and investigations in addition to desk-based analysis).

1.2.7 The SLVIA unavoidably, involves a combination of quantitative and qualitative assessment and wherever possible a consensus of professional opinion has been sought through consultation, internal peer review, and the adoption of a systematic, impartial, and professional approach.

Interface between seascape and landscape assessment

1.2.8 Together, the SLVIA and the onshore Landscape and Visual Impact Assessment (LVIA) provide a whole project assessment of the effects of Dublin Array. The offshore elements of Dublin Array include the wind farm, offshore substation platform (OSP) and offshore export cable corridor, and these are assessed in the SLVIA. The onshore elements of Dublin Array include the onshore substation, onshore cable corridor, landfall location and operations and maintenance base, and these are assessed in the LVIA. Both the SLVIA and the LVIA follow a broadly similar assessment methodology that uses the same glossary and terminology.

1.2.9 The SLVIA also refers to potential interrelated effects likely to result from any areas where the construction, operation and decommissioning of the offshore and onshore elements combine, or inter-relate to affect receptors within the SLVIA study area. An example could include effects on views where both offshore and onshore elements are visible, potentially resulting in whole project landscape and visual effects as a result of the construction, operation and decommissioning of the offshore and onshore elements. In those instances, the SLVIA provides whole project assessment.

Assessment of the foreshore

1.2.10 It is important to ensure that the foreshore area is clearly defined in terms of the transition it marks between land and sea, to ensure it is being fully represented in the respective SLVIA and LVIA.

1.2.11 Department of Communications, Climate Action and Environment (DCCAE) (2017) presents the following definition of 'foreshore'.

"The bed and shore below the line of high water of ordinary or medium tides of the sea, and of every tidal river and tidal estuary, and of every channel, creek, and bay of the sea, or of any such river or estuary to the outer foreshore as defined in the Foreshore Act, 1933 as amended. The foreshore commences at high water of ordinary or medium tides; its outer limit is 12 nautical miles (nm) from the baseline referred to in Section 85 of the Sea-Fisheries and Marine Jurisdiction Act 2006."

1.2.12 In terms of understanding how the landscape and seascape classification systems relate to the foreshore, while there is no advice in respect of landscape classification, the following extract, taken from Regional Seascape Character Assessment for Ireland 2020, highlights the fact that seascape classification includes a notable landward extent in the definition of seascape character.

"In the absence of national and regional landscape character areas in the Republic of Ireland the project team applied the landward boundary definition used in the Northern Ireland Regional Seascape Character Assessment (NIEA) which defines it based on the "following hierarchy of criteria". 1. Initially based on the coastal road, which as a defined feature, strongly relates to how the seascape is perceived; 2. Further modified to incorporate key natural and cultural physical features that have a strong marine influence; and 3. Where criteria 1 and 2 are not relevant, professional judgements were made to identify the extent to which terrestrial areas demonstrated a strong perceptual experience of the sea (NIEA 2014:17). This approach

was followed for this research to align with the Northern Ireland Regional Seascape Character Assessment. The seaward boundary is 12 nautical miles, also in common with the Northern Ireland approach."

1.2.13 The definition of the foreshore out to 12 nautical miles means that the seascape character receptors used in the assessment will be located within this foreshore area.

1.2.14 NatureScot adds support to the concept of considering seascape as a combination of sea, coast and hinterland, setting out their definition in their Guidance Note on Coastal Character (Scottish Natural Heritage (SNH), 2017);

"Seascape' refers to an area, as perceived by people, from land, sea or air, where the sea is a key element of the physical environment. Defining the character of the coast and its relationship with both its hinterland and the sea is an important aspect of character assessment."

1.2.15 The approach proposed means that the 'foreshore', which includes beaches, inter-tidal areas and coastlines between Mean High Water (MHW) and Mean Low Water (MLW), will be considered in both the landscape and seascape character assessments. This ensures adequate consideration will be given to assessing the relationship between terrestrial and marine areas and interactions across the interface between land and sea.

Defining the study area

1.2.16 The study area for the SLVIA is defined as the array area together with the Zone of Theoretical Visibility (ZTV) of the offshore components of Dublin Array.

1.2.17 The SLVIA study area covers a radius of 50 km from the outer limits of the array area, as illustrated in Figure 3.15.2 (SLVIA GIS Figures Appendix). Broadly, the SLVIA study area is defined by a western terrestrial area and an eastern maritime area. The terrestrial area extends from County Meath in the north to County Wexford in the south and from County Kildare in the east to the eastern seaboard. Wicklow, Dún Laoghaire-Rathdown, South Dublin, Dublin City and Fingal are the counties which make up the majority of the 50 km study area. The maritime area comprises an extent of the Irish Sea, out to approximately 60 km from the eastern seaboard.

1.2.18 The SLVIA study area is defined to extend far enough to include all areas within which significant effects could occur and is based on professional judgement. It is an outer limit to where significant effects could occur although it is considered highly unlikely that significant effects would occur beyond 30 to 40 km, and this has been confirmed by the findings of the SLVIA.

1.2.19 IEMA Guidance (IEMA, 2015 and 2017) recommends a proportionate ES focused on the significant effects and a proportionate ES topic chapter. An overly large SLVIA study area may be considered disproportionate if it makes an understanding of the key impacts of the Offshore Infrastructure of Dublin Array more difficult.

1.2.20 This is supported by LVIA Guidance produced by the Landscape Institute (GLVIA3) (Landscape Institute and IEMA, 2013) (para 3.16). This guidance recommends that "*The level of detail provided should be that which is reasonably required to assess the likely significant effects".* Para 5.2 at p70 also states that *"The study area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner".*

1.2.21 Other wind farm specific guidance, such as NatureScot's 'Visual Representation of Wind Farms Guidance' (NatureScot, 2017) recommends that ZTV distances are used for defining study area based on wind turbine height. This guidance recommends a 45 km radius for wind turbine generators (WTGs) greater than 150 m to blade tip (para 48, p12), however due to the age of the guidance it does not go beyond WTGs above 150 m in height. The height of current offshore wind turbine models has now exceeded the heights covered in this guidance. The SNH guidance recognises that greater distances may need to be considered for larger WTGs used offshore, as is the case for the SLVIA study area for the offshore infrastructure of Dublin Array. Despite the absence of specific guidance, consultation has led to the study areas of SLVIAs for other offshore wind farms typically being set at 50 km.

1.2.22 Beyond the array area, the SLVIA will generally focus on locations from where it may be possible to see the Offshore Infrastructure of Dublin Array, as defined by the Blade Tip ZTV (Figures 3.15.9b and 3.15.9c of the SLVIA GIS Figures Appendix).

1.2.23 The ZTVs are based on WTGs of 309.6 m to blade tip (above LAT) located within the array area and represents the Maximum Design Option (MDO) considered in the SLVIA. The ZTV illustrates where there would be no visibility of these WTGs, as well as areas where there would be WTGs visible, with six colour bands used to indicate the level of visibility.

1.2.24 Consideration of the blade tip ZTV (Figures 3.15.9b and 3.15.9c of the SLVIA GIS Figures Appendix) indicates that theoretical visibility of Dublin Array Offshore Infrastructure mainly occurs within 50 km and that beyond 50 km, the geographic extent of visibility will become very restricted. At distances over 50 km, the horizontal spread of Dublin Array Offshore Infrastructure will also occupy a small proportion of available views, and the apparent height of the WTGs will also appear very small. The horizontal angle ZTVs in Figures 3.15.11a and 3.15.11b of the SLVIA GIS Figures Appendix show that where theoretical visibility does occur at 50 km, the horizontal extent of Dublin Array will typically occupy 1 to 5 degrees of the wider 360-degree views potentially available.

1.2.25 The influence of earth curvature begins to limit the apparent height and visual influence of the WTGs visible at long distances, such as over 50 km, as the lower parts of the WTGs would be partially hidden behind the apparent horizon, leaving only the upper parts visible above the skyline. The extent of intervening built form and tree cover across this settled and cultivated study area will further reduce the actual visibility. Significant visual effects are, therefore, unlikely to arise at distances greater than 50 km, even if the WTGs are visible.

1.2.26 The variation of weather conditions influencing visibility off the ROI coast has also informed the SLVIA study area. Based on an initial review of Met Eireann visibility data on weather conditions recorded at Phoenix Park in Dublin, it can be concluded that visibility out to 10 km, which is the distance between the closest coastlines and the closest part of the Dublin Array offshore infrastructure, occurs relatively frequently.

1.2.27 In considering the SLVIA study area, the sensitivity of the receiving seascape, landscape and visual receptors has also been reviewed, taking particular account of the landscape designations shown in Figure 3.15.6, and principal visual receptors shown in Figure 3.15.8 (SLVIA GIS Figures Appendix). It is clear that the principal matters for the SLVIA to consider are the location of the Offshore Infrastructure off the east coast and, therefore, its exposure to, and visibility from, the developed coast between Sutton, through Dublin, to Wicklow; the Wicklow Mountains National Park (WMNP) and the Wicklow Areas of Outstanding Natural Beauty (AONB), which are largely within 10 to 30 km of the array area.

1.2.28 Potential cumulative interactions with other offshore wind farms have also influenced the definition of the SLVIA study area. Other offshore wind farms within the SLVIA study area are shown in Figure 3.15.16 (SLVIA GIS Figures Appendix).

1.3 Potential effects

Maximum Design Option

1.3.1 As set out in the Application for Opinion under Section 287B of the Planning and Development Act 2000, flexibility is being sought where details or groups of details may not be confirmed at the time of the application. In summary, and as subsequently set out in the ABP Opinion on Flexibility (detailed within Volume 2, Chapter 3: EIA Methodology) the flexibility being sought relates to those details or groups of details associated with the following components (in summary - see further detail in Project Description Chapter):

- WTG (model – dimensions and number);
- OSP (dimensions);
- Array layout;
- Foundation type (WTG and OSP; types and dimensions and scour protection techniques); and
- Offshore cables (IAC and ECC; length and layout).

1.3.2 To ensure a robust and transparent assessment, and one that is compliant with the ABP Opinion on Flexibility under Section 287B, the details or groups of details associated with those components where flexibility is being sought are defined in the form of a Maximum Design Option (MDO) and alternative design option(s). The MDO and alternative design option(s) are then assessed in terms of the magnitude of the effect, to provide certainty that any option within the range of parameters will not give rise to an effect which is of greater significance than the MDO.

1.3.3 In addition to the details or groups of details associated with the components listed above (where flexibility is being sought), the confirmed design details and the range of normal construction practises are also assessed within the EIAR (Project Description Chapter). Whilst flexibility is not being sought for these elements (for which plans and particulars are not required under the Planning Regulations), the relevant parameters are also incorporated into the MDO and alternative option(s) table herein (Table 4 of the SLVIA Chapter) to ensure that all elements of the project details are fully considered and assessed.

1.3.4 With respect to project design features where flexibility is not being sought, such as trenchless cable installation methodology at the landfall, the MDO and alternative design option(s) are the same (as there is no alternative). With respect to the range of normal construction practises that are intrinsic to installation of the development, such as the nature and extent of protection for offshore cables and the design of cable crossings, but which cannot be finally determined until after consent has been secured and detailed design is completed, the parameters relevant to the receptor being assessed are quantified, assigned and assessed as a maximum and alternative, as informed by the potential for impact upon that receptor. In the event of a favourable decision on the application they will be agreed prior to the commencement of the relevant part of the development by way of compliance with a standard 'matters of detail' planning condition (see Volume 2, Chapter 2: Consents, Legislation, Policy and Guidance). Throughout, an explanation and justification are provided for the MDO and alternative(s) within the relevant tables, as it relates to the details or groups of details where statutory design flexibility is being sought, and wider construction practises where flexibility is provided by way of planning compliance condition.

1.3.5 Table 4 of the SLVIA Chapter sets out the construction methodology and design parameters that represent the Maximum Design Option (MDO) taken forward for assessment of the effects on seascape, landscape and visual receptors, in addition to the alternative design options across the range of construction methodologies and design parameters. A justification is provided to evidence that alternative design options will result in a lesser or similar scale of impact than the MDO, but not a greater scale of impact.

1.3.6 The final WTG selection will be made post-consent and prior to construction and will be selected in accordance with the parameters set out in the MDO in the Project Description Chapter. The WTGs will comprise a tower and hub, with three blades, set on a multi-leg jacket foundation. The three potential layouts being considered include;

- 39 WTGs at a height of 309.6 m (LAT) to blade tip;
- 45 WTGs at a height of 281.6 m (LAT) to blade tip; and
- 50 WTGs at a height of 267.6 m (LAT) to blade tip.

1.3.7 These three WTG layouts have been considered in order to establish the MDO. The WTGs in all three layouts are spaced out to maximise the array area such that there is little difference in terms of the horizontal extent that the WTGs would occupy when seen from surrounding receptors. While the 50 WTGS at a height of 267.6 m (LAT) to blade tip present a slightly denser appearance, the more notable vertical elevation would be the greater height of the 39 WTGs at a height of 309.6 m (LAT) to blade tip, which would be 42 m taller and overall would present the MDO.

1.3.8 The layout comprising 39 WTGs each with a blade tip height of 309.6 m has, therefore, been used as the MDO in the SLVIA and is used in the photomontages in Figures 3.15.26 to 3.15.51 (SLVIA Visualisations Appendix). The MDO uses the location for the OSP that is relevant to the MDO layout. The comparative effects of the other two layouts are also considered in a comparative assessment in sections 15.12 and 15.13 of the SLVIA Chapter with this assessment supported by comparative wirelines in Figures 3.15.52 to 3.15.77 (SLVIA Visualisations Appendix).

Potential effects during construction and decommissioning

1.3.9 Potential effects on the seascape, landscape and visual resource are likely during the construction and decommissioning of the offshore infrastructure of Dublin Array during the construction and decommissioning periods, including:

- Seascape effects: Effects on perceived seascape character, arising as a result of the construction and decommissioning activities associated with the WTGs, OSP, inter-array cables and export cables and the presence of the WTGs and OSP, which may alter the seascape character of the array area itself and the perceived character of the wider seascape through visibility of these changes.
- Landscape effects: Effects on perceived landscape character, arising as a result of the construction and decommissioning activities associated with the WTGs, OSP, inter-array cables and export cables and the presence of the WTGs, OSP, which will be visible from the coast and may therefore affect the perceived character of the landscape. Effects on the special landscape qualities and integrity of designated landscapes as a result of the above construction and decommissioning activities.
- Visual effects: Effects on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, arising as a result of the construction and decommissioning activities associated with the WTGs, OSP, inter-array cables and export cables and the presence of the WTGs and OSP, which may alter the visual amenity experienced from the coastline and seaborne vessels.
- Whole project effects: Whole project effects could occur as a result of multiple construction and decommissioning activities related to the onshore and / or the offshore elements of Dublin Array affecting a seascape, landscape or visual receptor. Effects will be influenced by the construction phasing of the offshore and offshore elements of Dublin Array, the geographic location of receptors and visibility of the onshore and offshore elements.

Potential effects during operation

1.3.10 Potential effects on the seascape, landscape and visual resource are likely during the operation of the offshore elements of Dublin Array over its operational lifetime, including:

- Seascape effects: Effects on perceived seascape character arising as a result of the operational WTGs, substation and maintenance activities located, which may alter the seascape character of the array area itself and the perceived character of the wider seascape.
- Landscape effects: Effects on perceived landscape character (LCAs and designations), arising as a result of the operational WTGs, substation and maintenance activities, which will be visible from the coast and may therefore affect the perceived character of the landscape and may affect the special qualities of designated landscapes.
- Visual effects: Effects on views and visual amenity experienced by people as principal visual receptors and representative viewpoints, arising as a result of the operational WTGs, substations and maintenance activities, marine navigation and aviation lighting.
- Cumulative effects: Effects of operation of the offshore elements of Dublin Array that have the potential to contribute to cumulative seascape, landscape and visual effects including effects on seascape, landscape and visual amenity due to inter-visibility with other planned developments.

1.4 Guidance, data sources and site surveys

Guidance on methodology

1.4.1 This methodology accords with GLVIA3 (2013) and accompanying clarifications (2024). Where it diverges from specific aspects of the guidance, in a small number of areas, reasoned professional justification for this is provided as follows.

1.4.2 GLVIA3 sets out an approach to the assessment of magnitude of change in which three separate considerations are combined within the magnitude of change rating. These are the size or scale of the effect, its geographical extent and its duration and reversibility. This approach is to be applied in respect of both landscape and visual receptors. It is considered that the process of combining all three considerations in one rating can distort the aim of identifying significant effects of wind farm development. For example, a high magnitude of change, based on size or scale, may be reduced to a lower rating if it occurred in a localised geographical area and for a short duration. This might mean that a potentially significant effect could be overlooked if effects are diluted down due to their limited geographical extents and/ or duration or reversibility.

1.4.3 The consideration of the size or scale of the effect, its geographical extent and its duration and reversibility are kept separate, by basing the magnitude of change primarily on size or scale to determine where significant and non-significant effects occur and then describing the geographical extents of these effects and their duration and reversibility separately. Duration and reversibility are stated separately in relation to the assessed effects (i.e. as short/ medium/ long-term and temporary/ permanent) and are considered as part of drawing together conclusions about significance and combining with other judgements on sensitivity and magnitude, to allow a final judgement to be made on whether each effect is significant or not significant.

1.4.4 OPEN's assessment methodology utilises six scales of magnitude of change – high, medium-high, medium, medium-low, low and negligible; which are preferred to the 'maximum of five categories' suggested in GLVIA3 (3.27), as a means of clearly defining and summarising magnitude of change judgements.

1.4.5 These are not new diversions and follow practice established on Nationally Significant Infrastructure Projects (NSIP) in the UK such as Norfolk Vanguard, Norfolk Boreas, East Anglia TWO, East Anglia THREE and Thanet Extension.

1.4.6 A list of references, providing guidance on methodology is presented below.

- Landscape Institute and Institute of Environmental Management and Assessment (2013) - Guidelines for Landscape and Visual Impact Assessment: Third Edition (GLVIA3);
- Natural England (2014). An Approach to Landscape Character Assessment;
- Planning Inspectorate (2018) Advice Note Nine: Rochdale Envelope;
- Planning Inspectorate (2019). Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects - Version 2;
- NatureScot (2021). Assessing the Cumulative Impact of Onshore Wind Energy Developments;
- Landscape Institute (2019). Visual Representation of Development Proposals; and
- NatureScot (2017) - Visual Representation of Windfarms, Guidance (Version 2.2).

1.4.7 Whilst some of these guidance documents have been prepared by NatureScot for projects in Scotland, in the absence of alternative guidelines they have become best practice across Ireland and the UK.

Data sources

1.4.8 A list of the data sources used for this assessment is provided in Table 1. Note that relevant information on landscape character assessment may be contained in non-current local development plans.

Table 1 Key sources of seascape, landscape and visual data

Data sources	Year of Publication	Data Type	Confidence / Resolution	Comment
Ordnance Survey Ireland (OSI)0.0+. 50,000 Raster from Client	2019	Mapping information	High	OSI is the national data base for mapping information
Ordnance Survey Ireland 210,000 Raster from Client	2019	Mapping information	High	Larger scale mapping information
Ordnance Survey Ireland 10m DTM	2020	Digital Terrain Model	High	Detailed levels data
Ordnance Survey Ireland Administrative Boundaries	2019	Administrative Boundaries	High	Local government boundaries
Ordnance Survey Ireland Open Data	2019	Visual Receptors	High	Roads, Railway, Settlement, Ferry Routes
Dún Laoghaire Rathdown County Council - County Development Plan 2022-2028: Written Statement	2022	Landscape Character Assessment and Landscape Designations	High	Absence of national guidance on the assessment of landscape character
Fingal County Council - Fingal Development Plan 2023-2029.	2023	Landscape Character Assessment and Landscape Designations	High	Absence of national guidance on the assessment of landscape character
Kildare County Development Plan 2005 - 2011	2004	Landscape Character Assessment, Visual Receptors, Landscape Designations	High	Absence of national guidance on the assessment of landscape character
Meath County Development Plan 2013-2019	2013	Landscape Character Assessment	High	Absence of national guidance on the assessment of landscape character
South Dublin County Council Development Plan 2022-2028	2022	Landscape Character Assessment and Landscape Designations	Medium	Absence of national guidance on the assessment of landscape character

Wexford County Council Development Plan 2022-2028	2013	Landscape Character Assessment	High	Absence of national guidance on the assessment of landscape character
Wicklow County Council - Wicklow County Development Plan 2016-2022.	2016	Landscape Character Assessment and Landscape Designations	High	Absence of national guidance on the assessment of landscape character
The Marine Institute - Regional Seascape Character Assessment for Ireland 2020 Draft Consultation.	2020	Seascape Character Assessment	Medium	Initial draft without input from consultation review.
Heritage Council Ireland	2020	Pilgrim Paths	High	Data set covers the island of Ireland
Department of Culture, Heritage and the Gaeltacht - National Inventory for Architectural Heritage of designed landscapes	2021	Designed Landscapes	High	Collection and recording of data follows best practice guidance
Guidelines for Landscape and Visual Impact Assessment (GLVIA3)	2013	Accepted guidance for the production of LVIA	High	Guidelines setting out methodology and approach for LVIA
Notes and Clarifications on Aspects of Landscape and Visual Impact Assessment Third Edition	2024	Accepted accompanying guidance for the production of LVIA	High	Notes and clarifications on methodology and approach for LVIA
Met Eireann - Daily data.	2015-2024	Recorded data on visibility from weather station at Phoenix Park in Dublin.	High	Collection and recording of data follows best practice guidance
Dublin Array Scoping Report and Consultation Comments	2020	Defining scope of Dublin Array SLVIA	High	Feedback provided by statutory and other consultees on scope of EIA Report

Desk-based and site survey work

1.4.9 The SLVIA undertaken as part of the EIAR has been informed by desk-based studies and field survey work undertaken within the SLVIA study area. The landscape, seascape and visual baseline has been derived from a desk-based review of landscape and seascape character assessments and the ZTV, to identify receptors that may be affected by the offshore elements of Dublin Array and produce written descriptions of their key characteristics and value.

1.4.10 Interactions identified between Dublin Array offshore infrastructure and seascape, landscape and visual receptors have been used to predict potentially significant effects arising, with measures proposed to mitigate effects, where relevant.

1.4.11 For those receptors where a detailed assessment has been required, primary data acquisition has been undertaken through a series of surveys. These surveys include field survey verification of the ZTV from terrestrial landscape character areas (LCAs), micro-siting of viewpoint locations, panoramic baseline photography and visual assessment survey from all representative viewpoints. The viewpoint photography and assessment site surveys were undertaken between August 2018 and November 2023. Sea-based offshore surveys have been undertaken as part of the SLVIA with the ferry crossing made between Holyhead and Dublin.

1.5 Assessing seascape/landscape effects

Introduction

1.5.1 Landscape effects are defined by the Landscape Institute in GLVIA 3, paragraphs 5.1 and 5.2 as follows:

"An assessment of landscape effects deals with the effects of change and development on landscape as a resource. The concern ... is with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character."

1.5.2 In accordance with GLVIA 3 the term 'landscape' encompasses areas of 'townscape' and coastal areas of 'seascape'. Areas of landscape and seascape are relevant to this assessment, and they are described as follows.

Landscape character

1.5.3 GLVIA 3, paragraph 5.4, advises that Landscape Character Assessment should be regarded as the main source for baseline studies and identifies the following factors which combine to create areas of distinct landscape character:

- *"the elements that make up the landscape in the study area including:*
  - *physical influences – geology, soils, landform, drainage and water bodies;*
  - *landcover, including different types of vegetation and patterns and types of tree cover; and*

- *the influence of human activity, including land use and management, the character of settlements and buildings, and pattern and type of fields and enclosure.*

- *The aesthetic and perceptual aspects of the landscape – such as, for example, its scale, complexity, openness, tranquillity or wildness;*

- *The overall character of the landscape in the study area, including any distinctive Landscape Character Types or Areas that can be identified, and the particular combinations of elements and aesthetic and perceptual aspects that make each distinctive, usually by identification as key characteristics of the landscape."*

Seascape character

1.5.4 GLVIA 3 paragraph 5.6, advises that where LVIA is carried out in coastal or marine locations baseline studies must take account of seascape. Seascape is defined in Offshore Renewables – Guidance on Assessing the Impact on Coastal Landscape and Seascape: Guidance for Scoping an Environmental Statement (SNH, 2012) as *"the visual and physical conjunction of land and sea which combines maritime, coastal and hinterland character".*

1.5.5 GLVIA 3 paragraph 5.6, identifies the following different factors which together determine seascape character:

- *"coastal features;*
- *views to and from the sea;*
- *particular qualities of the open sea;*
- *the importance of dynamic changes due to weather and tides;*
- *changes in seascapes due to coastal processes;*
- *cultural associations; and*
- *contributions of coastal features to orientation and navigation at sea."*

Seascape/landscape effects

1.5.6 In respect of the offshore elements of Dublin Array, the potential seascape/landscape effects, occurring during the construction, operation and decommissioning periods of Dublin Array may therefore include, but are not restricted to the following:

- changes to seascape/ landscape character and qualities: seascape/landscape character may be affected through the incremental effect on characteristic elements, landscape patterns and qualities (including perceptual characteristics) and the addition of new features, the magnitude of which is sufficient to alter the overall seascape/landscape character within a particular area;

- changes to the perceived character of designated landscapes, including the National Parks and Areas of Outstanding Natural Beauty (AONB) that will affect the special landscape qualities underpinning the designation and its integrity; and
- cumulative seascape/ landscape effects: where more than one development of a similar type may lead to a cumulative effect.

1.5.7 Development may have a direct effect on the seascape, however all landscape effects arising from the offshore elements of Dublin Array on landscape character will be indirect effects, which will be perceived from the wider landscape, outside the site boundary and its seascape/landscape.

Evaluating seascape/landscape sensitivity to change

1.5.8 The assessment of sensitivity takes account of the seascape/ landscape value and the susceptibility of the receptor to the type or nature of change proposed.

1.5.9 Seascape/ landscape sensitivity often varies in response to both the type and phase of the development proposed and its location, such that sensitivity needs to be considered on a case-by-case basis. It should not be confused with 'inherent sensitivity' where areas of the landscape may be referred to as inherently of 'high' or 'low' sensitivity. For example, a National Park may be described as inherently of high sensitivity on account of its designation and value, although it may prove to be less susceptible (and therefore sensitive) to a particular development. The susceptibility of seascape/ landscape receptors has been assessed in relation to change arising from the specific development proposed, including the specific offshore elements of Dublin Array.

1.5.10 The sensitivity of a seascape/ landscape character receptor is an expression of the combination of the judgements made about the susceptibility of the receptor to the type or nature of change proposed, and the value related to that receptor.

Value of the seascape/ landscape receptor

1.5.11 The value of a seascape/ landscape character receptor is a reflection of the value that society attaches to that seascape/ landscape. The assessment of the seascape/ landscape value has been classified as high, medium-high, medium, medium-low or low and the basis for this assessment has been made clear using evidence and professional judgement, based on the following range of factors. Indicators of higher and lower value are described further in Table 2.

- **Seascape/ landscape designations** - A receptor that lies within the boundary of a recognised landscape related planning designation, or within its setting, will be of increased value, depending on the level of importance of the designation which may be international, national, regional or local. The absence of designations does not however preclude value, as an undesignated landscape character receptor may be valued as a resource in the local or immediate environment; however, the absence of a landscape designation and location outside the setting of a designation, may be an indicator of lower value.

- **Seascape/ landscape quality** - The quality of a seascape/ landscape character receptor is a reflection of its attributes, such as scenic quality, sense of place, rarity and representativeness and the extent to which its valued attributes have remained intact. A seascape/ landscape with high scenic quality that contributes to special qualities, with consistent, intact, well-defined and distinctive attributes is considered to be of higher quality and, in turn, higher value, than a landscape where the introduction of elements has detracted from its character, has low scenic qualities and does not contribute to special qualities.

- **Seascape/ landscape experience** - The experiential qualities that can be evoked by a landscape receptor can add to its value and relates to a number of factors including the perceptual responses it evokes (for example wildness, remoteness, tranquillity), the cultural associations that may exist in literature or history, or the iconic status of the seascape/landscape in its own right, the recreational value of the seascape/landscape, and the contribution of other values relating to the nature conservation or archaeology of the area.

Seascape/ landscape susceptibility to change

1.5.12 The susceptibility of a seascape/ landscape character receptor to change is a reflection of its ability to accommodate the changes that will occur as a result of the type or nature of change proposed without undue consequences for the maintenance of the baseline situation and/ or the achievement of landscape planning policies and strategies. Some landscape/ seascape receptors are better able to accommodate development than others due to certain characteristics that are indicative of capacity to accommodate change. These characteristics may or may not also be special landscape qualities that underpin designated landscapes.

1.5.13 The assessment of the susceptibility of the seascape/ landscape receptor to change has been classified as high, medium-high, medium, medium-low or low and the basis for this assessment has been made clear using evidence and professional judgement. Indicators of landscape/ seascape susceptibility to the type or nature of change proposed are based on the following criteria. Indicators of higher and lower susceptibility are described further in Table 2.

- **Natural** – form/ topography/ character of hinterland (relevant landscape character type), coastal edge (cliffs, rocky coasts, upper beach, dunes, intertidal etc) and tidal range.

- **Cultural/ social** – use of the sea (navigation, fishing, leisure, energy etc), coast and hinterland (settlement, industry, marine related development such as harbours, ports, industry, agriculture etc) and historic features on the coast (forts, castles, lighthouses etc).

- **Quality/ condition** – intactness (degree of completeness or fragmentation visually, presence of detractors) and state of repair (condition of natural and built features/ elements).

- **Aesthetic and perceptual** – scale of sea (in relation to coastal form or offshore areas); openness/ enclosure (the degree and nature of enclosure of the sea by land and framing of views); exposure (degree of shelter/ exposure); aspect (relationship with the sun); seascape pattern and foci (features and element on sea surface, coast and hinterland); tranquillity (movement, man-made structures, dark skies); wildness (sense of natural character uninfluenced by man); and remoteness (perceived distance from population and human interventions).
- **Visual characteristics** – key views from land to sea, sea to land and sea to sea, including nature of views and elevation, presence of iconic features; intervisibility of area with important receptors (amount, length, extent, nature of intervisibility and distance from development); and how seascape is experienced.
- **Relationship between seascape area and adjacent coast** – contribution of seascape to the setting of an important coast/ hinterland or character area; and key relationships between hinterland, coastal edge, intertidal area and sea.

Seascape/ landscape sensitivity rating

1.5.14 An overall sensitivity assessment of the seascape/ landscape receptor has been made by combining the assessment of the value of the seascape/ landscape character receptor and its susceptibility to change. The evaluation of seascape/ landscape sensitivity has been applied for each seascape/ landscape receptor - high, medium-high, medium, medium-low and low. The basis for the assessments has been made clear using evidence and professional judgement in the evaluation of sensitivity for each receptor, informed by criteria that tend towards higher or lower sensitivity are set out in Table 2 below.

Table 2 Seascape/ landscape sensitivity to change

Higher	Lower
Value	
Designation: Presence of designated seascape/ landscapes with national policy level protection or defined for their natural beauty. Perceived as lying within seascape setting of a designation.	Seascape/ landscapes without formal designation. Despoiled or degraded seascape/landscape with little or no evidence of being valued by the community. Not within seascape setting of a landscape designation.
Aesthetic/ scenic qualities: Higher quality seascape/ landscapes with consistent, intact and well-defined, distinctive attributes. A seascape/ landscape with high scenic quality that contributes to special qualities. Aesthetic / scenic or perceptual aspects of designated wildlife, ecological or cultural heritage features that contribute to seascape/landscape character.	Lower quality seascape/ landscapes with indistinct elements or features that detract from its inherent attributes. A seascape/ landscape with low scenic qualities that does not contribute to special qualities. Limited wildlife, ecological or cultural heritage features, or limited contribution to seascape/ landscape character.

Higher	Lower
Perceptual qualities: Seascape/landscape with perceptual qualities with high level of perceived wildness, high level of remoteness or high tranquility.	Seascape/landscape with no apparent wildness, low levels of perceived remoteness or low tranquility, often as a result of existing development influences.
Cultural associations: Seascape/landscape with strong/rich cultural associations that contribute to scenic quality. Presence of heritage designations overlooking or within area of potential development.	Seascape/landscape with few/limited cultural associations. Absence of heritage designations overlooking or within area of potential development.
Recreational and community value: Area used extensively for leisure especially related to enjoying seascape character and views. Highly valued area and features/ elements by people, communities of interest and place.	Area with limited use for leisure, or where leisure relates mainly to pursuing that activity and not the enjoyment of seascape character or views, or where leisure is dynamic/ at speed. Area or features with attributed limited value by people.
Rarity: Rare or unique seascape/landscape character types, features or elements.	Widespread or 'common' seascape/landscape character types, features or elements.
Susceptibility to change - natural	
Hinterland: Mountainous or hilly hinterland i.e. long slopes rising from coast, high elevation.	Plateau or flat hinterland. Highly enclosed by topography or land cover.
Coastal edge: Intricate, complex, rugged forms and dramatic headlands/ ends of peninsulas.	Flat, horizontal or gently undulating or largely straight coast. Simple forms. Man-made interventions/ structures in area.
Tidal range: Where tidal range or streams add to the seascape qualities.	The tidal range or streams make a limited contribution to seascape qualities.
Susceptibility to change – cultural / social	
Use of the sea: Uses with limited infrastructure. Rural uses or semi-natural land. Small scale, traditional, historic settlements and harbours. Little association with other contemporary development.	Presence of energy production and large shipping vessels/ trade routes nearby (not through area). Strong or direct association with other similar contemporary developments.
Use of the coast/hinterland: Uses with limited infrastructure. Rural uses or semi-natural land. Small scale, traditional, historic settlements and harbours. Little association with other contemporary development.	Presence of industry/ energy production/ dock infrastructure. Urban form. Strong or direct association with other similar contemporary developments.
Historic features on coast: Presence of coastal and island historic features such as forts, castles, chapels, monasteries, other buildings and structures and other heritage features which have a strong relationship with the coast and sea visually, physically or culturally.	Limited number or no heritage features
Susceptibility to change – quality / condition	
Intactness: Intact and consistent character of seascape. Few or no detractors. Fragile seascape/ landscape lacking ability to accommodate change.	Seascape character fragmented. Presence of detractors. Robust landscape capable of accommodating change.

Higher	Lower
State of repair: Well-maintained seascape or landscape character at coast.	Poorly maintained seascape or landscape character at coast. Presence of dereliction/ neglect.
Susceptibility to change – aesthetic / perceptual	
Scale: Small scale, enclosed, views to horizon limited by landform. Introduction of an element of scale into previously un-scaled area.	A seascape of large scale, with simple, broad and homogenous coastal landforms. Large scale views.
Openness and enclosure: Openness may increase susceptibility if there is wide visibility, however open seascape/ landscape may also be larger scale and simple which would decrease susceptibility. Where openness is a key characteristic and introduction of built elements may compromise this.	Enclosed seascape/ landscape can offer more screening potential, limiting visibility to a smaller area, however they may also be smaller scale and more complex which would increase susceptibility. Unframed open views unimpeded by natural elements or features.
Exposure: Sheltered and calm seascapes. Where seascape is extremely exposed such that the perceived wild, elemental nature is a key characteristic	Open, exposed seascapes which does not provide a perception of elemental or wild seascape character.
Aspect: Development would interfere with notable views of sunrises and particularly sunsets. Development seen from higher level views, where viewer elevation results in geometric layout pattern perceived as closer than on the horizon line.	Development located away from sunrise and sunset positions. Development seen from lower level views, where viewer elevation results in skyline development, on or over the horizon line.
Seascape pattern and foci: Complex or unified pattern which would be disrupted by development. Important focal points e.g. islands, islets, headlands, distinctive sweeping beaches, and high hills. Open unspoilt views of the sea with no signs of development offshore.	Presence of existing vertical or other elements at sea including shipping/ferries and offshore WTGs. Lack of intact pattern. Lack of natural or historic feature focal points.
Tranquility: Where stillness is a key feature, or where/ when movement is highly natural, irregular or dramatic. Very limited or no industrial/ semi-industrial structures. Where the area is unlit at night and is classified as such in a dark skies study.	Busier areas where development movement relates to other forms of mechanical movement present e.g. commercial shipping, ferries, boats, vehicles, WTGs. Presence of industrial/semi-industrial structures especially at sea, or on coast. Coast is already well lit at night. Lights at sea and land.
Wildness: Undeveloped seascape Wild character. Highly natural, semi-natural, unmanaged.	Highly developed seascape. Highly modified/ managed.
Remoteness: Remote or isolated. Receptor perceived to be at distance from centres of population and human interventions.	Not remote. Receptor perceived to be close to centres of population and human interventions.
Susceptibility to change – visual characteristics	
Key views (land to sea, sea to land, sea to sea): Open or framed views from key viewpoints. Views to key features e.g. islands, other coasts,	Few or no views from key viewpoints. Sea not used for leisure sailing. Developed, non-distinctive skylines without landmark features.

Higher	Lower
headlands. Views from well used sea area for leisure focused on seascape/ scenic quality. Distinctive undeveloped skylines with landmark features.	
Intervisibility and associations of the development area with receptors: Strong intervisibility with coast in terms of length and/ or area and/ or relatively close to. Adjacent seascape/ landscape character context connected by associated character and views.	Poor intervisibility with coast in terms of length and/ or area and/ or relatively far away. Host landscape character is separate from surrounding/ adjacent seascape/ landscape character with weak association.
Typical receptors – type and number: Coast path and users of paths and access land. Visitors to heritage features. Promenade and pier users. Leisure sailors.	Users of ferries. Shipping. People in urban areas at work. Users of roads (unless corniche). Users of railways.
How seascape is experienced: From remote or little used stretch of sea with little shipping or boat use. From secluded coastline, intimate coastal roads and footpaths. From important viewpoints and elevated positions where the focus is the view and not the activity.	From ferry/ shipping. From main coastal, busy roads. Crowded beaches where focus is on beach activities (rather than enjoyment of seascape character).
Susceptibility to change – relationship between seascape area and adjacent coast	
Contribution to setting: Is perceived from, and forms the setting of, a sensitive coast or seascape character area within the limits of visual perception.	Is perceived from a less sensitive coast or seascape character area. Is beyond the limits of visual perception.

Seascape/ landscape magnitude of change

Overview

1.5.15 The magnitude of change affecting seascape/ landscape receptors is an expression of the scale of the change that will result from the offshore elements of Dublin Array and is dependent on a number of variables regarding the size or scale of the change and the geographical extent over which the change will be experienced.

Size or scale of change

1.5.16 This criterion relates to the size or scale of change to the seascape/ landscape that will arise as a result of the offshore elements of Dublin Array, based on the following factors.

- **Seascape/ landscape elements:** The degree to which the pattern of elements that makes up the seascape/ landscape character will be altered by the offshore elements of Dublin Array, by removal or addition of elements in the seascape/ landscape. The magnitude of change will generally be higher if the features that make up the seascape/ landscape character are extensively removed or altered, and/ or if many new offshore elements are added to the seascape/ landscape.

- **Seascape/ landscape characteristics:** This relates to the extent to which the effect of the offshore elements of Dublin Array changes, physically or perceptually, the key characteristics of the seascape/ landscape that may be important to its distinctive character. This may include, for example, the scale of the landform, its relative simplicity or irregularity, the nature of the seascape/ landscape context, the grain or orientation of the seascape/landscape, the degree to which the receptor is influenced by external features and the juxtaposition of the offshore elements of Dublin Array in relation to these key characteristics. If the offshore elements of Dublin Array are located in a seascape/ landscape receptor that is already affected by other similar development, this may reduce the magnitude of change if there is a high level of integration, and the developments form a unified and cohesive feature in the seascape/landscape.

- **Seascape/ landscape designation:** In the case of designated landscapes, the degree of change is considered in light of the effects on the special landscape qualities which underpin the designation and the effect on the integrity of the designation. All landscapes change over time and much of that change is managed or planned. Often landscapes will have management objectives for 'protection' or 'accommodation' of development. The scale of change may be localised, or occurring over parts of an area, or more widespread affecting whole landscape receptors and their overall integrity.

- **Distance:** The size and scale of change is also strongly influenced by the proximity of the offshore elements of Dublin Array to the receptor and the extent to which the development can be seen as a characterising influence on the landscape. Consequently, the scale or magnitude of change is likely to be lower in respect of landscape receptors that are distant from the offshore elements of Dublin Array and / or screened by intervening landform, vegetation and built form to the extent that the scale of their influence on landscape receptors is small or limited. Conversely, landscapes closest to the development are likely to be most affected. Host landscapes (where the development is located within a 'host' landscape character unit) will be directly affected whilst adjacent areas of landscape character will be indirectly affected.

- **Amount and nature of change:** The amount of Dublin Array that will be seen. Visibility of the offshore elements of Dublin Array may range from one WTG blade tip to all of the WTGs; generally, the greater the amount of the offshore elements of Dublin Array that can be seen, the higher the scale of change. The degree to which Dublin Array is perceived to be on the horizon or 'within' the seascape/ landscape. Generally, the magnitude of change is likely to be lower if Dublin Array is largely perceived to be on the horizon at distance, rather than 'within' the seascape/ landscape.

Geographical extent

1.5.17 The geographic extent over which the seascape/ landscape effects has been experienced is also assessed, which is distinct from the size or scale of effect. This evaluation is not combined in the assessment of the level of magnitude, but instead expresses the extent of the receptor that will experience a particular magnitude of change and therefore the geographical extents of the significant and non-significant effects.

1.5.18 The extent of the effects will vary depending on the specific nature of the offshore elements of Dublin Array and is principally assessed through analysis of the extent of perceived changes to the seascape/ landscape character through visibility of the offshore elements of Dublin Array.

1.5.19 Landscape effects are described in terms of the geographical extent or physical area that will be affected (described as a linear or area measurement). This should not be confused with the scale of the development or its physical footprint. The manner in which the geographical extent of the seascape/ landscape effect is described for different seascape/ landscape receptors is explained as follows.

- **Seascape/ landscape character:** The extent of the effects on seascape/ landscape character will vary depending on the specific nature of the offshore elements of Dublin Array. This is not simply an expression of visibility or the extent of the ZTV, but also includes a specific assessment of the extent of landscape character that will be changed by the offshore elements of Dublin Array in terms of its character, key characteristics and elements.

- **Landscape designations:** In the case of a designated landscape, this refers to the extent the special landscape qualities of the designation are affected and whether this can be defined in terms of area or linear measurements, or subjectively through professional judgement (with the support of an expert topic group and / or peer review) and whether the integrity of the designation is affected.

Duration and reversibility

1.5.20 The duration and reversibility of seascape/ landscape effects has been based on the period over which offshore elements of Dublin Array are likely to exist (during construction and operation) and the extent to which these elements has been removed (during decommissioning) and its effects reversed at the end of that period. Long-term, medium-term and short-term seascape/ landscape effects are defined as follows:

- long-term – more than 10 years (may be defined as permanent or reversible);
- medium-term – 5 to 10 years; and
- short-term – 0 to 5 years.

Seascape/ landscape magnitude of change rating

1.5.21 The 'magnitude' or 'degree of change' resulting from the offshore elements of Dublin Array is described as 'High', 'High-medium', 'Medium', 'Medium-low' 'Low' or 'Negligible'. In assessing magnitude of change, the assessment focuses on the size or scale of change and its geographical extent. The duration and reversibility are stated separately in relation to the assessed effects (i.e., as short/ medium/ long-term and temporary/ permanent). The basis for the assessment of magnitude for each receptor has been made clear using evidence and professional judgement. The levels of magnitude of change that can occur are defined in Table 3.

Table 3 Seascape / landscape magnitude of change ratings

Magnitude of change	Description / reason
High	The proposed development will result in a high level of alteration to the baseline characteristics or special qualities of the seascape/ landscape, forming the prevailing influence and/ or introducing elements that are uncharacteristic in the baseline landscape/ seascape. The addition of the proposed development will result in a large-scale change, loss or addition to the baseline seascape/ landscape.
Medium-high	Intermediate rating with combination of criteria from high or medium magnitude.
Medium	The proposed development will result in a medium level of alteration to the baseline characteristics or special qualities of the seascape/ landscape, forming a readily apparent influence and/ or introducing elements that are potentially uncharacteristic in the baseline seascape/landscape. The addition of the proposed development will result in a medium-scale change, loss or addition to the baseline seascape/ landscape.
Medium-low	Intermediate rating with combination of criteria from medium or low magnitude.
Low	The proposed development will result in a low level of alteration to the baseline characteristics or special qualities of the seascape/ landscape, providing a slightly apparent influence and/ or introducing elements that are characteristic in the baseline seascape/ landscape. The addition of the proposed development will result in a small-scale change, loss or addition to the baseline seascape/ landscape.
Negligible	The proposed development will result in a negligible alteration to the baseline characteristics or special qualities of the seascape/landscape, providing a barely discernible influence and/or introducing elements that are substantially characteristic in the baseline seascape/landscape. The addition of the proposed development will result in negligible change, loss or addition to the baseline seascape/landscape.

Evaluating seascape/landscape effects and significance

1.5.22 The level of seascape/ landscape effect is evaluated through the combination of seascape/ landscape sensitivity and magnitude of change. Once the level of effect has been assessed, a judgement is then made as to whether the level of effect is 'significant' or 'not significant' as required by the relevant EIA Regulations. This process is assisted by the matrix in

1.5.23 Table 7 which is used to guide the assessment. The factors considered in the evaluation of the sensitivity and the magnitude of the change resulting from the offshore elements of Dublin Array and their conclusion, has been presented in a comprehensive, clear and transparent manner.

1.5.24 Further information is also provided about the nature of the effects (whether these will be direct/ indirect; temporary/ permanent/ reversible; beneficial/ neutral/ adverse or cumulative).

1.5.25 A significant effect will occur where the combination of the variables results in the offshore elements of Dublin Array having a defining effect on the seascape/ landscape receptor, or where changes of a lower magnitude affect a seascape/ landscape receptor that is of particularly high sensitivity. A major loss or irreversible effect over an extensive area or seascape/ landscape character, affecting landscape elements, characteristics and / or perceptual aspects that are key to a nationally valued landscape are likely to be significant.

1.5.26 A non-significant effect will occur where the effect of the offshore elements of Dublin Array is not defining, and the landscape character of the receptor continues to be characterised principally by its baseline characteristics. Equally a small-scale change experienced by a receptor of high sensitivity may not significantly affect the special landscape quality or integrity of a designation. Reversible effects, on elements, characteristics and character that are of small-scale or affecting lower value receptors are unlikely to be significant.

1.6 Assessing visual effects

Overview

1.6.1 Visual effects are concerned wholly with the effect of the offshore elements of Dublin Array on views, and the general visual amenity and are defined by the Landscape Institute in GLVIA 3, paragraphs 6.1 as follows:

"An assessment of visual effects deals with the effects of change and development on views available to people and their visual amenity. The concern ... is with assessing how the surroundings of individuals or groups of people may be specifically affected by changes in the context and character of views."

1.6.2 Visual effects are identified for different receptors (people) who will experience the view at their place of residence, within their community, during recreational activities, at work, or when travelling through the area. The visual effects may include the following:

- **Visual effect:** a change to an existing static view, sequential views, or wider visual amenity as a result of development or the loss of particular landscape elements or features already present in the view; and
- **Cumulative visual effect:** the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect.

1.6.3 The level of visual effect (and whether this is significant) is determined through consideration of the sensitivity of each visual receptor (or range of sensitivities for receptor groups) and the magnitude of change that will be brought about by the construction, operation and decommissioning of the offshore elements of Dublin Array.

Zone of Theoretical Visibility (ZTV)

1.6.4 Plans mapping the Zone of Theoretical Visibility (ZTV) are used to analyse the extent of theoretical visibility of the offshore elements of Dublin Array, across the study area and to assist with viewpoint selection. The ZTV does not however, take account of the screening effects of buildings, localised landform and vegetation, unless specifically noted (see individual figures). As a result, there may be roads, tracks and footpaths within the study area which, although shown as falling within the ZTV, are screened or filtered by built form and vegetation, which will otherwise preclude visibility.

1.6.5 The ZTVs provide a starting point in the assessment process and accordingly tend towards giving a 'worst case' or greatest calculation of the theoretical visibility.

Viewpoint analysis

1.6.6 Viewpoint analysis is used to assist the assessment and is conducted from selected viewpoints within the study area. The purpose of this is to assess both the level of visual effect for particular receptors and to help guide the design process and focus the assessment. A range of viewpoints are examined in detail and analysed to determine whether a significant visual effect will occur. By arranging the viewpoints in order of distance it is possible to define a threshold or outer geographical limit, beyond which significant effects will be unlikely.

1.6.7 The assessment involves visiting the viewpoint location and viewing wirelines and photomontages prepared for each viewpoint location. The fieldwork is conducted in periods of fine weather with good visibility and considers seasonal changes such as reduced leaf cover or hedgerow maintenance.

1.6.8 The SLVIA therefore includes viewpoint analysis prepared for each viewpoint and presented as supporting assessment in the SLVIA. A summary table of the findings is also provided in order of distance from the offshore elements of Dublin Array. This summary table assists in defining the direction, elevation, geographical spread and nature of the potential visual effects and identify areas where significant effects are likely to occur. This approach seeks to provide clarity and confidence to consultees and decision makers by allowing the detailed judgements on the magnitude of visual change to be more readily scrutinised and understood.

1.6.9 The viewpoint analysis is used to assist the visual assessment of visual receptor locations reported in the ES.

Evaluating visual sensitivity to change

1.6.10 In accordance with paragraphs 6.31-6.37 of GLVIA3, the sensitivity of visual receptors has been determined by a combination of the value of the view and the susceptibility of the visual receptors.

Value of the view

1.6.11 The value of a view or series of views reflects the recognition and the importance attached either formally through identification on mapping or being subject to planning designations, or informally through the value which society attaches to the view(s). The value of a view has been classified as high, medium-high, medium, medium-low or low and the basis for this assessment has been made clear using evidence and professional judgement, based on the following criteria.

- **Formal recognition** - The value of views can be formally recognised through their identification on OS or tourist maps as formal viewpoints, sign-posted and with facilities provided to add to the enjoyment of the viewpoint such as parking, seating and interpretation boards. Specific views may be afforded protection in local planning policy and recognised as valued views. Specific views can also be cited as being of importance in relation to landscape or heritage planning designations, for example the value of a view has been increased if it presents an important vista from a designed landscape or lies within or overlooks a designated area, which implies a greater value to the visible landscape.

- **Informal recognition** - Views that are well-known at a local level and/or have particular scenic qualities can have an increased value, even if there is no formal recognition or designation. Views or viewpoints are sometimes informally recognised through references in art or literature, and this can also add to their value. A viewpoint that is visited or appreciated by a large number of people will generally have greater importance than one gained by very few people.

Susceptibility to change

1.6.12 Susceptibility relates to the nature of the viewer experiencing the view in respect of their occupation or activity and as a consequence the extent to which their attention may be focused on the views or visual amenity experienced at that location (Landscape Institute 2013). A judgement to determine the level of susceptibility relates to the nature of the viewer and their experience from that particular viewpoint or series of viewpoints, classified as high, medium-high, medium, medium-low or low and based on the following criteria.

- **Nature of the viewer** - The nature of the viewer is defined by the occupation or activity of the viewer at the viewpoint or series of viewpoints. The most common groups of viewers considered in the visual assessment include residents, motorists, and people taking part in recreational activity or working. Viewers, whose attention is focused on the landscape, or with static long-term views, are likely to have a higher sensitivity. Viewers travelling in cars or on trains will tend to have a lower sensitivity as their view is transient and moving. The least sensitive viewers are usually people at their place of work as they are generally less sensitive to changes in views.

- **Experience of the viewer** - The experience of the visual receptor relates to the extent to which the viewer's attention or interest may be focused on the view and the visual amenity they experience at a particular location. The susceptibility of the viewer to change may be influenced by the viewer's attention or interest in the view, which may be focused in a particular direction, from a static or transitory position, over a long or short duration, and with high or low clarity. The visual amenity experienced by the viewer at a particular location varies depending on the presence and relationship of visible elements, features or patterns experienced in the view and the degree to which the landscape in the view may accommodate the type or nature of the change proposed.

1.6.13 An overall level of sensitivity has been applied for each visual receptor or view – high, medium-high, medium, medium-low or low – by combining assessments of the value of the view and the susceptibility of the visual receptor to change. Each visual receptor, meaning the particular person or group of people likely to be affected at a specific viewpoint, is assessed in terms of their sensitivity. The basis for the assessments has been made clear using evidence and professional judgement in the evaluation of each receptor. Criteria that tend towards higher or lower sensitivity that inform judgements on the visual sensitivity assessed are set out in Table 4 below.

Table 4 Visual sensitivity to change

Higher	Lower
Value	
Specific viewpoint identified in OS maps and / or tourist information and signage.	Viewpoint not identified in OS maps or tourist information and signage.
Facilities provided at viewpoint to aid the enjoyment of the view.	No facilities provided at viewpoint to aid enjoyment of the view.
View afforded protection in planning policy.	View is not afforded protection in planning policy.
View is within or overlooks a designated landscape, which implies a higher value to the visible landscape.	View is not within, nor does it overlook, a designated landscape.
View has informal recognition and well- known at a local level, as having particular scenic qualities.	View has no informal recognition and is not known as having particular scenic qualities.
View or viewpoint is recognised through references in art or literature.	View or viewpoint is not recognised in references in art or literature.
View has high scenic qualities relating to the content and composition of the visible landscape.	View has low scenic qualities relating to the content and composition of the visible landscape.

Higher	Lower
Susceptibility to change	
Viewer who is likely or liable to be influenced by the offshore elements of the proposed development.	Viewer who is unlikely or not liable to be influenced by the offshore elements of the proposed development.
Viewers such as walkers, or tourists, whose main attention and interest are on their surroundings.	Viewers whose main attention is not focused on their surroundings, such as people at work, or specific forms of recreation.
Residents that gain static, long-term views of the offshore elements of the proposed development in their principal outlook.	Viewers who are transient and dynamic, such as those travelling in cars or on trains, where the view is of short duration.
Viewpoint is visited or used by a large number of people.	View is visited or gained by very few people.
A view that is focused in a specific directional vista, with notable features of interest in a particular part of the view.	Open views with no specific point of interest, or specific directional vista away from direction of the proposed development.
Viewers are focused on the experience of a high level of visual amenity at the location due to its overall pleasantness as an attractive visual setting or backdrop to activities.	The visual amenity experienced at the location by viewers is less pleasant or attractive than might otherwise be the case.

Visual magnitude of change

1.6.14 The visual magnitude of change is an expression of the scale of the change that will result from the offshore elements of Dublin Array and is dependent on a number of variables regarding the size or scale of the change and the geographical extent over which the change will be experienced. A separate assessment is also made of the duration and reversibility of visual effects.

Size or scale of change

1.6.15 An assessment has been made about the size or scale of change in the view that is likely to be experienced as a result of the offshore elements of Dublin Array, based on the following criteria:

- **Distance:** the distance between the visual receptor/viewpoint and the offshore elements of Dublin Array. Generally, the greater the distance, the lower the magnitude of change, as the offshore elements of Dublin Array will constitute a smaller scale component of the view.

- **Size:** the amount and size of the offshore elements of Dublin Array that will be seen. Visibility may range from small or partial visibility of the offshore elements of Dublin Array, to all of the offshore elements being visible. Generally, the larger and greater number of the offshore elements of Dublin Array that appear in the view, the higher the magnitude of change. This is also related to the degree to which the offshore elements of Dublin Array may be wholly or partly screened by landform, vegetation (seasonal) and/or built form. Conversely open views are likely to reveal more of the offshore elements of Dublin Array, particularly where this is a key characteristic of the landscape.

- **Scale:** the scale of the change in the view, with respect to the loss or addition of features in the view and changes in its composition. The scale of the offshore elements of Dublin Array may appear larger or smaller relative to the scale of the receiving seascape/landscape.

- **Field of view:** the vertical/ horizontal field of view (FoV) and the proportion of the view that is affected by the offshore elements of Dublin Array. Generally, the more of the proportion of a view that is affected, the higher the magnitude of change will be. If the offshore elements of Dublin Array extend across the whole of the open part of the outlook, the magnitude of change will generally be higher as the full view will be affected. Conversely, if the offshore elements of Dublin Array cover just a narrow part of an open, expansive and wide view, the magnitude of change is likely to be reduced as they will not affect the whole open part of the outlook. This can in part be described objectively by reference to the horizontal/vertical FoV affected, relative to the extent and proportion of the available view.

- **Contrast:** the character and context within which the offshore elements of Dublin Array will be seen and the degree of contrast or integration of any new features with existing landscape elements, in terms of scale, form, mass, line, height, colour, luminance and motion. Contrasts and changes may arise particularly as a result of the rotation movement of the WTG blades, as a characteristic that gives rise to effects. Developments which contrast or appear incongruous in terms of colour, scale and form are likely to be more visible and have a higher magnitude of change.

- **Consistency of image:** the consistency of image of the offshore elements of Dublin Array in relation to other developments. The magnitude of change of offshore elements of Dublin Array is likely to be lower if its WTG height, arrangement, and layout design are broadly similar to other developments in the seascape, in terms of its scale, form and general appearance. New development is more likely to appear as logical components of the landscape with a strong rationale for their location.

- **Skyline/background:** Whether the offshore elements of Dublin Array will be viewed against the skyline, or a background seascape may affect the level of contrast and magnitude. If the offshore elements of Dublin Array add to an already developed skyline the magnitude of change will tend to be lower.

- **Number:** generally, the greater the number of separate offshore elements of Dublin Array seen simultaneously or sequentially, the higher the magnitude of change. Further effects will occur in the case of separate developments and their spatial relationship to each other will affect the magnitude of change. For example, development that appears as an extension to an existing development will tend to result in a lower magnitude of change than a separate, new development.

- **Nature of visibility:** the nature of visibility is a further factor for consideration. The offshore elements of Dublin Array may be subject to various phases of development change and the manner in which the offshore elements of Dublin Array may be viewed could be intermittent or continuous and / or seasonally, due to periodic management or leaf fall.

Geographical extent

1.6.16 The geographic extent over which the visual effects will be experienced has also been assessed. This is distinct from the size or scale of effect and is described in terms of the physical area or location over which it will be experienced (described as a linear or area measurement). The extent of the effects will vary according to the specific nature of the offshore elements of Dublin Array and is principally assessed through ZTV, field survey and viewpoint analysis of the extent of visibility likely to be experienced by visual receptors. The geographical extent of visual effects is described as per the following examples.

1.6.17 The geographical extent can be described as an area measurement or proportion of the total area of the receptor affected. For example, effects on people within a particular area such as a golf course or area of common land can be illustrated via a 'representative viewpoint' that represents a similar visual effect, likely to be experienced by larger numbers of people within that area. The geographical extent of that visual effect can be expressed as approximately '5 hectares' or '10%' of an area of common land or defined recreational area.

1.6.18 The geographical extent can be described as a linear measurement (m or km) according to the length of route affected. For example, effects on people travelling on a route through the landscape such as a road or footpath can be illustrated via a 'representative viewpoint' that represents a similar visual effect, likely to be experienced by larger numbers of people along that route. The geographical extent of that visual effect can be expressed as approximately '2km' or '10%' of the total length of the route.

1.6.19 The geographical extent of a visual effect experienced from a specific viewpoint may be limited to that location alone. An example of a 'specific viewpoint' is a public viewpoint recommended in tourist literature such as a well visited hill summit. An example of an 'illustrative viewpoint' is a particular location within a built up or well vegetated area where an uncharacteristically open or restricted view exists.

Duration and reversibility

1.6.20 The duration and reversibility of visual effects are based on the period over which the offshore elements of Dublin Array are likely to exist (during construction and operation) and the extent to which the offshore elements of Dublin Array will be removed (during decommissioning), with effects reversed at the end of that period.

1.6.21 Long-term, medium-term and short-term visual effects are defined as follows:

- long-term – more than 10 years (may be defined as permanent or reversible);
- medium-term – 5 to 10 years; and
- short-term – 0 to 5 years.

Visual magnitude of change rating

1.6.22 The 'magnitude' or 'degree of change' resulting from the offshore elements of Dublin Array is described as 'High', 'High-medium', 'Medium', 'Medium-low' 'Low' and 'Negligible' as defined in Table 5. In assessing the magnitude of change the assessment has focused on the size or scale of change and its geographical extent. The duration and reversibility are stated separately in relation to the assessed effects (i.e., as short/medium/long-term and temporary/permanent). The basis for the assessment of magnitude for each receptor has been made clear using evidence and professional judgement. Examples of criteria that tend towards higher or lower magnitude of change that can occur on views and visual receptors are set out in Table 5.

Table 5 Visual magnitude of change

Magnitude of change	Description / reason	
High	The offshore elements of the proposed development will result in a high level of alteration to the baseline view, forming the prevailing influence and/or introducing elements that are substantially uncharacteristic in the existing view. The addition of the offshore elements of the proposed development will result in a high change, loss or addition to the baseline view.	Size and Scale: A large, prominent and/or prevailing change to the view. Number: Involving the loss/addition of a large number of features/elements. Distance: Typically appearing closer to the viewer in the fore to middle ground. FoV: Affecting a large vertical angle and wide horizontal FoV. Nature of Visibility: Multiple phase development, continuously and sequentially visible. Contrast: Strong degree of contrast with surroundings with little or no screening. Skyline: Visible on the skyline as a new feature. Consistency of Image: Contrasting with other developments, lacking in visual rationale.

Magnitude of change	Description / reason	
		Typically experienced from representative viewpoints illustrating a visual effect likely to be experienced by larger numbers of people, relative to the activity, affecting a large area or length / proportion of route. May also be experienced from a specific viewpoint.
Medium-high	Intermediate rating with combination of criteria from high or medium magnitude of change category.	
Medium	The offshore elements of the proposed development will result in a medium level of alteration to the baseline view, forming a readily apparent influence and/or introducing elements that are potentially uncharacteristic in the existing view. The addition of the offshore elements of the proposed development will result in a medium change, loss or addition to the baseline view.	Size and Scale: A moderate, readily apparent and/or noticeable change to the view. Number: Involving the loss/addition of a number of features/elements. Distance: Typically appearing in the middle ground. FoV: Affecting a medium vertical angle and moderate horizontal FoV. Nature of Visibility: Multiple phase development, intermittently and sequentially visible. Contrast: Contrast with surroundings and may benefit from some screening. Skyline: Visible on the skyline along with other features. Consistency of Image: Different from other developments, some visual rationale. Typically experienced from representative viewpoints illustrating a visual effect likely to be experienced by a medium number of people, relative to the activity, affecting a medium area or length / proportion of route. May also be experienced from a specific viewpoint.
Medium-low	Intermediate rating with combination of criteria from medium or low magnitude of change category.	
Low	The offshore elements of the proposed development will result in a low level of alteration to the baseline view, providing a slightly apparent influence and/or introducing elements that are characteristic in the existing view. The addition of the offshore elements of the proposed development will result in a low change, loss or addition to the baseline view.	Size and Scale: A small, slightly apparent and/or perceptible change. Number: Involving the loss/addition of a small number of features/elements. Distance: Typically appearing in the background. FoV:Affecting a small vertical angle and narrow horizontal FoV. Nature of Visibility: Simple, single development, intermittently and infrequently visible. Contrast: Some parity/'fits' with surroundings and may benefit from screening. Skyline: Partly visible on a developed skyline or not visible on the skyline. Consistency of Image: Similar from other developments with visual rationale, appearing reasonably well accommodated within its surroundings.

Magnitude of change	Description / reason	
		Typically experienced from illustrative viewpoints likely to be experienced by low numbers of people, relative to the activity, affecting a smaller area or length / proportion of route. May also be experienced from a specific viewpoint.
Negligible	The offshore elements of the proposed development will result in a negligible alteration to the existing view. If visible it may, form a barely discernible influence and/or introduce elements that are substantially characteristic in the baseline view. The addition of the offshore elements of the proposed development will result in negligible incremental change, loss or addition to the baseline view.	Size and Scale: A negligible, barely discernible and/or inconspicuous change. Number: Involving the loss/addition of a small number of features/elements. Distance: Typically appearing in the far distance. FoV: Affecting a very small vertical and narrowest horizontal FoV. Nature of Visibility: Simple, single development, intermittently and infrequently visible. Contrast: Blends with surroundings and/or is well screened. Skyline: Partly visible on a developed skyline or not visible on the skyline. Consistency of Image: Similar from other developments with strong visual rationale, appearing well accommodated within its surroundings. Typically experienced from illustrative viewpoints likely to be experienced by low numbers of people, relative to the activity, affecting a smaller area or length/proportion of route. May also be experienced from a specific viewpoint.

Evaluating visual effects and significance

1.6.23 The level of visual effect is evaluated through the combination of visual sensitivity and magnitude of change. Once the level of effect has been assessed, a judgement is then made as to whether the level of effect is 'significant' or 'not significant' as required by the relevant EIA Regulations. This process is assisted by the matrix in

1.6.24 Table 7 which is used to guide the assessment. The factors considered in the evaluation of the sensitivity and the magnitude of the change resulting from the offshore elements of Dublin Array and their conclusion, have been presented in a comprehensive, clear and transparent manner.

1.6.25 Further information is also provided about the nature of the effects (whether these will be direct/indirect; temporary/permanent/reversible; beneficial/neutral/adverse or cumulative).

1.6.26 A significant effect is more likely to occur where a combination of the variables results in the offshore elements of Dublin Array having a defining effect on the view or visual amenity or where changes affect a visual receptor that is of high sensitivity.

1.6.27 A non-significant effect is more likely to occur where a combination of the variables results in the offshore elements of Dublin Array having a non-defining effect on the view or visual amenity or where changes affect a visual receptor that is of low sensitivity.

Weather conditions

1.6.28 The assessment of visual effects is undertaken in clear weather with good to excellent visibility. This means that the viewpoint assessment represents a maximum effect assessment of the likely visual effects. The same viewpoint may be experienced under less optimal viewing conditions resulting in a significant effect appearing as non-significant, due to the change in the variable weather conditions. Due to the conditions of the assessment the reverse (a non-significant effect appearing as significant) is unlikely to occur.

1.7 Assessing turbine lighting visual effects

Introduction

1.7.1 The visual assessment of turbine lighting is based on the description of proposed WTG lighting set out in the Project Description Chapter, Volume 3, Chapter 12: Aviation and Radar (hereafter referred to as Aviation Chapter), and Volume 3, Chapter 10: Shipping and Navigation. The assessment follows guidance set out in the Irish Aviation Authority (IAA) 'guidance material on offshore wind farms' (2015) and the relevant ICAO/CAA regulations and standards, including Air Navigation Order 2016: Civil Aviation (CAA, 2016).

1.7.2 The effect of the visible lights will be dependent on a range of factors, including the type and intensity of lights used, the clarity of atmospheric visibility and the degree of negative/positive vertical angle of view from the light to the receptor. In compliance with EIA regulations, the likely significant effects of a 'worst-case' scenario for WTG lighting are assessed and illustrated in this visual assessment.

1.7.3 As it has not been determined whether the IAA requirements will be altered to align with the ICAO/CAA requirements, the visual assessment of turbine lighting assesses both types. The IAA regulations worst-case approach considers the potential effects of medium-intensity 2,000 candela (cd) flashing white aviation lights in clear visibility. The ICAO/CAA regulations worst-case approach considers the potential effects of medium-intensity 2,000 candela (cd) steady red aviation lights in clear visibility.

1.7.4 It should be noted however, that in respect of both the white flashing, and red steady scenarios, medium intensity lights are only likely to be operated at their maximum 2,000 cd during periods of poor visibility. The assessment is presented in Volume 4, Appendix 15-2: Visual Assessment of Turbine Lighting (hereafter referred to as Visual Assessment of Turbine Lighting Appendix). Photomontages showing 2,000 cd aviation white flashing and steady red lights are provided from three representative viewpoints to support these worst-case assessments and presented in Volume 4, Appendix 15-4: SLVIA Visualisations.

1.7.5 Both scenarios also contain marine navigation lighting and the maximum parameters are that these lights will have an intensity of 140 cd and be fitted at the minimum platform level of 15 m. These are also shown in the photomontages and referenced in the assessment. It should be noted that the WTGs would also include infra-red lighting on the WTG hubs, which would not be visible to the human eye.

1.7.6 The focus of the night-time visual assessment in this assessment is on the visible lighting requirements of Dublin Array. The study area for the visual assessment of WTG lighting is shown in Figures 3.15.21 to 3.15.23 of the SLVIA GIS Figures Appendix and is coincident with the 50 km SLVIA study area, however, is particularly focused on the closest areas of the coastline. The assessment of the lighting of Dublin Array is intended to determine the likely effects on the visual resource i.e. it is an assessment of the visual effects of aviation lighting on views experienced by people at night.

1.7.7 ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50 cd/m^2 or darker. It does not require 2,000 candela medium intensity to be on during 'twilight', when landscape character may be discerned. The aviation and marine navigational lights may be seen for a short time during the twilight period when some recognition of landscape features/ profiles/ shapes and patterns may be possible. It is considered however, that level of recognition does not amount to an ability to appreciate in any detail landscape character differences and subtleties, nor does it provide sufficient natural light conditions to undertake a landscape character assessment.

1.7.8 The assessment of the lighting of Dublin Array is primarily intended to determine the likely significant effects on the visual resource i.e. it is an assessment of the visual effects of aviation lighting on views experienced by people at night. The matter of visible aviation and marine navigation lighting assessment is primarily a visual matter and the assessment presented focusses on that premise.

1.7.9 The IAA requirement to have the white lights on 24 hours presents the potential for day-time effects to arise should this requirement be implemented. During the daytime, the effect on landscape and visual receptors will relate principally to the presence of the Dublin Array offshore infrastructure, in particular the WTGs and the movement of their blades during operation, and the presence of the emerging WTGs and the construction vessels and cranes during construction. The influence of white lights during daytime will appear less prominent owing to the relative brightness of the sky, compared to the influence of red or white lights seen within a dark night-time sky, and this will moderate the effect during daytime. While the influence of the white lights during daytime will have an additional effect on landscape and visual receptors, this will form a component part of the more substantial overall effect of the Dublin Array offshore infrastructure and will not alter the ratings for magnitude of change and assessment of significant effects presented in the SLVIA Chapter. The Visual Assessment of Turbine Lighting Appendix therefore, focusses on the effects of turbine lighting during night-time.

Regulations and guidance

International Civil Aviation Organisation (ICAO)

1.7.10 ICAO (a United Nations (UN) body) sets international Standards; Recommendations and 'Notes' for aviation lighting in its publication 'Annex 14 to the Convention on International Civil Aviation' –– Volume I Aerodrome Design and Operations (ICAO, Eighth Edition, July 2018). In the section on 'Lighting' of wind turbines (ICAO Annex 14, Section 6.2.4), the following criteria is recommended:

'When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm should be regarded as an extensive object and the lights should be installed:

a) to identify the perimeter of the wind farm;

b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;

d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and

e) at locations prescribed in a), b) and d), respecting the following criteria:

'i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle should be provided;

ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light. The lights should be installed to assure that the output of either light is not blocked by the other; and

iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, should be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be used.'

1.7.11 ICAO Table 6.1 (ICAO Annex 14 page 6-4) identifies the international definitions of daylight; twilight and night based on measured background illuminance as follows.

- Daylight: Above 500 cd/m2
- Twilight: 50-500 cd/m2
- Night: Below 50 cd/m2

1.7.12 For 2,000 cd lights, ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50 cd/m2 or darker. ICAO Table 6.3 (page 6-5) identifies minimum requirements and recommendations for 2,000 cd aviation lights on wind turbines at 150 m and above. In summary these are:

1.7.13 Minimum requirements:

- 0 to +3° from horizontal: 2,000 cd minimum average intensity (or 1,500 cd minimum intensity)
- -1° from horizontal: 750 cd minimum intensity

1.7.14 The navigational requirements for marking man-made structures in the marine environment are set out in the IALA Recommendation 'R0139 (O-139) The Marking of Man-Made Structures' (2021) and IALA Guideline 'G1162 The Marking of Man-made Structures' (2022). In respect of groups of offshore WTGs, the guidelines require significant peripheral structures (SPS) to be marked using a flashing yellow light with a nominal range of 5 nautical miles and with a special mark characteristic.

Irish Aviation Authority

1.7.15 The Irish Aviation Authority (IAA) Guidance Material on Offshore Wind Farms (IAA, 2015) is the active guidance for lighting of wind turbines in Ireland. It states the following in relation to offshore wind turbine lighting requirements to protect marine navigation safety:

'Yellow lights will be fixed to all machines and shall be located appropriately at a point(s) on the structure above the Highest Astronomical Tide but below the lowest point of the arc of the structure's rotor blades. Such lights will be visible through 360° in azimuth and will have vertical divergence of 5° above and below the horizontal, 5 nautical miles visibility and a minimum of 99% availability.

Structures chosen as suitable for representing the periphery of wind farms are termed Significant Peripheral Structures. Such structures will be spaced along the periphery of wind farms at intervals of no more than 3 nautical miles, where practicable. Such structures will be lighted with flashing lights of distinctive navigational characteristic fitted above the Highest Astronomical Tide but below the lowest point of the arc of the structure's rotor blades. Such lights will be visible through 360° in azimuth and have a vertical divergence of 5° above and below the horizontal, 10 nautical miles visibility and a minimum of 99% availability.'

1.7.16 IAA (2015) also states that the lighting required to protect air navigation will be supplemented as follows:

'All Significant Peripheral Structures, of height ≥ 90 m, to the highest point of the structure including the top of blade spin where appropriate, above Mean Sea Level; will be fitted with high intensity warning lighting meeting the following requirements:

the lighting must be mounted on the highest point practicable of the fixed structure;

be in accordance with the International Civil Aviation Organisation (ICAO) Annex 14 standards, on a H24 basis, for High Intensity Type A lighting:-

colour white with a flash rate of 40~60 flashes per minute (fpm);

have an effective intensity, with background luminance above 500cd/m², of 200,000 cd ± 25%;

have an effective intensity, with background luminance 50~500cd/m², of 20,000 cd ± 25%;

have an effective intensity, with background luminance below 50cd/m², of at least 2,000 cd;

light fittings will be fully cut off so that practically no light will be emitted below the horizontal, or as otherwise agreed with the IAA;

all lights across the farm should flash in synchronisation and reductions in light intensity should occur simultaneously, if practicable;

be visible through 360° in azimuth

any light which fails shall be repaired or replaced as soon as is reasonably practicable. An alerting system for light failure will be put in place, such as remote monitoring or other suitable method agreeable to the IAA.'

UK Air Navigation Order 2016

1.7.17 The UK Air Navigation Order 2016 sets out the guidelines for offshore WTG aviation lighting across the UK. Although this guidance is not implemented in Ireland, it is understood that the IAA may bring forward updated guidance for WTG aviation lighting in Ireland, prior to construction of the proposed development, which is closer to the guidance adopted across the UK. For this reason, an assessment has been undertaken of a scenario in which the parameters for aviation lighting set out in the Air Navigation Order 2016 are implemented as part of the proposed development.

1.7.18 The Air Navigation Order 2016 includes the following relevant provisions for offshore WTG aviation lighting under Article 223:

'(1) (a) the height of which is 60 metres or more above the level of the sea at the [Highest Astronomical Tide (HAT)].

(2) the person in charge of a wind turbine generator must ensure that it is fitted with at least one medium intensity steady red light positioned as close as reasonably practicable to the top of the fixed structure.

(3) If four or more wind turbine generators are located together in the same group, with the permission of the CAA only those on the periphery of the group need be fitted with a light.

(4) The lights must be so fitted as to show when displayed in all directions.

(5) When displayed—

(a) the angle of the plane of the beam of peak intensity emitted by the light must be elevated to between three and four degrees above the horizontal plane;

(b) not more than 45% or less than 20% of the minimum peak intensity specified for a light of this type is to be visible at the horizontal plane;

(c) not more than 10% of the minimum peak intensity specified for a light of this type is to be visible at a depression of 1.5 degrees or more below the horizontal plane.

(8) If visibility in all directions from every wind turbine generator in a group is more than 5 km the light intensity for any light required by this article to be fitted to any generator in the group and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type'.

Guidelines for Landscape and Visual Impact Assessment (GLVIA3)

1.7.19 GLVIA3 (page 103) provides the following guidance on the assessment of lighting effects: *'For some types of development the visual effects of lighting may be an issue. In these cases it may be important to carry out night-time 'darkness' surveys of the existing conditions in order to assess the potential effects of lighting and these effects need to be taken into account in generating the 3D model of the scheme. Quantitative assessment of illumination levels, and incorporation into models relevant to visual effects assessment, will require input from lighting engineers, but the visual effects assessment will also need to include qualitative assessments of the effects of the predicted light levels on night-time visibility.'*

1.7.20 GLVIA3 (page 60) also provides the following guidance with regards to mitigation of obtrusive light: *'lighting for safety or security purposes may be unavoidable and may give rise to significant adverse effects; in such cases, consideration should be given to different ways of minimising light pollution and reference should be made to appropriate guidance, such as that provided by the Institution of Lighting Professionals (ILP, 2011)'.*

Institute of Lighting Professional Guidance

1.7.21 Guidance produced by the Institute of Lighting Professionals (ILP) (2011) (GN01:2011) is useful in setting out some key lighting terminology that relates to potential visual effects.

'Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task. Skyglow - the brightening of the night sky; Glare - the uncomfortable brightness of a light source when viewed against a darker background; and Light Intrusion - the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others.'

1.7.22 The following key guidance within the ILP GN01:2011 is noted as follows:

- *'The most sensitive/critical zones for minimising sky glow are those between 90° and 100° (note that this equates to 0-10° above the horizontal).*
- *Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°.*

- *In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape.*
- *Upward Light Ratio (ULR) of the Installation is the maximum permitted percentage of luminaire flux that goes directly into the sky. A ULR of 0 (zero) Candela (cd) is suggested for Dark Sky Parks.'*

1.7.23 In the absence of equivalent guidance for Ireland, the Campaign for Rural England (CPRE) also identifies these same broad terms as the three types of light pollution:

- *'skyglow – the pink or orange glow we see for miles around towns and cities, spreading deep into the countryside, caused by a scattering of artificial light by airborne dust and water droplets.*
- *glare – the uncomfortable brightness of a light source.*
- *light intrusion – light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains'*.

NatureScot Guidance

1.7.24 NatureScot guidance is useful as it represents current guidance specifically relevant to the assessment of wind farms including the presentation of visible aviation lighting.

1.7.25 In terms of how lighting is captured in visualisations, the main change in the latest version of the NatureScot guidance 'Visual Representation of Wind Farms' (Version 2.2, February 2017) is in paragraphs 174-177, which states: *'The visualisation should use photographs taken in low light conditions, preferably when other artificial lighting (such as street lights and lights on buildings) are on, to show how the wind farm lighting will look compared to the existing baseline at night'… 'We have found that approximately 30 minutes after sunset provides a reasonable balance between visibility of the landform and the apparent brightness of artificial lights, as both should be visible in the image.'*

1.7.26 The night-time photography has therefore been captured in low light conditions, when other artificial lighting (such as streetlights and lights on buildings) is on, to show how the wind farm lighting would look compared to the existing baseline at night (including situations where no existing lighting is visible in the view).

1.7.27 NatureScot workshops indicate that a proportionate and pragmatic approach is required, both in terms of the need to assess likely significant effects under the EIA regulations (in the context of complying with current civil aviation standards) and also in providing mitigation (on a project and site-specific basis).

1.7.28 Mitigation options to eliminate or reduce the need for, and effects of, visible lighting are evolving quickly, and developers are exploring these with consultees in relation to specific sites. NatureScot has offered a perspective on the efficacy of different mitigation options, noting that the most effective appears to be radar activated, albeit accepting the considerable cost implications inherent in this potential option.

1.7.29 Ministers and planning authorities are using planning conditions to manage effects. It is recognised that the EIA Report should not necessarily specify one mitigation option, as these are evolving rapidly, and developers need flexibility to utilise the most appropriate mitigation once they are ready to start discharging conditions. Conditions provide some flexibility for developers to identify the most appropriate mitigation option(s) post consent and prior to construction, and to agree these with the relevant decision maker.

1.7.30 In terms of visual effects, NatureScot's view (as expressed at a seminar in November 2019) is that lengthy debate about the exact brightness of lights (including in visualisations) is potentially not helpful and that it is better to focus on where they will be visible, how many lights will be visible and the level of change from the baseline situation. This is recognised in the visual assessment in this SLVIA. NatureScot has also taken a proportionate and pragmatic view with night-time visualisations, requesting that decision makers, consultees and communities require visualisations from a small number of relevant viewpoints to understand these effects. NatureScot also recognises the challenges of capturing night-time photography and accept that some post photographic manipulation of images to provide a good representation is acceptable.

1.7.31 The effect of the visible lights will be dependent on a range of factors, including the intensity of lights used, the clarity of atmospheric visibility and the degree of negative/positive vertical angle of view from the light to the receptor. In compliance with EIA regulations, the likely significant effects of a 'worst-case' scenario for WTG lighting are assessed and illustrated in this visual assessment.

Assessment parameters

1.7.32 The assessment of effects arising from visible lighting requirements (aviation and marine navigational) of the Dublin Array offshore infrastructure are based on the project design parameters set out in Section 15.10 of the SLVIA Chapter and the Lighting and Marking Plan in the Aviation Chapter. These project design parameters for marine and aviation lighting are set out to accord with guidance contained in the following:

- IAA Guidance Material on Offshore Wind Farms (IAA, 2015);
- International Associated of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation G1162 On the Marking of Man-Made Offshore-Structures (IALA, 2021); and
- MGN 6–4 - Guidance on UK Navigational Practice, Safety and Emergency Response (2016).

1.7.33 A further assessment is also made in the SLVIA Chapter, which considers the potential effects of aviation lighting specified to accord with the Air Navigation Order 2016. The key difference in these assessments being that the assessment of lighting according with Irish guidance (IAA, 2015) is based on a white 2,000cd flashing light on the nacelle, fully cut off so that practically no light will be emitted below the horizontal; whereas the assessment of lighting according with UK Air Navigation Order (2016) is based on a red 2,000cd steady light on the nacelle (with no cut off below the horizontal).

Significance criteria for night-time visual effects

Types of effect

1.7.34 ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50 cd/m2 or darker. It does not require 2,000 candela medium intensity to be on during 'twilight', when landscape character may be discerned. The aviation and marine navigational lights may be seen for a short time during the twilight period when some recognition of landscape features/ profiles/ shapes and patterns may be possible. It is considered however, that level of recognition does not amount to an ability to appreciate in any detail landscape/seascape character differences and subtleties, nor does it provide sufficient natural light conditions to undertake a landscape/seascape character assessment.

1.7.35 The assessment of the night time lighting of the proposed development is therefore primarily intended to determine the likely significant effects on the visual resource i.e. it is an assessment of the visual effects of aviation lighting on views experienced by people at night. The matter of visible aviation and marine navigation lighting assessment at night time is primarily a visual matter and the assessment presented focusses on that premise.

1.7.36 Formal recognition of this approach to assessment is the Scottish Ministers' Decision for the Crystal Rig IV PLI, where the Reporters concluded that *"without being able to see and fully appreciate the features of the landscape and the composition of views it is not possible to carry out a meaningful landscape character assessment. On this matter, we find that the proposed lighting is indeed a visual concern."*

1.7.37 The Scottish Government's Aviation Lighting Working Group is working on guidance to streamline the process for night-time lighting assessments. While this guidance has yet to be published, there is some consensus that the perception of landform/skylines at night is a relevant consideration (with perception being a component of visual effects), however there is also widespread agreement that it is not possible to undertake landscape/seascape character assessment after the end of civil twilight, when it is technically 'dark' and wind turbine aviation lighting is switched on.

1.7.38 Assessment of visible wind turbine lighting on landscape/seascape character at night is therefore focused on particular areas where the landform of the foreshore, coastal landforms and inshore islands etc may be perceived at night with lights in the background on the sea skyline i.e. where a perceived character effect may occur as a component of visual effects; and for particular designations where dark skies are a specific 'special quality' defined in their citation.

Criteria for Assessing Significance

1.7.39 The nature of the daytime and night-time effects from visible aviation and marine navigation lighting are clearly very different, in that during day light hours visibility of moving WTG rotors gives rise to effects that are very different to the pinpoint effects of lighting at night. It is considered therefore, that the same criteria should not be used to assess these differences in daytime and night-time effect.

1.7.40 In relation to the sensitivity of visual receptors, this is defined through the application of professional judgement in relation to the interaction between the 'value' of the view experienced by the visual receptor and the 'susceptibility' of the visual receptor (or 'viewer', not the view) to the particular form of change likely to result from the proposed development.

1.7.41 The factors weighed in reaching a decision on 'value' of the view are not all applicable at night-time, in the same way they may be during the day. It is not appropriate, for example, to attribute value to views at night when the detail of the view, or of elements that add value to it within a landscape, cannot readily be discerned. Furthermore, the popularity of a viewpoint during the day may be completely different to its use at night. Value factors assessed for day-time viewpoints may therefore be of less relevance to the value judgement for night-time viewpoints, which is factored into the following assessments.

1.7.42 In reaching a view on the significance of the likely visual effects from the visible aviation lighting, it is relevant to consider what parts of the landscape, where darkness qualities are well displayed, are likely to be affected by visibility of the aviation lights and, in turn, to understand what people might be doing in these areas at night to be susceptible to visibility of aviation lights. Descriptions of 'susceptibility' provided for daytime viewpoints and receptors in Section 15.7 of the SLVIA Chapter are considered appropriate for the purposes of establishing receptor sensitivity at night-time, however the susceptibility of people experiencing night-time views will depend on the degree to which their perception is affected by existing baseline lighting. In brightly lit areas, or when travelling on roads from where sequential experience of lighting may be experienced, the susceptibility of receptors is likely to be lower than from within areas where the baseline contains no or limited existing lighting.

1.7.43 In relation to the other key component in determining significance of effect, the magnitude of change, reference to 'loss of important features' and 'composition of the view' are not readily discernible or relevant at night and, on this basis, a distinct set of criteria to explain the magnitude of change at night, as a consequence of the appearance of aviation lights, is set out in Table 6 below.

Table 6 Night-time visual magnitude of change

Magnitude of change	Description / reason
High	Addition of aviation and marine navigation lighting results in large scale of change/large intrusion to the existing night-time baseline conditions/darkness in the view, due to a full and/ or close-range view of visible aviation lighting and/ or a high degree of contrast/ low degree of integration with level of baseline lighting in the view. Results in obtrusive light which compromises or diminishes the view of the night sky.
Medium	Addition of aviation lighting results in moderate scale of change/moderate intrusion to the existing night-time baseline conditions/ darkness in the view, due to partial and/ or middle distance view of visible aviation lighting and/ or moderate level of contrast/ integration with level of baseline lighting in the view. Results in light that may partially compromise or diminish the view of the night sky, but which is not considered obtrusive.

Magnitude of change	Description / reason
Low	Addition of aviation and marine navigation lighting results in small scale of change/minor intrusion to the existing night-time baseline conditions/ darkness in the view, due to limited and/ or distant view of aviation lighting and/ or low degree of contrast/ high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.
Negligible	Addition of aviation and marine navigation lighting results in a largely indiscernible change/negligible intrusion to the existing night-time baseline conditions/ darkness in the view, due to glimpsed view of lighting and/ or slight degree of contrast/ very high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.

1.7.44 The significance of effects of aviation and marine navigation lighting is assessed through a combination of the sensitivity of the visual receptor and the magnitude of change that would result from the visible aviation lighting, taking into account the considerations described above, and informed by the matrix in Table 7, which gives an understanding of the threshold at which significant effects may arise.

1.7.45 A significant effect occurs where the aviation and marine navigation lighting would provide a defining influence on a view or visual receptor. A not significant effect would occur where the effect of the aviation and marine navigation lighting is not material, and the baseline characteristics of the view or visual receptor continue to provide the definitive influence. In this instance the aviation lighting may have an influence, but this influence would not be definitive.

1.7.46 In determining significance, particular attention is paid to the potential for 'Obtrusive Light' i.e. whether the lighting impedes a particular view of the night sky; creates sky glow, glare or light intrusion (ILP, 2011) in a prominent, incongruous or intrusive way.

1.8 Assessing cumulative seascape, landscape and visual effects

Methodology

Approach to Additional or Combined Cumulative Effects

1.8.1 The cumulative effects assessment (CEA) takes into account the impact associated with Dublin Array together with other relevant plans or projects. Cumulative effects are therefore the additional or combined effect of Dublin Array offshore infrastructure in combination with the effects from a number of different plans or projects, on the same receptor or resource.

1.8.2 GLVIA3 (Landscape Institute and IEMA 2013, p120) defines cumulative landscape and visual effects as those that *"result from additional changes to the landscape and visual amenity caused by the proposal in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future."*

1.8.3 NatureScot's guidance, Assessing the Cumulative Impact of Onshore Wind Energy Developments (NatureScot, 2021) is widely used across the ROI and the UK to inform the specific assessment of the cumulative effects of wind farms. Both GLVIA3 and NatureScot's guidance provide the basis for the methodology for the cumulative SLVIA undertaken in the SLVIA. The NatureScot (2021) guidance states:

- *"An assessment of cumulative impacts associated with a specific development proposal should encompass the impacts of the proposal in combination with:*
  - *Existing development, either built or under construction;*
  - *Approved development, awaiting implementation; and*
  - *Proposals awaiting determination within the planning process with design information in the public domain (NatureScot, 2021: p4);*
- *Cumulative landscape effects are those effects that 'can impact on either the physical fabric or character of the landscape, or any special values attached to it' (NatureScot, 2021, p10); and*
- *Cumulative visual effects are those effects that can be caused by combined visibility, which occurs where the observer is able to see two or more developments from one viewpoint and / or sequential effects which occur when the observer has to move to another viewpoint to see different developments" (NatureScot, 2021, p11).*

1.8.4 In line with NatureScot guidance and GLVIA3, cumulative effects are assessed in this SLVIA as the additional changes caused by Dublin Array offshore infrastructure in conjunction with other similar developments (not the totality of the cumulative effect).

1.8.5 The CEA assesses the cumulative effect of Dublin Array offshore infrastructure with other projects (Section 15.15 of the SLVIA Chapter) against the baseline, with the assessment of significance apportioning the amount of the effect that is attributable to Dublin Array offshore infrastructure. The contribution of Dublin Array offshore infrastructure to the cumulative effect upon the baseline landscape character and visual amenity is assessed and information provided on how the effects of the applicant's proposal would combine and interact with the effects of other development.

1.8.6 Adjacent developments may complement one another, or may be discordant with one another, and it is the increased or reduced level of significance of effects which arises as a result of this change that is assessed in the CEA, such as through design discordance or proliferation of multiple developments affecting characteristics or new geographic areas, and ultimately if character changes occur because of multiple developments becoming a prevailing characteristic of the seascape, landscape or view.

Long list and short list process

1.8.7 A screening process has been carried out by defining an agreed range within which different plans and projects may have a cumulative landscape or visual effect with Dublin Array offshore infrastructure and then identifying those plans and projects within that area. The range for SLVIA has been set at 50km as it is within this radius that there is potential for significant cumulative effects to arise, as based on the professional judgement of the author and from precedents set by jurisdictions and countries with an established offshore renewable energy sectors and where comprehensive guidance has been developed. For example, a 50km study area is used in the SLVIA for the Awel Y Mor Offshore Wind Farm off the north coast of Wales. The main assessment has demonstrated that the outer limits of significant landscape and visual effects will be 21km. It is in respect of this finding that a 50km radius study area will ensure that all potential SLVIA cumulative effects will be captured.

1.8.8 The long list has been established via a robust and auditable matrix-based approach that takes into account both the type of project, and a receptor led consideration of potential for cumulative effects to arise. The cumulative long list is detailed in full within Volume 2, Chapter 4: Annex A - Offshore long-list.

1.8.9 This long list has been interrogated to scope in projects which will make a notable contribution to the cumulative scenarios, and which will give rise to cumulative interactions that could contribute to cumulative effects and scope out projects that will not. Table 5 of the SLVIA Chapter presents the groups of development used in the compilation of the long list and sets out their relevance to the cumulative SLVIA taking into account the separation distances from Dublin Array offshore infrastructure and the likely size and influence of the developments in respect of the cumulative baseline.

Offshore Wind Farms

1.8.10 The three Phase 1 offshore wind farms that lie within the 50km study area of the Dublin Array offshore infrastructure are Codling Wind Park, Arklow Bank Phase 2 and North Irish Sea Array (NISA). The proximity and size of these offshore wind farms means that they will have a notable influence on the cumulative context and will form the principal focus in the cumulative assessment of the SLVIA.

Dublin Port Masterplan 2012-2040

1.8.11 The Dublin Port Masterplan comprises of a series of proposals to improve the capacity and services provided at the port in a phased programme up to 2040. These improvements include the deepening of the harbour basin and channels, the construction of 3km of quay walls, upgrades to berths, the construction of passenger terminal building and heritage zone, and redevelopment of land to increase shipping container storage.

1.8.12 While these, and other developments associated with the port, have potential to influence the cumulative assessment, this influence will be moderated by the following factors. Firstly, Dublin Port has a strong industrial baseline character that will not be affected by the additional developments. Secondly, the scale of the developments is either smaller or commensurate with the scale of the existing developments in the port and will therefore appear to fit with the existing scale. Thirdly, the enclosure from the existing developments, including the large energy developments on the southern side of the port, means that many of the new developments will be screened in views from the wider surrounding area. These factors will all reduce the potential influence that the developments will contribute to the cumulative context. Furthermore, the developments will be associated with a heavily developed coastline that will be seen distinct from the undeveloped seascape where the principal cumulative interactions of this assessment will occur. These developments are therefore not included in the short-list and are not referenced in the detailed cumulative assessment of the SLVIA.

Short List

1.8.13 In summary, the short-list of the cumulative developments comprises the Phase 1 offshore wind farms which will potentially have the most notable influence on the cumulative assessment. These are the offshore wind farm projects awarded a MAC in 2022 and include Dublin Array, NISA, Oriel Offshore Wind Farm, CWP and Arklow Bank Phase 2. Their cumulative influence relates to their location in the currently undeveloped seascape, the large size and number of the WTGs that make up each of the Phase 1 offshore wind farms, and the broad extents of the WTGs across the seascape.

Projects for cumulative assessment

1.8.14 All relevant projects considered cumulatively alongside Dublin Array offshore infrastructure have been allocated into 'Tiers' as defined within the Cumulative Effects Assessment Methodology Chapter (Volume 2, Chapter 4).

1.8.15 The short list of projects selected as relevant to the assessment of impacts to SLVIA are based upon an initial screening exercise undertaken on the long list. Each project has been considered and scoped in or out on the basis of potential cumulative seascape, landscape and visual effects. Both onshore and offshore projects have been considered in this process.

1.8.16 It should be noted that built and operational projects will be included within the cumulative assessment where they have not been included within the environmental characterisation, i.e. they were not operational when the baseline characterisations were undertaken, and/ or any residual impact may not have yet fed through to and been captured in estimates of 'baseline' conditions or there is an ongoing effect.

1.8.17 Table 6 of the SLVIA Chapter identifies those Tier 1, Tier 2, Tier 3 and Phase 1 projects that are relevant to the SLVIA and, therefore, have been scoped into the cumulative assessment. Existing offshore wind farms which form part of the baseline are also listed in the table.

Types of Cumulative Effect

1.8.18 The range of potential cumulative effects that are identified and included in the CEA, is a subset of those considered for Dublin Array alone assessment. This is because some of the potential impacts identified and assessed for Dublin Array alone, are localised and temporary in nature. It is considered therefore, that these potential impacts have limited or no potential to interact with similar changes associated with other plans or projects. These have therefore been scoped out of the cumulative impact assessment.

1.8.19 Similarly, some of the potential impacts considered within Dublin Array alone assessment are specific to a particular phase of development (e.g. construction, operation and maintenance or decommissioning). Where the potential for cumulative effects with other plans or projects only have potential to occur where there is spatial or temporal overlap with Dublin Array during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no plans or projects have been identified that have the potential for cumulative effects during this period.

Cumulative Visual Effects

1.8.20 Cumulative visual effects consist of combined and sequential effects:

- **Combined visibility** - occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be where several developments are within the observer's main angle of view at the same time, or, where the observer has to turn to see the various developments. The cumulative visual effect of Dublin Array may be significant, or not significant, depending on factors influencing the cumulative magnitude of change, such as the degree of integration and consistency of image with other developments in combined views; and its position relative to other developments and the landscape context in successive views.

- **Sequential visibility** - occurs when the observer has to move to another viewpoint to see different developments. Sequential effects are assessed along regularly used routes such as major roads, railway lines and footpaths. The occurrence of sequential effects range from 'frequently sequential' (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to 'occasionally sequential' (long time lapses between appearances, because the observer is moving slowly and/or there are large distances between the viewpoints). The cumulative visual effect is more likely to be significant when frequently sequential.

Cumulative Seascape/ Landscape Effects

1.8.21 Cumulative development within a particular area may build up to create different types of seascape/ landscape effect. The significance of the cumulative seascape/ landscape effects of the addition of Dublin Array will be assessed as follows.

1.8.22 If Dublin Array forms a separate isolated feature from other developments within the seascape/ landscape, too infrequent and of insufficient significance to be perceived as a characteristic of the area, then the cumulative seascape/ landscape effect of Dublin Array is unlikely to be significant.

1.8.23 If the addition of Dublin Array results in offshore windfarms and/or energy generation/ transmission developments forming a key characteristic of the seascape/ landscape, exerting sufficient presence as to establish or increase the extent of a 'seascape/ landscape with windfarms'; then the cumulative seascape/ landscape effect of the proposal may be significant or not significant, depending on the sensitivity of the receptor and magnitude of the change.

1.8.24 If the addition of Dublin Array results in offshore windfarms forming the prevailing characteristic of the seascape/ landscape, seeming to define the seascape/ landscape as a 'windfarm seascape/ landscape character type' then the cumulative seascape/ landscape effect of Dublin Array is likely to be significant.

Assessing cumulative seascape, landscape and visual effects

Cumulative Sensitivity of Landscape and Visual Receptors

1.8.25 In evaluating cumulative sensitivity in the CEA in Section 15.15 of the SLVIA Chapter, the sensitivity to change of seascape, landscape and visual receptors are retained from the main assessment in Section 15.7 of the SLVIA Chapter.

Cumulative Magnitude of Change

1.8.26 The cumulative magnitude of change is an expression of the degree to which seascape, landscape and visual receptors will be changed by the addition of Dublin Array cumulatively. The cumulative magnitude of change is assessed according to a number of criteria, described below.

- **The location, position and visual relationship of Dublin Array in relation to other developments:** Depending on the viewpoint/viewing angle from the coast, Dublin Array may be viewed adjacent to other developments on the skyline, covering a wider lateral spread; they may form one grouping or could be viewed separately on the skyline (separated by space on the skyline); or could be viewed with one project being 'behind' the other project. The overall magnitude of change will vary depending on this visual relationship at different viewpoints and is likely to be higher when two projects are viewed adjacent to each other over a wider lateral spread; and lower when one project is viewed behind the other project.

- **The location of Dublin Array in relation to other developments:** If Dublin Array is seen in a part of the view or setting to a landscape receptor that is not affected by other development, this will generally increase the cumulative magnitude of change as it will extend influence into an area that is currently unaffected by development. Conversely, if Dublin Array is seen in the context of other developments, the cumulative magnitude of change may be lower as development is not being extended to otherwise undeveloped parts of the outlook or setting. This is particularly true where the scale and layout of the proposal is similar to that of the other developments as where there is a high level of integration and cohesion with an existing site the various developments may appear as a single site.

- **The extent of the developed skyline:** the proportion (or horizontal angle) of the view that is affected by the combined lateral spread of Dublin Array and other projects on the horizon. If the lateral spread/ horizontal angle of Dublin Array will add notably to the developed horizon in a view, the cumulative magnitude of change will tend to be higher.

- **The number and scale of developments seen simultaneously or sequentially:** Generally, the greater the number of clearly separate developments that are visible, the higher the cumulative magnitude of change will be. The addition of Dublin Array to a view or seascape/ landscape where a number of smaller developments are apparent will usually have a higher cumulative magnitude of change than one or two large developments as this can lead to the impression of a less co-ordinated or strategic approach.

- **The scale comparison between developments:** If Dublin Array is of a similar scale to other visible developments, particularly those seen in closest proximity to it, the cumulative magnitude of change will generally be lower as it will have more integration with the other sites and will be less apparent as an addition to the cumulative situation.

- **The consistency of image of the proposal in relation to other developments:** The cumulative magnitude of change of Dublin Arrays is likely to be lower if its turbine height, arrangement, layout design and visual appearance/aesthetics are broadly similar to other developments in the seascape, as they are more likely to appear as relatively simple and logical components of the seascape.

- **The context in which the developments are seen:** If projects are seen in a similar seascape/ landscape context, the cumulative magnitude of change is likely to be lower due to visual integration and cohesion between the sites. If projects are seen in a variety of different settings, this can lead to a perception that development is unplanned and uncoordinated, affecting a wide range of landscape character and blurring the distinction between them.

- **The magnitude of change of Dublin Array as assessed in the project alone assessment:** Where Dublin Array is assessed to have a negligible or low magnitude of change on a view or seascape/ landscape receptor, there is more likely to be a low cumulative effect.

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

- **High** - where the magnitude of change arising from Dublin Array will result in a high cumulative change, loss or addition to the seascape/ landscape receptor or view;
- **Medium** - where the magnitude of change arising from Dublin Array will result in a medium change, loss or addition to the seascape/ landscape receptor or view;
- **Low** - where the magnitude of change arising from Dublin Array will result in a low change, loss or addition to the seascape/ landscape receptor or view; and
- **Negligible** - where the magnitude of change arising from Dublin Array will result in a negligible incremental change, loss or addition to the seascape/landscape receptor or view.

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

Significance of Cumulative Effects

1.8.29 The objective of the cumulative assessment is to determine whether any effects that the construction and operation of the Offshore Infrastructure will have on seascape, landscape and visual receptors, when seen or perceived cumulatively with the construction and operation of the other projects, will be significant or not significant. Significant cumulative seascape, landscape and visual effects arise where the addition of Dublin Array, leads to offshore windfarms becoming a prevailing seascape, landscape or visual characteristic of a receptor that is sensitive to such change. Cumulative seascape/ landscape effects may evolve as follows:

- A small scale, single development will often be perceived as a new or 'one-off' landscape feature or landmark within the seascape. Except at a local site level, it usually cannot change the overall existing seascape character, or become a new characteristic element of a landscape/ seascape;
- With the addition of further development, it can become a characteristic element of the landscape/ seascape, as they appear as elements or components that are repeated. Providing there was sufficient 'space' or undeveloped landscape/ seascape between each development, or the overlapping of several developments is not too dense; they would appear as a series of developments within the landscape/ seascape and would not necessarily become the dominant or defining characteristic of the seascape nor have significant cumulative effects; and

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

1.8.30 Less extensive, but nevertheless significant cumulative seascape, landscape and visual effects may also arise as a result of the addition of Dublin Array where it results in a seascape, landscape or view becoming defined by the presence of more than one offshore windfarm or similar/ large scale development, so that other patterns and components are no longer definitive, or where the proposal contrasts with the scale or design of an existing or development.

1.8.31 Higher levels of cumulative effect may arise when projects are clearly visible together in views, however provided that the projects are designed to achieve a high level of visual integration, with few notable visual differences between developments, these effects may not necessarily be significant. In particular, the effects of an extension to an existing development are often less likely to be significant, where the effect is concentrated, providing that the design of the developments are compatible, and that the overall capacity of the seascape is not exceeded.

1.8.32 The capacity of the seascape/ landscape or view may be assessed as being exceeded where the seascape, landscape and visual receptor becomes defined by a particular type of development, or if Dublin Array extends across seascape/ landscape character areas or clear visual/topographic thresholds in a view.

1.8.33 More substantial cumulative effects may result from developments that have some geographical separation, but remain highly inter-visible, potentially resulting in extending effects into new areas, such as an increased presence of development on a skyline, or the creation of multiple, separate offshore windfarm defined seascape/ landscapes.

1.9 Evaluation of significance

1.9.1 The matrix presented in Table 7 is used as a guide to illustrate the LVIA process. In line with the emphasis placed in GLVIA3 upon the application of professional judgement, an overly mechanistic reliance upon a matrix is avoided through the provision of clear and accessible narrative explanations of the rationale underlying the assessment made for each landscape and visual receptor. Such narrative assessments provide a level of detail over and above the outline assessment provided by use of the matrix alone.

1.9.2 The landscape and visual assessment unavoidably involves a combination of quantitative and qualitative assessment and wherever possible cross references have been made to objective evidence, baseline figures and/or to photomontage visualisations to support the assessment conclusions. Often a consensus of professional opinion has been sought through consultation, internal peer review, and the adoption of a systematic, impartial, and professional approach. Importantly each effect results from its own unique set of circumstances and have been assessed on a case-by-case basis. The matrix as presented in Table 7 should therefore be considered as a guide; where deviations from this guide have been made, this is explained clearly in the assessment.

1.9.3 Significant seascape, landscape and visual effects are highlighted in bold and shaded dark grey in Table 7. They relate to all those effects that result in a 'Significant' effect at either a 'Major' or 'Major/ moderate' level. In those boxes shaded light grey, effects are at a 'Moderate' level and can be either significant or not significant. This decision relies on reasoned assessment and the professional judgement of the assessor with assessments explained in full in the *SLVIA Chapter* where they occur. White or un-shaded boxes in Table 7 indicate a not significant effect at a 'Moderate/ minor', 'Minor', 'Minor/ negligible' or 'Negligible' level. In those instances where there would be no effect, the magnitude will be recorded as 'no change' and the level of effect as 'no effect'.

Table 7 Significance of effect matrix

Magnitude> Sensitivity	High	Medium-high	Medium	Medium-low	Low	Negligible
High	**Major (significant)**	**Major (significant)**	**Major/ moderate (significant)**	Moderate (Significant or Not Significant)	Moderate/ Minor (Not Significant)	Minor (Not significant)
Medium-high	**Major (Significant)**	**Major-moderate (Significant)**	**Moderate (Significant or Not Significant)**	Moderate (Significant or Not Significant)	Moderate-minor (Not significant)	Minor (Not significant)
Medium	**Major-moderate (Significant)**	Moderate (Significant or Not Significant)	Moderate (Significant or Not Significant)	Moderate-minor (Not significant)	Minor (Not significant)	Minor/ negligible (Not significant)
Medium-low	Moderate (Significant or Not Significant)	Moderate (Significant or Not Significant)	Moderate-minor (Not significant)	Minor (Not significant)	Minor/ negligible (Not significant)	Negligible (Not significant)
Low	Moderate (Significant or Not significant)	Moderate-minor (Not significant)	Minor (Not significant)	Minor/ negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

1.10 Definition of effects

Overview

1.10.1 The Environmental Protection Agency has produced Guidelines on the Information to be Contained in Environmental Impact Statements' (EPA 2022). Table 3.3 of this document sets out terminology to be applied in describing significant effects, although it is noted '*all categories of terms do not need to be used for every effect*'.

1.10.2 The five categories covered in Table 3.3 are set out in Table 8. Table 8 below alongside an explanation of their relevance to the SLVIA and how they have been covered in the assessment.

Table 8 Definition of effects relevant to SLVIA

EPA Draft Guidelines Category	EPA Draft Guidelines Criteria	SLVIA
Quality of effects	Positive effects Negative effects Neutral effects	This category and these criteria are applied in the SLVIA, albeit with the category referred to as 'Nature of Effects' and the effects referred to as beneficial, adverse or neutral in line with GLVIA3 guidance. Further detail is presented below under the heading 'Nature of Effects'.
Describing significance of effects	Imperceptible Not significant Slight effects Moderate effects Significant effects Very significant Profound effects	Section 1.9 set out the evaluation of significance which is applied in the SLVIA. The matrix in Table 7 demonstrates how the assessment process leads to the determination of significant and not significant effects. No intermediate levels are provided as these are not requires by the EIA regulations.
Describing the extent and context of effects	Extent Describe the size of the area, the number of sites, and the proportion of a population affected by an effect. Context Describe whether the extent, duration, or frequency will conform or contrast with established baseline conditions	The extent of the effect is considered in the assessments presented in sections 15.12, 15.13 and 15.15 of the SLVIA Chapter by describing the geographical area over which the significant effects is considered to occur. The extent to which the effect conforms or contrasts with the baseline is also considered as an integral part of the assessment presented in sections 15.12, 15.13 and 15.15 of the SLVIA Chapter, in particular through consideration of the contrast to the seascape, landscape and visual context that will arise as a result of the Dublin Array Offshore Infrastructure.

EPA Draft Guidelines Category	EPA Draft Guidelines Criteria	SLVIA
Describing the probability of effects	Likely Effects The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented. Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.	As described in section 15.11 of the SLVIA Chapter, there is very limited opportunity to mitigate landscape and visual effects with standard mitigation measures undertaken in the iterative design process. There is, therefore, no additional mitigation to be considered in the SLVIA. While this means that the effects identified will be 'likely effects' their probability will be affected to some extent by weather conditions. Further detail is presented below under the heading 'Likelihood of visual effects.'
Describing the duration and frequency of effects	Momentary effects - lasting from seconds to minutes Brief effects - lasting less than a day Temporary effects - lasting less than a year Short-term effects - lasting one to seven years. Medium-term effects - lasting seven to fifteen years. Long-term effects - lasting fifteen to sixty years. Permanent effects - lasting over sixty years Reversible effects that can be undone, for example through remediation or restoration Frequency of effects - how often the effect will occur. (once, rarely, occasionally, frequently, constantly).	These criteria have been used to define the different durations of effect, with those of relevance to the SLVIA including temporary, short, medium, long and permanent. These are included in section 1.5 and section 1.6 of this appendix, under the heading 'Duration of Effect'. All SLVIA effects are reversible following the decommissioning of the Offshore Infrastructure. All effects relating to seascape and landscape are constant. Effects relating to visual receptors are periodic relating to the passive or active pastime people experiencing the views are partaking in. The frequency of the effects these people will experience is discussed in the assessments presented in sections 15.112, 15.13 and 15.15 of the SLVIA Chapter.

1.10.3 Cumulative effects have been described in section 15.8, and 'short-term, medium-term and long-term, permanent and temporary' effects are described in section 1.5 and section 1.6 under the heading 'Duration of Effect'. Transboundary effects relating to the SLVIA concern the overlap of the 50 km study area with other countries and the potential for effects of Dublin Array on seascape, landscape and visual receptors in countries outside Irish territorial waters.

1.10.4 The definitions of the remaining terms used in this assessment are defined below.

Direct and indirect effects

1.10.5 In addition to the categories and criteria set out in Table 8 above, the SLVIA also considers direct and indirect effects. The majority of the SLVIA effects are indirect effects as they are affecting the character of the wider seascape or landscape, or the visual amenity of people in those seascapes and landscapes. Direct effects only occur on the area of seascape where the Dublin Array Offshore Infrastructure will be constructed and situated during its operational life.

1.10.6 Indirect landscape effects relate to those seascape and landscape receptors separated by distance or remote from the Dublin Array Offshore Infrastructure and are, therefore, only affected in terms of perceptual effects. The Landscape Institute also defines indirect effects as those which are not a direct result of the development but are often produced away from it, or as a result of a complex pathway. Visual effects are also considered as indirect effects, as it is people's perception of their wider environment that will be affected.

Positive and negative effects

1.10.7 Guidance provided by the in GLVIA3 on the nature of effect (i.e., beneficial or adverse) states that *'in the LVIA, thought must be given to whether the likely significant landscape and visual effects are judged to be positive (beneficial) or negative (adverse) in their consequences for landscape or for views and visual amenity'*, but it does not provide guidance as to how that may be established in practice. The nature of effect is therefore one that requires interpretation and, where applied, reasoned professional opinion.

1.10.8 In this assessment the nature of effects refers to whether the landscape and/or visual effect of the offshore elements of Dublin Array is positive or negative (herein referred to as 'beneficial'/'neutral' or 'adverse').

1.10.9 In relation to many forms of development, SLVIA will identify 'beneficial' and 'adverse' effects by assessing these under the term 'Nature of Effect'. The seascape, landscape and visual effects of wind farms are difficult to categorise in either of these brackets as, unlike other disciplines, there are no definitive criteria by which the effects of wind farms can be measured as being categorically 'beneficial' or 'adverse'. In some disciplines, such as noise or ecology, it is possible to quantify the effect of a wind farm in numeric terms, by objectively identifying or quantifying the proportion of a receptor that is affected and consequently assessing the nature of that effect in justifiable terms. However, this is not the case in relation to landscape and visual effects where the approach combines quantitative and qualitative assessment.

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

- **Beneficial effects** - contribute to the seascape, landscape and visual resource through the enhancement of desirable characteristics or the introduction of new, beneficial landscape and visual attributes. The development contributes to the seascape, landscape or visual amenity by virtue of good design. The removal of undesirable existing elements or characteristics can also be beneficial, as can their replacement with more appropriate components.

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

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

Frequency and likelihood of visual effects – weather conditions

1.10.11 As described in section 15.11 of the SLVIA Chapter, there is very limited opportunity to mitigate landscape and visual effects with standard mitigation measures undertaken in the iterative design process. There is, therefore, no additional mitigation to be considered in the SLVIA. While this means that the effects identified will be 'likely effects' their probability will be affected to some extent by weather conditions.

1.10.12 The judgements made in the SLVIA are based on optimum 'very good' to 'excellent' visibility of the Dublin Array Offshore Infrastructure. This assumption is assessed as the worst-case scenario, but in reality, the degree and extent of visual effects arising from the construction and operation of the Offshore Infrastructure is a combination of several different factors, including the prevailing weather conditions. The prevailing weather can determine changes in character and visibility, with varied wind, light and tidal movements and the clarity or otherwise of the atmosphere. Collectively, these will combine to reduce the number of days upon which views of the Dublin Array Offshore Infrastructure will be available from the coastline and hinterland, or to inhibit views, rendering them more visually recessive within the wider seascape. Viewing conditions and visibility will be found to vary in the study area, and the effects of the Dublin Array Offshore Infrastructure will vary greatly according to the weather. This means that effects that are assessed to be significant may be not significant under different, less clear conditions.

1.10.13 The following levels of visibility are set by Met Eireann. Daily data recorded at Phoenix Park in Dublin over the past ten years indicates that visibility from this part of the eastern seaboard is typically good or moderate, such that this would only intermittently reduce the likelihood of significant effects experienced from seascape, landscape and visual receptors along this coast.

- Good: more than 5 nautical miles (9 km)
- Moderate: 2 – 5 nm (4 – 9 km)
- Poor: 0.5 to 2 nm (4 km)
- Fog: less than 0.5 nm (1 km)

1.11 Visual Representations

Overview

1.11.1 Zones of Theoretical Visibility (ZTVs) and visualisations (wirelines or wirelines and photomontages) are graphical images produced to assist and illustrate the SLVIA and the cumulative assessment. The methodology used for viewpoint photography and photomontages has been produced in accordance with:

- NatureScot guidance on Visual Representation of Wind Farms, Version 2.2 (2017);
- Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA 3) (Landscape Institute and IEMA, 2013); and
- Landscape Institute Technical Guidance Note on Visual Representation of Development Proposals (2019).

Zone of theoretical visibility (ZTV)

1.11.2 The ZTVs in Figures 3.15.9 to 3.15.15, Figures 3.15.17 to 3.15.20 and Figures 3.15.22 and 3.15.23 in SLVIA GIS Figures Appendix have been calculated using computer software to generate a ZTV of the offshore elements of Dublin Array, to demonstrate the theoretical extent of visibility from any point in the study area.

1.11.3 A 3D computer model has been developed of the existing landscape and key reference using digital terrain data as follows.

- 30m Copernicus DTM data: Used to produce the main or standard ZTV plot and wirelines, these tiles provide a digital record of the existing landform, or Digital Terrain Model (DTM) at 30m grid squares and models representing the specified geometry and position of the offshore elements. The computer model will include the entire study area and takes account of the effects caused by atmospheric refraction and the Earth's curvature.

- Ordnance Survey Ireland 10m DTM: Used to produce more detailed ZTV plots where required to assess particular effects, such as along the coastline, or within a detailed part of the study area. The computer model takes account of atmospheric refraction and the Earth's curvature.

1.11.4 The resulting ZTV plots have been overlaid on Ordnance Survey mapping at an appropriate scale and presented as figures using desktop publishing or graphic design software. Cumulative ZTV plots based on the intervisibility of the offshore elements of Dublin Array and other relevant developments within the study area have also been produced. There are limitations in this theoretical production, and these should be considered in the interpretation and use of the ZTV as follows.

1.11.5 Where the ZTV has been calculated using 30 m Copernicus DTM or Ordnance Survey Ireland 10m DTM, this will not account for the screening effects of vegetation or built form unless added in the form of OS Vectormap data or digitally added and stated on the figure.

- The ZTVs are based on theoretical visibility from 2m above ground level.
- The Blade Tip ZTV does not indicate the decrease in visibility that occurs with increased distance from the array area. The nature of what is visible from 3 km away will differ markedly from what is visible from 10 km away, although both are indicated on the Blade Tip ZTV as having the same level of visibility.
- There is a wide range of variation within the visibility shown on the ZTV, for example, an area shown on the blade tip ZTV as having visibility of 39 WTGs may gain views of the smallest extremity of blade tips, or of 39 full WTGs. This can make a considerable difference in the effects of the offshore elements of Dublin Array on that area. The hub height ZTV has been used in conjunction with the blade tip ZTV to provide an indication of the degree to which the WTGs are visible.

1.11.6 These limitations mean that while the ZTV is used as a starting point in the assessment, providing an indication of where the offshore elements of Dublin Array will be theoretically visible and tending to present a worst-case or over-estimate the actual visibility. The information drawn from the ZTV is checked by field survey observation.

1.11.7 The SLVIA includes a Horizontal Angle ZTV to show the horizontal field of view (in degrees) that may be affected by views of the WTGs.

Methodology for baseline photography

Overview

1.11.8 Once a view has been selected, the location is visited, confirmed, and assessed with the aid of a wireline or similar visualisation in the field. A photographic record is taken to record the view, and the details of the viewpoint location and associated data are recorded to assist in the production of visualisations and to validate their accuracy.

1.11.9 The following photographic information is recorded:

- date, time, weather conditions and visual range;

- GPS recorded 12 figure grid reference accurate to ~5 to10m;
- GPS recorded Above Ordnance Datum (AOD) height data;
- use of a fixed 50mm focal length lens is confirmed;
- horizontal field of view (in degrees); and
- bearing to Dublin Array.

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

1.11.11 All the resulting visualisations have been prepared to indicate other cumulative development in order that they may assist the cumulative assessment as well as the SLVIA.

1.11.12 Whilst no two-dimensional image can fully represent the real viewing experience, the visualisation aims to provide a realistic representation of the offshore elements, based on current information and photomontage methodology.

Weather conditions

1.11.13 Guidelines for LVIA (GLVIA3) para 8.22 state – '*In preparing photomontages, weather conditions shown in the photographs should (with justification provided for the choice) be either:*

- *representative of those generally prevailing in the area; or*
- *taken in good visibility, seeking to represent a maximum visibility scenario when the development may be highly visible'.*

1.11.14 In preparing photomontages for the SLVIA, photographs have been taken in favourable weather conditions during periods of 'good', 'very good' or 'excellent' visibility seeking to represent a maximum visibility scenario when the offshore elements of Dublin Array may be most visible.

1.11.15 Baseline viewpoint photographs have been taken to represent the different prevailing viewing conditions in which Dublin Array will be viewed. Baseline viewpoint photographs have also been taken to illustrate alternative viewing scenarios, such as in viewpoints from the north, west and south of Dublin Array, which can be viewed when the sun is outside the main panorama towards Dublin Array and provides side or front lighting of the WTGs.

Methodology for production of visualisations

1.11.16 Photomontages have been produced in accordance with NatureScot Visual Representation of Windfarms Guidance (NatureScot, 2017) and Landscape Institute (2019) Technical Guidance Note (TGN) 06/19 Visual Representation of Development Proposals.

1.11.17 A photomontage is a visualisation which superimposes an image of a proposed development upon a photograph or series of photographs. Photomontage is a widespread and popular visualisation technique, which allows changes in views and visual amenity to be illustrated and assessed, within known views of the 'real' landscape.

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

1.11.19 The baseline photographs and cumulative wireline visualisations shown for each viewpoint cover a 90° field of view (or in some cases, up to 360°), which accords with NatureScot guidance. These are cylindrically projected images and should be viewed flat at a comfortable arm's length. The photographs are also joined to create planar projection panoramas using PTGui software. These are used in the creation of the 53.5° field of view photomontages.

1.11.20 Wireline representations that illustrate the offshore elements of Dublin Array, and set within a computer-generated image of the landform, are used in the assessment to predict theoretical appearance of the WTGs. These are produced with Resoft WindFarm software and are based on a terrain model with a 30m data grid (Copernicus DTM data) with a more detailed area of terrain modelling (OSI 10m DTM) used for the coastal parts of the study area, which includes the majority of viewpoints used in the SLVIA. There are limitations in the accuracy of digital terrain model (DTM) data so that landform may not be picked up precisely and may result in WTGs being more or less visible than is shown; however, the use of OS 10 m DTM minimises these limitations. Where descriptions within the assessment identify the numbers of WTGs visible this refers to the illustrations generated and therefore the reality may differ to a degree from these impressions.

1.11.21 Daytime visualisations and wirelines show a WTG model which represents the maximum development scenario of the offshore elements of Dublin Array in the array area and allow the potential proportions of the WTGs to be appreciated from the visualisations.

1.11.22 Fully rendered photomontages have been produced for the agreed viewpoints using Resoft WindFarm software, to provide a photorealistic image of the appearance of the offshore elements of Dublin Array. In the daytime photomontages modelled representations are combined with the baseline view photographs to create a photorealistic rendered photomontage image of the development.

1.11.23 'Panoramic photomontages' are produced in the SLVIA with a 53.5° HFoV, based on relevant guidance (NatureScot, 2017) and due to their suitability to encompass the horizontal spread of Dublin Array and show the WTGs at a representative scale and distance. In some views, two adjacent 53.5° photomontages will be required to capture the horizontal spread of Dublin Array.

1.11.24 The 53.5° field of view wirelines and photomontages are prepared using a planar projected image and should also be viewed flat at a comfortable arm's length. These images are each printed on paper 841 x 297mm (half A1) which provides for a relatively large-scale image.

1.11.25 In the wirelines, the WTGs are shown with the central WTGs facing the viewer directly, with the full rotor diameter visible at its tallest extent. In the photomontages, the WTG rotors are shown with a random appearance with the central WTGs facing the viewer directly. WTGs are shown with monopile foundations.

1.11.26 The OSPs are shown in the photomontages for viewpoints within 20 km, where they are likely to influence the effects arising. Photomontages for viewpoints located beyond 20 km do not show OSPs.

Night-time visualisations

1.11.27 Night-time visualisations have been produced from three key viewpoints, to visually represent aviation and marine navigation lighting at night.

1.11.28 The visual effect of Dublin Array at night has been assessed in the Visual Assessment of Turbine Lighting Appendix, informed by the night-time photomontage visualisations produced from three representative viewpoints:

- Viewpoint 4: Greystones Harbour (Figure 3.15.28 of the SLVIA Visualisations Appendix);
- Viewpoint 11: Vico Road seating area (Figure 3.15.35 of the SLVIA Visualisations Appendix); and
- Viewpoint 18: Howth Head Viewpoint (Figure 3.15.42 of the SLVIA Visualisations Appendix).

1.11.29 The photomontages in the SLVIA Visualisations Appendix and Visual Assessment of Turbine Lighting Appendix considers the potential effects of either white medium-intensity 2000cd flashing lights and red medium-intensity 2000 cd steady lights in clear visibility.

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

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

Information on limitations of visualisations

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

1.11.33 The photomontage visualisations of the offshore elements of Dublin Array (and any wind farm proposal) have a number of limitations when using them to form a judgement on visual impact. These include the following:

- a visualisation can never show exactly what the offshore elements of Dublin Array will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image;
- the images provided give a reasonable impression of the scale of the WTGs and the distance to the WTGs but can never be 100% accurate;
- a static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;
- the viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations;
- to form the best impression of the impacts of the offshore elements of Dublin Array proposal these images are best viewed at the viewpoint location shown;
- the images must be printed and viewed at the correct size (260mm by 820mm);
- images should be held flat at a comfortable arm's length. If viewing these images on a wall or board at an exhibition, stand at arm's length from the image presented to gain the best impression;
- it is preferable to view printed images rather than view images on screen. Images on screen should be viewed using a normal PC screen with the image enlarged to the full screen height to give a realistic impression; and
- there are practical limitations to shooting viewpoint photographs only in very good or excellent visibility and at particular times of day. The photographs shown in the visualisations show the most favourable weather conditions available during photographic survey work.

Technical Methodology – Visualisations

1.11.34 In accordance with the requirements of Landscape Institute (2019) Technical Guidance Note 06/19, Table 9 sets out technical information for the preparation of photomontage visualisations.

Table 9 Technical methodology - visualisations

Category	Details
Photography	
Visualisation type	Photo-realistic Level 4 Landscape Institute Guidance.
Camera location	Established via hand-held Garmin GPS.
Level of accuracy of locations	Within 3m.
Camera	Nikon D600, Canon EOS 5D Mark II and Canon EOS 6D Digital SLR. Full-frame (35mm negative size) CMOS sensor.
Lens	50mm fixed f1.4 lens.
Tripod	Set to approximately 1.5m. Nodal Ninja panoramic head with Adjust Leveller. Nodal Ninja panoramic head set to take photographs at 20° increments.
Photography process	Camera used on fully manual settings. Photographs taken in RAW image format. Bracketed exposures are taken for each view and those depicting the clearest images are selected to prepare the panoramic image.
Preparation of panoramic photographs	PTGUI v12.8 is used to join and cylindrically project the images. Adobe Photoshop 2021 used to correct tonal alterations and create an even range of exposure across the photographs so that the individual photographs are not apparent. Planar panoramic images are prepared using Resoft Windfarm software or Hugin Panorama Stitcher.
3D Model / Visualisation	The substation model is an AutoCAD/3dMax combo and the turbines are Resoft Windfarm.
Topographic height data	Ordnance Survey Ireland 10m (10m resolution) and 30m Copernicus DTM data.
Use of coordinates in software	Coordinates are brought in from the surveyed GPS coordinates. Positions checked using aerial photography.
Markers for horizontal alignment	Landform
Markers for vertical alignment	Landform
Rendering software	Resoft Windfarm v.5.2.5.3 (WTGs in wirelines and photomontages). Sketchup or AutoCAD Map 3D 2018 (OSPs, Met Mast and jacket foundations). Autodesk 3ds Max 2018. Visual Nature Studio V 3.10.
Limitations	Refer to section above at 15.11.33.
Terrain data	There may therefore be local, small-scale landform that is not reflected in the data and subsequently the visualisation but may alter the real visibility of the proposed development, either by screening theoretical visibility or revealing parts of the proposed development that are not theoretically visible.
Movement	Static images are unable to capture the movement within the view or of the WTGs.

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