19. OFFSHORE AIR QUALITY, AIRBORNE NOISE AND VIBRATION

19.1 Introduction

This Chapter of the EIA Report (EIAR) will provide an overview of the sensitivities associated with offshore air quality, airborne noise and vibration effects of the Sceirde Rocks Offshore Wind Farm (the Project). This Chapter provides an assessment of the likely significant effects of the Offshore Site on dwellings and human receptors (i.e., sensitive receptors) from changes in offshore air quality, airborne noise and vibration, during the construction, operational and decommissioning of the Project. Where required, mitigation is proposed, and the residual effects and their significance are assessed. Potential cumulative effects are also considered.

This Chapter considers only works undertaken in the Offshore Site (i.e. in the marine environment) and the potential impacts to sensitive receptors from air quality, airborne noise and vibration associated with these activities. Airborne noise and vibration impacts to sensitive receptors associated with onshore works are considered in Chapter 26: Onshore Noise and Vibration. Underwater sound generated by the Offshore Site and associated activities is not covered within this Chapter and has been considered in:

- Chapter 10 Fish and Shellfish Ecology;
- Chapter 11 Marine Ornithology;
- Chapter 12 Marine Mammals and Other Megafauna; and
- Appendix 12-1 Underwater Noise Modelling and Assessment

19.1.1 Statement of Authority

This Chapter of the EIAR has been prepared by Duncan Swanney, Pia Ricca, Ewan Edwards and Dr Anthony Millais of Xodus Group Limited (Xodus), and Matthew Cand (Hoare Lea) who undertook the Offshore Site airborne noise study (Appendix 19-1 Operational Airborne Turbine Noise Assessment).

Duncan Swanney is an Environmental Consultant with Xodus, having joined the company in November 2022. Duncan holds a BSc (Hons) in Marine Biology with Heriot Watt University and a MSc in Marine Conservation with the University of Aberdeen. Duncan has supported on a variety of different renewable projects at different levels, such as the MeyGen tidal project, and Berwick Bank Cambois Cable Connection. Duncan also was involved with the large scale ScotWind Morven project through secondment with bp. Duncan contributed to the baseline characterisation for this EIAR Chapter.

Pia Ricca is an Environmental Consultant with over seven years of professional experience in research, policy and project management within the ecology and sustainability sectors. She holds an MSc in Applied Marine and Fisheries Ecology and a BSc in Environmental Biology. She has worked on various offshore renewables projects, including electrification scopes, offshore wind, and tidal turbines, at various stages (including screening, scoping, Environmental Impact Assessment (EIA) and post-consent). She has provided technical support through contributions to a number of EIA chapters, including Climate and Carbon assessment for a UK offshore wind farm, and to Net Positive Impact assessments. Pia undertook the air quality impact assessment.

Ewan Edwards is an Environmental Specialist in the Xodus EIA team, with over 15 years of environmental research and advisory roles. He is the Offshore EIA Manager for the Sceirde Rocks Offshore Wind Farm and previously worked as the Renewables Science Advice Leader for Marine Scotland Science, a division of the Scottish Government, where he led the provision of environmental advice to the Scottish marine industries regulator. In this previous role Ewan has reviewed numerous air

quality and airborne noise assessments, and consultation responses, in relation to offshore wind farm developments in Scotland. Ewan reviewed and managed the production of this Chapter, working with colleagues in Xodus and Hoare Lea.

Dr Anthony (Tony) Millais is an Environmental Specialist and leads the Xodus Environmental Engineering team. He has an extensive research background in environmental chemistry, biodegradation, ecotoxicology, environmental modelling and risk assessment. Tony also provides due diligence and expert witness support to projects as an environmental chemist and modeller. Tony has been delivering Environmental Risk Assessments in consultancy and regulatory roles since 1995 across a large number of offshore energy projects, including offshore wind developments in the UK. Tony undertook a quality assurance/quality control review of air quality sections of this Chapter. The airborne noise assessment was undertaken by Matthew Cand (Dipl. Eng., PhD, MIOA) of Hoare Lea LLP. Matthew is a full member of the United Kingdom (UK) Institute of Acoustics. He is an Associate Director at Hoare Lea LLP who has responsibility for running the environmental noise group, which has a focus on EIAs. He has over 19 years' experience in the assessment of environmental acoustics and has conducted more than 70 noise assessments for EIA of wind farms in the UK and Ireland. Matthew is an expert in the assessment of wind farm noise and is one of the authors of the UK Institute of Acoustics Good Practice Guide (IOA, 2013). He has also been engaged as expert witness at planning inquiries and noise nuisance cases in the UK and Ireland. Matthew undertook a quality assurance/quality control review of airborne noise sections of this Chapter.

19.2 Legislation, Policy and Guidance

In addition to the regulations listed in Chapter 2: Background and Planning Policy, the legislation and policy relevant to the assessment of potential impacts from the Offshore Site on air quality and airborne noise receptors and which require the provision of atmospheric emissions inventories and the assessment of carbon are detailed below.

19.2.1 Legislation

- EU Clean Air For Europe (CAFE) Directive (2008/50/EC)
- The Sea Pollution (Prevention of Air Pollution from Ships) (Amendment) Regulations 2017 (S.I. No. 48/2017)
- Air Quality Standards Regulations 2011 (Europe) (S.I. No. 180, 2011)
- European Union (Medium Combustion Plant) Regulations (Europe) (S.I. No. 121, 2017)

19.3 Policy

- National Marine Planning Framework (Ireland) (DoHLGH, 2021)
- Clean Air Strategy for Ireland (Government of Ireland, 2023)
- Clare County Development Plan 2023-2029. Noise Pollution Objective CDP 11.40

19.3.1 Guidance

- Guidance on the assessment of the air quality effects of development on designated nature conservation sites prepared by the Institute of Air Quality Management (UK) (IAQM 120, 2019)
- Wind Energy Development Guidelines (WEDG) (2006) (DHLGH, 2020)
- Working Group on Noise from Wind Turbines (WGNWT) – ETSU-R-97: The Assessment & Rating of Noise from Wind Farms (UK). This is the current UK framework for assessing wind farm noise (WGNWT, 1996)

- Institute of Acoustics (IOA) – A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise (Cand, et al., 2013)
- British Standard BS 5228-1:2009-A:2014 (2014). 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (BS 5228-1 (2014))
- World Health Organization (WHO) Air Quality Guidelines (WHO, 2021)

19.3.2 Air Quality Objectives

In addition to those specific considerations above, specific air quality objectives apply under the EU CAFE Directive (2008/50/EC), which aim to reduce, prevent, and avoid harmful effects on human health and the environment (Table 19-1).

Table 19-1 Limit values of CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value μgm^{-3}	Limit Value ppb	Basis of Application of the Limit Value
Sulphur dioxide	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
Sulphur dioxide	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
Sulphur dioxide	Protection of vegetation	Calendar year	20	7.5	Annual mean
Sulphur dioxide	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
Nitrogen dioxide	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
Nitrogen dioxide	Protection of human health	Calendar year	40	21	Annual mean
Nitric oxide + nitrogen dioxide	Protection of ecosystems	Calendar year	30	16	Annual mean
Particulate matter < 10 micrometres (PM_{10})	Protection of human health	24 hours	50		Not to be exceeded more than 35 times in a calendar year
PM_{10}	Protection of human health	Calendar year	40		Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value μgm^{-3}	Limit Value ppb	Basis of Application of the Limit Value
Particulate matter < 2.5 micrometres ($PM_{2.5}$) - Stage 1	Protection of human health	Calendar year	25		Annual mean
$PM_{2.5}$ - Stage 2	Protection of human health	Calendar year	20		Annual mean
Lead	Protection of human health	Calendar year	0.5		Annual mean
Carbon Monoxide	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene	Protection of human health	Calendar year	5	1.5	Annual mean

19.3.3 Operational Airborne Noise Guidance

ETSU-R-97 (WGNWT, 1996) is the current UK framework to assess wind farm noise and provides indicative noise levels to provide protection to onshore sensitive receptors. The 2006 Irish WEDGs include recommendations on noise which are consistent with those in ETSU-R-97. Although these guidelines do not specifically deal with offshore wind turbines, they are considered relevant when assessing operational wind turbine noise affecting noise-sensitive residential receptors onshore. Wind Turbine Generator (WTG) noise and background noise both vary with wind speed. Therefore, noise assessments conducted at noise-sensitive properties consider the variation of site-specific background noise at different wind speeds. Limits are placed on noise over a range of wind speeds up to 12 metres/second (m/s). The background and WTG noise is described using LA90,10min, which describes the decibel (dB) level exceeded for 90% of a 10-minute sample period. See Appendix 19-1 for further details.

Noise limits are set for the nearest noise-sensitive properties both for the daytime and night-time, set relative to the existing background noise at those properties and reflect the variation in WTG noise and background noise with wind speed. Day-time noise limits are derived from background noise data measured during quiet periods of the day (weekday evenings from 18:00 to 23:00, Saturday afternoons and evenings from 13:00 to 23:00, and all day and evening on Sundays from 07:00 to 23:00). Night-time quiet periods are between 23:00 and 07:00. Noise limits can be either fixed or in relation to the background noise limits and are as follows:

- The day-time noise limit is set as the greater of either (a) a level 5 A-weighted decibels (dB(A)) above the best-fit background noise curve, or (b) a fixed level in the range of 35 dB(A) to 40 dB(A), whichever is greater; and
- The night-time noise limit is set as the greater of either (a) a level 5 A-weighted decibels (dB(A)) above the best fit background noise curve, or (b) a fixed level of 43 dB(A), whichever is greater.

ETSU-R-97 also advises that if predicted operational WTG noise levels are lower than the lowest limit of 35 dB considered above, they are considered acceptable regardless of background noise levels.

Guidance on good practice on the application of ETSU-R-97 has been provided by the Institute of Acoustics Good Practice Guide (IOA GPG).

19.4 Consultation

Stakeholder consultation has been ongoing throughout the EIAR preparation and has played an important part in ensuring the scope of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.

The Scoping Report was submitted to stakeholders, in September 2023. Relevant comments from the other consultation specific to offshore air quality, airborne noise and vibration are provided in Table 19-2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

Further consultation has been undertaken throughout the pre-application stage. Table 19-2 below summarises the consultation activities carried out relevant to offshore air quality, airborne noise and vibration.

Table 19-2 Summary of consultation relevant to offshore air quality, airborne noise and vibration

Consultee	Comment	Where the comment has been addressed in the EIAR
Met Eireann	Raised concerns on the potential detrimental impact on the measurement of wind speed and direction at Met Éireann's automatic weather station at Mace Head Atmospheric Research Station. Advised that the offshore array area should be at least 9.75km away from the Mace Head wind measurement equipment based on a calculation taken from World Meteorological Organisation's Guide to Instruments and Methods of Observation Volume 1. Requested that their feedback be taken into the next stage planning process and address the points raised about the proposed offshore array area's impacts on wind measurements at Mace Head.	The effects of the Offshore Site on Mace Head Atmospheric Research Station during installation and construction have been assessed in Sections 19.7.2.1 and 19.7.3.1.1.
Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media	No response	No action required.

Department of Housing, Local Government and Heritage	No response	No action required.
Failte Ireland	Advised that the following subjects are of most relevance and importance: Population and Human Health (including Socio-Economic, Tourism and Recreation); and Coastal and Marine Infrastructure and Other Users. Noted the importance of avoiding any effects that may negatively impact local attractions and experiences.	Effects of airborne noise, vibration, and air quality on onshore sensitive receptors, including human health and tourism are assessed in Section 19.7.2.2, Section 19.7.2.3, Section 19.7.3.2, and Section 19.7.3.3.
National University of Ireland Galway – Property Management Section (Mace Head Atmospheric Research Station)	Raised concerns on the effects of new sources of pollution and perturbations to natural system within the Mace Head measurement footprint area will render it unfit for purpose as a baseline station – there is no tolerance in gradation acceptable. Raised concerns of the impact on the turbulence structure, the wind speed profiles, whitecapping and including cloud reflectance, cloud-microphysics, and precipitation formation – all contributing to natural impacts, alongside the additional anthropogenic species that will be added directly to the system.	The effects of the Offshore Site on Mace Head Atmospheric Research Station during installation and construction have been assessed in Sections 19.7.2.1 and 19.7.3.1. The effects of the Offshore Site on meteorological conditions around the Offshore Site during construction have been assessed in Section 19.7.3.1.2. Consultation is ongoing with respect to the potential for relocation of monitoring instruments to mitigate any effects of the Project.

19.5 Assessment Methodology

19.5.1 Data and Information Sources

The existing data sets and literature with relevant coverage of the Offshore Site, which have been used to inform the baseline characterisation for the EIAR, are outlined in Table 19-3. References that have been used to inform the baseline for offshore air quality, airborne noise and vibration are listed in Table 19-3.

Table 19-3 Data and information sources used to inform the offshore air quality, airborne noise and vibration baseline description

Title	Description	Author	Date
1:25,000 Ordnance Survey map of the Project area to identify potential receptors	N/A	Ordnance Survey	N/A

Title	Description	Author	Date
Air Quality in Ireland 2022	https://indd.adobe.com/view/36d600c3-52e4-4117-8b42-06c75e944f0a	Environmental Protection Agency (EPA)	2023
Air Quality in Ireland Web Maps	https://airquality.ie/	EPA	2024
The Intergovernmental Panel on Climate Change (IPCC)	Sixth Assessment Report	IPCC	2021
Sceirde Rocks Background Noise Survey	Survey technical note describing the survey methodology and equipment used. See Appendix 19-1.	AWN Consulting	May 2024
SG DD-236 Acoustic Emission	Noise emission levels from the Siemens-Gamesa SG DD-236 wind turbine model. Document reference AE-IE-17187-110000105398-00.	Siemens-Gamesa	December 2023
BS 5228-1, BSI 2014	BS 5228-1 provides sound emission levels from typical construction plant for various activities and example criteria.	British Standards Institution	2014

19.5.2 Site Surveys

19.5.2.1 Metocean Survey

The Applicant commissioned Deltares to undertake a metocean study of the Offshore Array Area (OAA) (Deltares, 2022; Appendix 7-2). Hindcast metocean data for wind, water levels, currents and wave conditions were obtained to estimate operational and extreme metocean parameters to support ongoing design and optimisation studies. The metocean hindcast timeseries were obtained for a 43-year period (1979 – 2021), at one-hour intervals, for three representative locations across the OAA. The hindcast timeseries included the following:

- Water levels and depth-averaged current speeds at metres per second (m/s) and directions;
- Waves - significant wave heights (Hs) in metres, peak wave periods (Tp) in seconds and mean wave directions (MWD) in degrees; and
- Wind speeds and direction at 10m above mean sea level (MSL), with the information used to estimate conditions at an indicative hub height of 170m MSL, which represents the average wind conditions acting on the WTGs.

19.5.2.2 Vessel Traffic Surveys

A summer and winter vessel traffic survey has been undertaken around the Offshore Site Boundary by Anatec Ltd for Xodus on behalf of Corio Generation. The purpose of the vessel traffic surveys was to inform the Navigational Risk Assessment (NRA) for Chapter 14: Shipping and Navigation (Appendix 14-1), the information obtained is relevant to establishing the vessel emissions for the offshore air quality, airborne noise and vibration baseline.

19.5.2.3 Baseline Noise Survey

An operational airborne WTG noise assessment was undertaken by Hoare Lea for Xodus on behalf of the Applicant (Hoare Lea, 2024) to assess the potential operational noise impacts of the WTGs

(provided in Appendix 19-1). As part of the assessment, a baseline background noise survey was conducted by AWN Consulting Ltd between 30th January 2024 and 19th February 2024 from two noise monitoring locations which are representative of properties on the shoreline, located 5km or more from the closest potential location of the WTGs. Two Rion NL 52 logging sound level meters, enclosed in environmental cases and windshield systems to reduce wind induced noise, measured noise levels continuously over the deployment period. No acoustically important drifts in calibration were found to have occurred during the monitoring period. Consequently, the recording equipment is not considered to meaningfully contribute to any observed variation in noise levels over the monitoring period. A total monitoring period of more than two weeks is considered in excess of the minimum of one week suggested by ETSU-R-97 and is compliant with the IOA GPG requirements (Section 19.3.3).

Data were inspected to identify periods which may have been influenced by noise sources causing atypical and elevated levels of background noise, including any data affected by rainfall. Data from a rain gauge were used to exclude periods of rainfall. Additionally, periods of easterly winds coming from inland were excluded, as these are not representative of conditions in which the noise from the WTGs could be experienced by onshore receptors.

19.5.3 Consideration of data sources and quality

As part of the development of the EIAR Chapter baseline (Section 1.4.4), an extensive literature review of publicly available sources (as identified in Table 19-3) was undertaken to define the ambient offshore airborne noise and vibration within the Offshore Site and its surrounding marine environment. Site-specific surveys were carried out for vessel traffic requirements (Chapter 14: Shipping and Navigation) which will aid understanding of the noise and emissions, and a baseline noise survey was undertaken to assess the offshore airborne noise and vibration effects on onshore receptors.

Baseline offshore airborne pollutant levels have not been monitored for the Project and no specific offshore airborne pollutant data sources are publicly available. It is considered that terrestrial air quality data can provide an indication of air quality offshore due to the influence of prevailing winds bringing generally clean air masses from the Atlantic Ocean. As such, where appropriate, terrestrial baseline airborne pollutant sources have been used to supplement the assessment. However, given additional localised terrestrial sources of pollution, there is the potential that baseline air quality within the Offshore Site is of higher quality than onshore.

The information presented from these sources is considered appropriate to describe suitable existing baseline conditions to inform this EIAR, to ensure an informative assessment of likely significant effects.

The assessment of operational WTG noise is based upon a candidate WTG which was selected as typical (on a robust basis) of the type and size of WTG that would be used for the Project.

19.5.4 Assessment Methodology

19.5.4.1 Impacts requiring assessment

This assessment covers all likely significant effects identified during the scoping process, as well as any further potential impacts that have been highlighted as the EIA has progressed. Table 19-4 indicates all of the direct and indirect impacts assessed with regard to offshore air quality and airborne noise and vibration and indicates the Project phases to which they relate. The assessment of cumulative effects can be found in Section 19.9.

Table 19-4 Potential impacts requiring assessment

Potential impact	Description
Construction/decommissioning[1]	
Impacts to the functions of Mace Head Atmospheric Research Station	There will be likely effects from the construction/decommissioning stage of the Project on the functions and equipment of Mace Head Atmospheric Research Station particularly its important role in monitoring ambient air quality as part of a global network of clean air stations.
Airborne noise and vibration generated from cable installation, vessel movements and Project specific machinery which has the potential to impact marine users, and/or onshore sensitive receptors	Airborne noise and vibration generated during cable installation activities, from cable laying vessels, and from other Project specific machinery and vessels. The scale of these impacts may depend on the construction methods required and the duration of the construction methods.
Exhaust emissions from Offshore Site vessels used during the construction and decommissioning phase have the potential to increase local ambient noise levels and concentrations of SO_2, NO_x, PM10 and $PM_{2.5}$, in addition to impacting onshore sensitive receptors	Vessels associated with the Project will contribute to atmospheric emissions. Although local-scale vessel activity is likely to increase notably (especially over short durations) given the comparatively limited existing boat traffic, any related emission will likely be negligible in the wider context of the emissions of cargo, passenger and fishing vessels operating in proximity to the OAA. The supporting Vessel Management Plan (VMP) will outline the mitigation measures to be adopted by the Project throughout the construction, operational and decommissioning phases of the Project.
Operational	
Impacts to the functions of Mace Head Atmospheric Research Station	Given the likelihood of effects from the operational phase, assessment is required to understand the potential interaction between operation of the Project, predominantly WTGs in the OAA and any Project vessel activity, and the functions and equipment of Mace Head Atmospheric Research Station, particularly its important role in monitoring ambient air quality as part of a global network of clean air stations.
Production of airborne noise and vibrations during WTG operation	The noise generation produced during the operation of WTGs adding to the ambient airborne noise levels. Vibration levels during operation from onshore WTGs become imperceptible beyond a short distance of a few hundred metres. For the Project, the lack of groundborne vibration transmission path and the separation distances from sensitive onshore receptors are such that this does not require further consideration. See Appendix 19-1 for details.

[1] *The impacts during the decommissioning of the Project are considered analogous with, or likely less than, those of the construction stage. Where this is not the case it has been stated and decommissioning impacts have been assessed.*

Potential impact	Description
Potential increase in noise, vibration and vessel emissions relating to Project vessels and their movements.	Maintenance works associated with operations of the WTGs resulting in an increase to the ambient noise, vibration and emissions from the Project vessels. See Appendix 19-1 for details.

19.5.4.2 Assessment Methodology

19.5.4.2.1 *Characterisation of Impacts and Effects*

An assessment of potential impacts is provided for the construction (including pre-construction), operational and decommissioning phases of the Offshore Site. The assessment for offshore air quality, airborne noise and vibration is undertaken following the principles set out in Chapter 4: EIA Methodology, in line with the EPA EIAR Guidelines (EPA, 2022) (hereafter referred to as EPA Guidelines). Potential impacts are characterised based on the following relevant factors in Table 3.5 of the EPA (2022) EIAR Guidelines:

- **Quality of effects**: Whether an effect results in a change that improves (positive) or reduces (negative) the quality of the environment;
- **Extent**: Describes the size of the area, the number of sites and the proportion of a population affected by an effect;
- **Context**: Describes whether the extent, duration or frequency will conform or contrast with established (baseline) conditions;
- **Probability**: If effects are likely or unlikely;
- **Duration**: Describes the length of time an impact is expected to occur based on the set definitions within the guidelines;
- **Frequency**: Describes how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, annually, etc.); and
- **Reversibility**: Whether an effect can be undone, through remediation or restoration.

The criteria for the sensitivity of offshore air quality receptors are presented in Table 19-5, and the magnitude of impact in Table 19-6. The criteria for sensitivity of noise receptors are presented in Table 19-7. These assessment sensitivity criteria have been determined based upon expert judgment and interpretation of relevant published guidance for air quality (IAQM, 2011) and airborne noise (Scottish Government, 2011).

An assessment of potential impacts is provided separately for the construction (including pre-construction), operational, and decommissioning phases.

Table 19-5 Receptor sensitivity criteria for offshore air quality

Sensitivity of Receptor	Definition
High	• The receptor or group have no capacity to accommodate a particular effect and no ability to recover or adapt. • The economic value of the receptor or group is of international or national importance.
Medium	• The receptor or group have low capacity to accommodate a particular effect with low ability to recover or adapt. • The economic value of the receptor or group is of regional importance.

Sensitivity of Receptor	Definition
Low	› The receptor or group have some tolerance to accommodate a particular effect or will be able to recover or adapt. › The economic value of the receptor or group is of local importance.
Negligible	› The receptor or group is generally tolerant and can accommodate a particular effect without the need to recover or adapt. › The receptor or group is widespread and of low economic value.

Table 19-6 Effect magnitude criteria for offshore air quality

Magnitude criteria	Definition
High	› An impact will result in a total change or major alteration to key elements/features of baseline conditions. › The impact will occur over a large scale or spatial geographical extent and/or is long-term or permanent in nature. › The impact will occur at a high frequency and/or at high intensity.
Medium	› An impact will result in a partial change or alteration to one or more key elements or features of baseline conditions. › The impact will occur over a medium scale/spatial extent and/or has a medium-term duration. › The impact will occur at a medium to high frequency and/or at moderate intensity or occurring occasionally/intermittently for short periods of time but at a moderate to high intensity.
Low	› An impact will result in a minor shift away from baseline conditions. › The impact will occur over a local to medium scale/spatial extent and/or has a short to medium-term duration. › The impact is unlikely to occur or at a low frequency.
Negligible	› An impact will result in a very slight change from baseline conditions. › The impact is highly localised and short term with full, rapid recovery expected to result in very slight or imperceptible changes to baseline conditions. › The impact is very unlikely to occur and, if it does occur, will occur at very low frequency or intensity. to occur and, if it does occur, will occur at very low frequency or intensity.

Table 19-7 Receptor sensitivity criteria for airborne noise

Sensitivity of Receptor	Definition
High	› Receptors where noise may be detrimental to vulnerable receptors, including care homes, schools, and healthcare buildings.
Medium	› Receptors where noise may cause disturbance, and a level of protection is required but a level of tolerance is expected. This can include residential accommodation, temporary holiday

Sensitivity of Receptor	Definition
	accommodation, leisure facilities, and national parks or tourism areas.
Low	› Receptors in noise-producing environments, where particularly high noise levels may cause an effect. This can include offices, shops, cafes, and outdoor amenities areas (including recreational areas and public play spaces).
Negligible	› Receptors where noise is not expected to be detrimental, including car parks, agricultural land, and industrial areas.

The consequence and significance of effect is then determined using the matrix provided in Chapter 4: EIA Methodology.

19.5.4.2.2 Determining Significance of Effect

The EPA guideline's definitions for describing significance of effect have been used for the offshore air quality, airborne noise and vibration impact assessment (Table 19-8).

Table 19-8 Describing significance of effect (EPA, 2022)

Magnitude criteria	Definition	Significance
Imperceptible	An effect capable of measurement but without significant consequences.	Not significant.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.	
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.	
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.	
Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.	Significant. Mitigation measures must be in place to prevent, reduce, or avoid the impact, and if not possible then compensatory measures are proposed.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.	
Profound Effects	An effect which obliterates sensitive characteristics.	

19.5.5 Design Parameters

Table 19-9 summarises the design parameters that are used for the assessment of potential impacts on offshore airborne noise and vibration receptors during construction (including pre-construction), operational and decommissioning. The full Project design is detailed in Chapter 5: Project Description.

Table 19-9 Design scenario specific to offshore airborne noise and vibration impact assessment

Potential Impact	Design Scenario	Further information
Construction and decommissioning		
Impacts to the functions of Mace Head Atmospheric Research Station	› Up to 23 construction vessels; › A maximum of 11 construction vessels within the Offshore Site at one time; › Up to 22 vessel transits per day; and › A total of four years of pre-construction and construction	The number of vessels and vessel transits that would result in the potential for vessel emissions which would impact the function of Mace Head Atmospheric Research Station.
Airborne noise generated from cable installation, vessel movements and Project specific machinery which has the potential to impact marine users and/or onshore sensitive receptors	Cables: › Maximum total length of inter-array cables (IAC) is 73.0 km. Target depth of lowering of 1.0 m, with up to 100 % of the IAC (73 km) requiring protection; › Maximum total length of Offshore Export Cable (OEC) is 63.5 km. Target depth of lowering of 1.0 m, with up to 22% of the OEC requiring protection; › Protection methods including rock placement, concrete mattresses, cast-iron shells and/or rock/grout bags. Protection material will be installed from a construction vessel e.g. fallpipe vessel; › One cable crossing, within the Offshore Export Cable Corridor (OECC). Cable protection at crossings over a maximum area of 89m^2, with a 1.2m height and 8.1m width using concrete mattresses, cast-iron shells and/or rock dump. Vessels: › Up to 23 construction vessels; › A maximum of 11 construction vessels within the Offshore Site at one time; and › A total of four years of construction (with an additional year of pre-construction activities).	The extent and duration of potential offshore noise/vibration, and the number of vessels and vessel transits which will impact other sea users and onshore sensitive receptors.
Exhaust emissions from Offshore Site vessel used during the construction and decommissioning phase	› Up to 23 construction vessels; › A maximum of 11 construction vessels within the Offshore Site at one time; and › A total of four years of construction (with an additional year of pre-construction activities).	The number of vessels and vessel transits that would result in the potential for increase to vessel exhaust emissions and vessel noise/vibrations to

have the potential to increase local ambient noise levels and concentrations of SO_2, NO_x, PM10 and $PM_{2.5}$, in addition to impacting onshore sensitive receptors	Decommissioning: The decommissioning methodology for the Offshore Site will generally be the reverse of the installation process. Firstly, the WTG towers, blades, nacelle and internal cabling are dismantled and removed from the Offshore Site. The Offshore 220kV Electrical Substation (OSS) is separated from the Gravity Based Structure Fixed-Bottom Foundation (GBS) structure and removed from the Offshore Site. Then the GBS foundations are de-ballasted, re-floated and towed from the Offshore Site. Stonebeds both for the GBS foundations and the WTIV operations will be decommissioned *in situ*. The IAC and OEC decommissioning plans that any exposed or unburied and accessible cable will be cut and removed. However, any buried cables will be decommissioned *in situ*. Cable protection will be decommissioned *in situ*, as this method is likely to result in the lowest environmental impact. The Rehabilitation Schedule is detailed within Appendix 5-18 of Chapter 5: Project Description	offshore ambient levels and onshore human and ecological receptors.
Operational		
Impacts to the functions of Mace Head Atmospheric Research Station	Up to 8 transits per day through operational life by operational phase vessels › Operational life of 38 years. › Presence of 30 WTGs with a minimum spacing of 1,017m between WTGs; › Presence of one OSS, located within the OAA.	The number of vessels and vessel transits that would result in the potential for impacts from vessel emissions; and the presence of OAA infrastructure which could result in meteorological impacts on Mace Head.
Production of airborne noise during WTG operation	› Operational life of 38 years. › Presence of 30 WTGs with a minimum spacing of 1,017m between WTGs; › Presence of one OSS, located within the OAA	The extent and duration of potential production of airborne noise and vibrations during WTG operation.
Potential increase in noise, vibration and vessel emissions relating to Project vessels and their movements during the operational phase	› Up to 8 transits per day through operational life by operational phase vessels.	The number of vessels and vessel transits that would result in impacts from vessel noise.

19.5.6 Mitigation by design

As described in Chapter 4: EIA Methodology certain measures have been adopted as part of the Project design in order to mitigate the potential for impacts to the environment. These measures follow best practice and the measures specifically relating to offshore airborne noise and vibration are outlined within Table 19-10.

Table 19-10 Embedded mitigation measures relevant to offshore air quality, airborne noise and vibration

Embedded Mitigation Measure	Details
Implementation and compliance with the measures outlined in the Offshore Environmental Management Plan (OEMP): Appendix 5-2	Implement the OEMP which includes measures for pollution prevention and the control of noise and vibration during construction. With respect to airborne noise and air quality, this includes advisory speed restrictions on vessels operating within the Offshore Site.
Compliance with the Sea Pollution (Prevention of Air Pollution from Ships) Regulations 2010 as amended	The regulations implement the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI in Ireland and establish controls on marine engines and marine fuel to limit emissions, in particular NO_x and SO_x. All vessels associated with the Offshore Site will require the appropriate International Air Pollution Prevention Certification (IAPP) to be in place.
Compliance with the Vessel Management Plan (VMP)	The supporting Vessel Management Plan (VMP) outlines the mitigation measures to be adopted by the Project throughout the construction, operational and decommissioning phases of the Project.

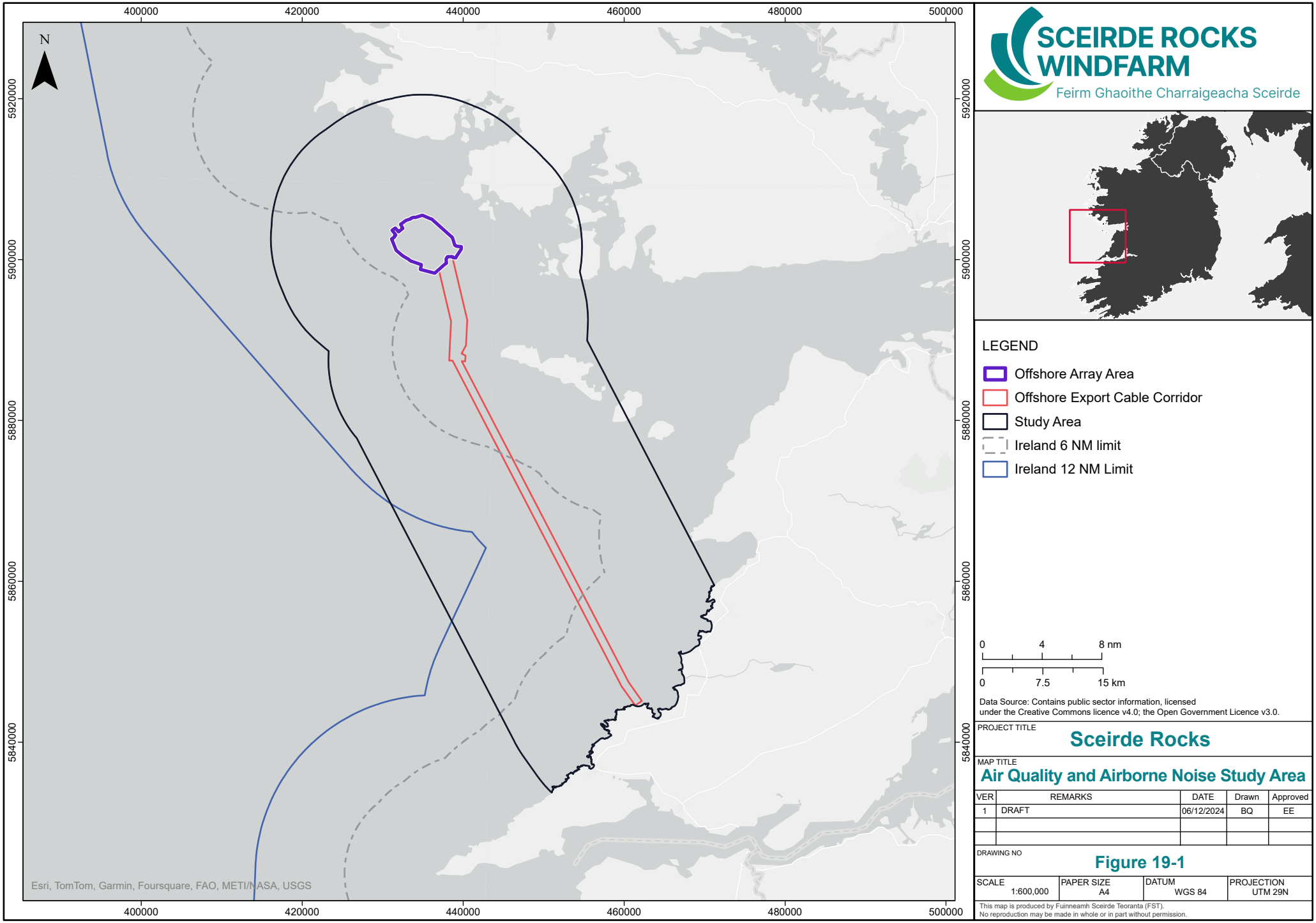
19.6 Baseline Conditions

This Section summarises current knowledge on offshore air quality, airborne noise and vibration within the Study Area. The characterisation of the current environment is established from a combination of a site-specific survey results, desk-based studies and consultation with key stakeholders.

19.6.1 Study Area

A buffer of 15km around the Offshore Site has been used to define the offshore air quality, airborne noise and vibration study area. The range of this buffer region has been determined based on expert judgment on the likelihood of effects of airborne noise (originating offshore) on onshore receptors. This buffer region is considered to suitably encapsulate all the potential effects of the Project during the construction, operational and decommissioning phases, for example emissions from movement of Project vessels as well as ensuring potential impacts to Mace Head Atmospheric Research Station (hereafter 'Mace Head') are considered (Figure 19-1).

Additionally, a 350m buffer has been applied around the Landfall to capture residential properties and public amenity areas within and near construction activities. This buffer was likewise determined based upon relevant expert judgement.



SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit

0 4 8 nm

0 7.5 15 km

PROJECT TITLE

Sceirde Rocks

MAP TITLE

Air Quality and Airborne Noise Study Area

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 19-1

SCALE	PAPER SIZE	DATUM	PROJECTION
1:600,000	A4	WGS 84	UTM 29N

19.6.2 Baseline Environment

19.6.2.1 Airborne pollutants

Greenhouse gases (GHGs) are the gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the earth's surface, the atmosphere and clouds. These substances prevent energy from leaving the atmosphere and thus contribute to heating of the atmosphere.

On a global scale, concern with regard to atmospheric emissions of GHGs (including water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NO_x), Ozone (O_3) and chlorofluorocarbons (CFCs) is focused on the impact they have on global climate change. The Intergovernmental Panel on Climate Change (IPCC) in its sixth assessment report (AR6) states that 'it is unequivocal that the increase of CO_2, methane (CH_4) and nitrous oxide (NO_x) in the atmosphere over the industrial era is the result of human activities and that human influence is the principal driver of many changes observed across the atmosphere, ocean, cryosphere and biosphere' (IPCC, 2021). AR6 reports that each of the last four decades have been successively warmer than any decade that preceded it since 1850. IPCC (2021) reports a 47% increase in CO_2 concentrations since 1750 which far exceed the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years, stating that the combustion of fossil fuels is the primary contributor to the observed global warming.

Emissions considered within the baseline will be those generated by vessels used during the lifetime of the Offshore Site. The primary atmospheric pollutants associated with shipping activities are emissions such as nitrogen and sulphur oxides (NO_x and SO_x), carbon monoxide (CO), particulate matter (PM) and non-methane volatile organic compounds (NMVOCs) may affect local air quality with potential impacts on human health and the environment.

- NOx emissions form photochemical pollution in the presence of sunlight which can damage human respiratory tracts;
- SOx emissions are a precursor to acid rain and atmospheric particulates and can exacerbate respiratory illnesses;
- CO can directly affect human health at elevated levels, acting as an asphyxiant;
- PM can contribute to human heart disease and lung cancer; and
- NMVOCs can contribute to the deterioration of local air quality.

Measurements carried out at Dublin port by NUIG have indicated that ship emissions account for over 75% of pollution events in the area (O'Dowd, et al., 2024). These are generally not captured in climate modelling due to the difficulties in accounting for relevant emissions.

As detailed in Section 19.5.3, airborne pollutant levels are not collected offshore. Nonetheless, an indication of offshore baseline air quality has been considered based on terrestrial air quality data sources due to the prevailing winds bringing air masses from the Atlantic Ocean which has an influence on terrestrial air quality.

The Environmental Protection Agency (EPA) annually report on air quality data for. The 2023 EPA air quality report (EPA, 2024a) states that Ireland met all of its CAFE legal air quality requirements but failed to meet the WHO guideline values for health in 2023. However, terrestrial air quality monitoring data in the vicinity of the Offshore Site for 2023 Ireland (see Figure 19-2, EPA, 2024b) highlighted low levels of NO_x (expressed as NO_2 $\mu g/m^3$) in proximity to the Offshore Site at <5 $\mu g/m^3$ which is less than the WHO guideline limits (10 $\mu g/m^3$). Additionally, PM_{10} was also less than the WHO limits (15 $\mu g/m^3$) at proximity to the Offshore Site. $PM_{2.5}$ was generally found to be <8 $\mu g/m^3$ in proximity to the Offshore Site, this is just above the 5 $\mu g/m^3$ WHO guideline limit (WHO, 2021). Average annual Ozone concentrations were also recorded and in 2023 at >60 $\mu g/m^3$ in proximity to the Offshore Site.

Nonetheless, there is no current thresholds set for ozone concentrations, however, the EPA states that concentrations across Ireland are considered to be Moderate (EPA, 2024a).

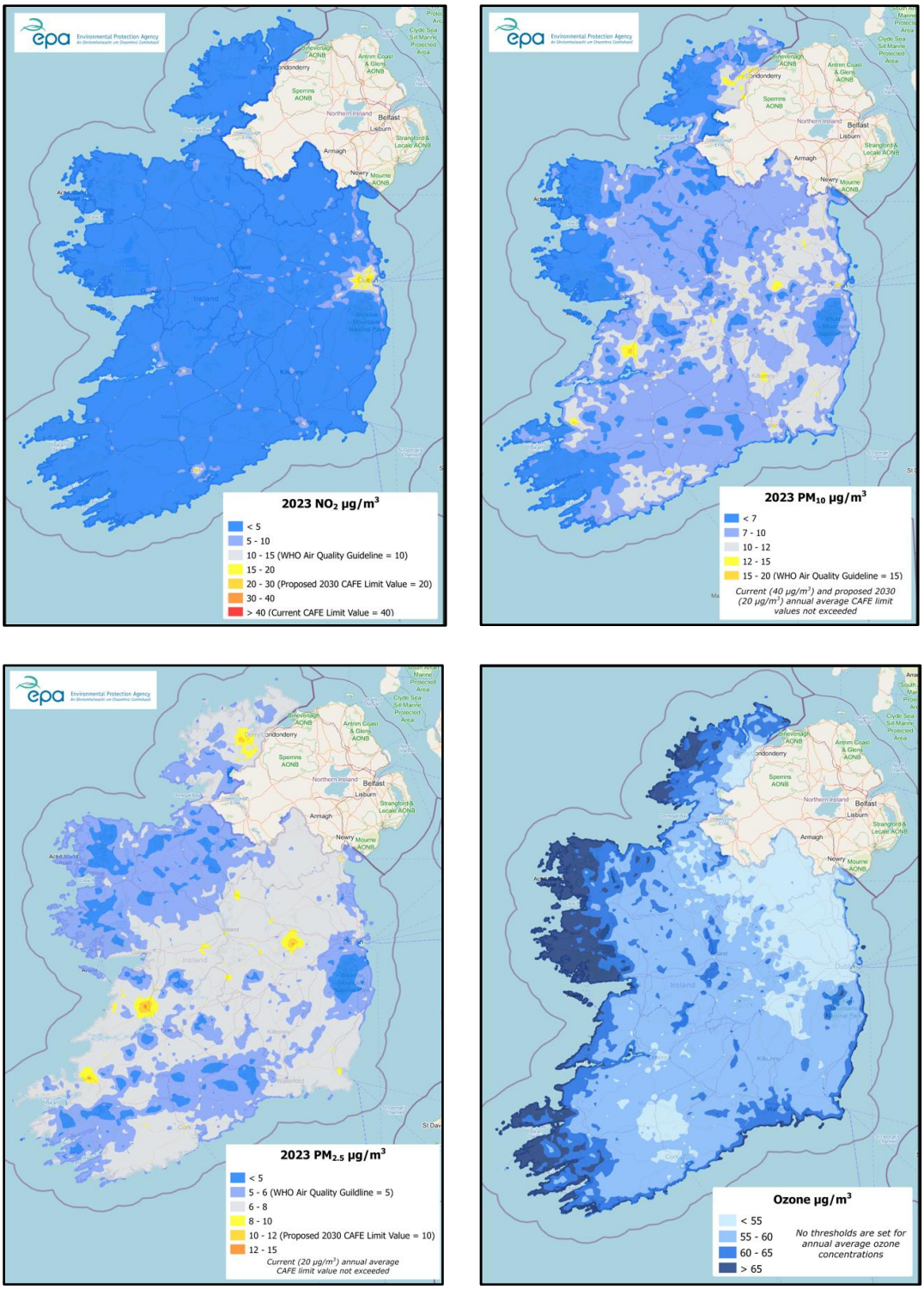


Figure 19-2 EPA 2023 Air Quality Monitoring Maps (EPA, 2024b)

Furthermore, there are two monitoring stations in proximity to the Offshore Site, the Ennistymon, Co. Clare Station and the Mace Head Station. The Ennistymon, Co. Clare Station currently reports an Air Quality Index for Health (AQIH) of 1[2], the highest air quality status available. The Mace Head station is also in proximity to the Offshore Site. Nonetheless, there are no publicly available records for air quality for this station currently publicly accessible from the EPA. Given the terrestrial information available, it is inferred that air quality at the Offshore Site is also of high quality. Nonetheless, this cannot be confirmed with certainty in the absence of specific long term offshore monitoring data currently unavailable.

19.6.2.2 Meteorology

The predominant wind speeds at the Offshore Site are from the southwest to west i.e. from the sea towards the coast. Wind speeds at hub height range from 0 to 40 metres per second (m/s), but approximately 90% of the time the wind speed is lower than 17.0 m/s (Deltares, 2022). Meteorological conditions measured at Mace Head also indicate predominantly south westerly winds near to the Offshore Site, with average wind speeds (at 10m height) in 2022 of 7.6 m/s (monthly average range 5.7 – 11.6 m/s) (Jennings et al, 2003; Met Éireann, 2023). These windspeeds are also consistent with longer-term measurements showing seasonality trends in horizontal wind speed, with a winter median of 11 m/s in January and a lower summer median of 7 m/s in July (Preißler & O'Dowd, 2020). Wind speeds measured during the baseline noise survey (Hoare Lea, 2024) peaked at 14 m/s during the quiet daytime and night-time periods (see Section 19.5.2.3), directed mainly from the southwest.

Between 2020 - 2022, Mace Head experienced an average annual total precipitation of 1100 millimetres (mm). Precipitation was highly seasonal, with average monthly precipitation peaking in October with 176.2 mm, and a minimum in April of 26.9 mm (Met Éireann, 2023). Relative humidity is generally high, at about 80-85%. Average air temperature is about 10°C (approximately 15°C in summer, and 5°C in winter).

19.6.2.3 Mace Head Atmospheric Research Station

Mace Head measures atmospheric pollutants and provides data on air quality for Europe. The location of Mace Head is rare in Europe, offering westerly exposure to the North Atlantic Ocean and clear conditions to study atmospheric composition representative of the northern hemisphere. Mace Head is part of an internationally recognised research networks including the Advanced Global Atmospheric Gases Experiment (AGAGE), the Atmospheric/Ocean Chemistry Experiment (AEROCE) and the World Meteorological Organisation/Global Atmospheric Watch (WMO/ GAW). Air samples are collected from a terrestrial collection point to measure GHGs in the atmosphere, including CO, CO_2, CH_4, H_2, N_2O, and SF_6 as well as other atmospheric characteristics. As noted in Section 19.6.2.1, it is not currently possible to access the data recorded from the station on the EPA webpage.

19.6.2.4 Airborne noise

There are two main sources of airborne noise that are considered to characterise the offshore marine environment:

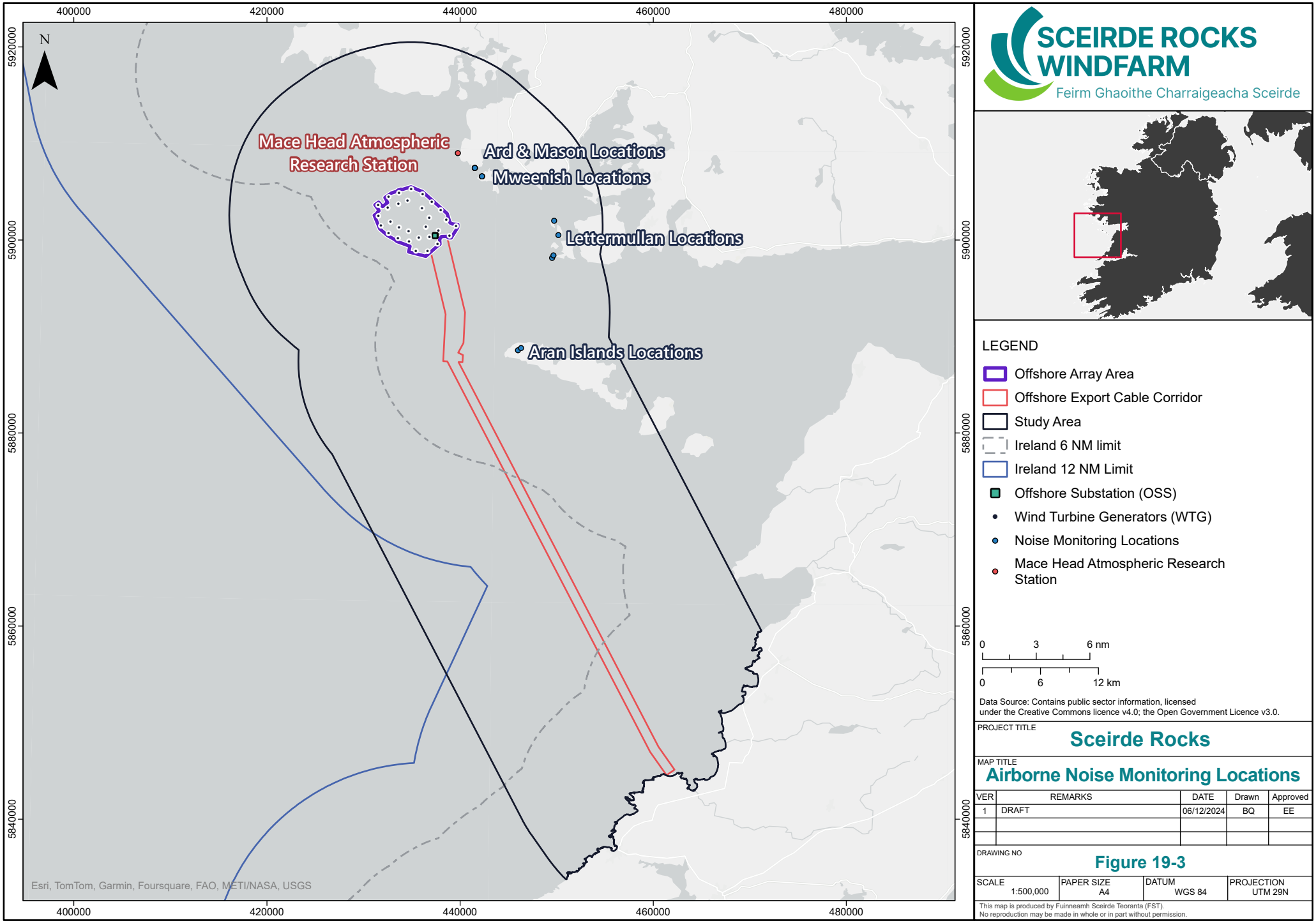
- Natural sources – arising from noise generated by wind, wave and precipitation; and
- Anthropogenic sources – arising from vessel traffic and other sea users (e.g., oil and gas and commercial fisheries activities).

The Offshore Site is located off a coastal area which is rural in nature, with isolated properties away from main settlements. The natural noise environment is characterised by sources such as wind, which

[2] *AQIH ranks the amount of pollutant in the air on a scale from 1 to 10, with 1 being the cleanest air and 10 being the most polluted.*

disturbs vegetation along the coastline, coastal water movements, and precipitation. Anthropogenic noise sources include intermittent vehicle movements in the area, and with the absence of other major offshore developments in the area, the key source of anthropogenic noise is vessel movements.

Noise-sensitive properties were considered based on the closest properties to the OAA on the shoreline of the islands or peninsulas of Ard, Mweenish, and Mason. These properties were identified due to being closest to the Offshore Site, thereby representing the properties most sensitive to airborne noise originating from the Offshore Site (Figure 19-3). Mason Island is generally uninhabited but has two holiday cottages that are occasionally used for limited periods of the year along with some day trips and short camping stays. Similarly, some additional areas with no permanent inhabitation but occasional visitation were included within the assessment following precautionary principles. This includes St MacDaras Island which does not have any residential properties but has occasional visitors to a monastery on the island (especially on St MacDara's Day, 16 July each year), and therefore is not considered noise-sensitive in terms of the Wind Energy Guidelines. Locations representative of shoreline residential properties on the Aran Islands and Lettermullan Islands have also been included in the assessment, despite an increased separation distance, under these precautionary principles.


400000
420000
440000
460000
480000
5920000
5900000
5880000
5860000
5840000
N
Mace Head Atmospheric Research Station
Ard & Mason Locations
Mweenish Locations
Lettermullan Locations
Aran Islands Locations
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde
LEGEND
Offshore Array Area
Offshore Export Cable Corridor
Study Area
Ireland 6 NM limit
Ireland 12 NM Limit
Offshore Substation (OSS)
Wind Turbine Generators (WTG)
Noise Monitoring Locations
Mace Head Atmospheric Research Station
0 3 6 nm
0 6 12 km
Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0.
PROJECT TITLE
Sceirde Rocks
MAP TITLE
Airborne Noise Monitoring Locations
VER | REMARKS | DATE | Drawn | Approved
1 | DRAFT | 06/12/2024 | BQ | EE
DRAWING NO
Figure 19-3
SCALE 1:500,000 | PAPER SIZE A4 | DATUM WGS 84 | PROJECTION UTM 29N
This map is produced by Fuinneamh Sceirde Teoranta (FST).
No reproduction may be made in whole or in part without permission.

Distances of the properties from the closest potential location of the WTGs are provided in Table 19-11 (Hoare Lea, 2024). Background noise levels were measured during the baseline airborne noise assessment at two representative locations nearest to the OAA and were considered representative of the noise-sensitive properties at Ard and Mweenish. The measurement results at Ard were also considered to be representative of holiday locations on Mason Island. Properties on Lettermullan and the Aran Islands are more than 10km from the proposed WTGs and as a result were considered to be too distant from the WTGs to necessitate the characterisation of background noise levels at these properties, and no survey was undertaken at these locations, as indicated in Table 19-11.

Table 19-11 Background noise monitoring locations encompassing the representative assessment properties considered at onshore locations nearest to the Development (Hoare Lea (2024); Appendix 19-1). Approximate Easting/Northing: Irish Transverse Mercator

Monitoring Location	Easting	Northing	Properties considered to be represented by the monitoring location	Approximate distance to closest WTG (km)
1	475610	729964	Mweenish 1	5.6
			Mweenish 2	5.5
			Mweenish 4	5.5
			Mweenish 3	5.7
2	474883	730847	Ard 1	5.5
			Ard 2	6.0
			Ard 3	6.2
			Ard 4	5.6
			Mason 1*	4.1
			Mason 2*	4.1
			St MacDaras 1**	3.0
			St MacDaras 2**	3.0
N/A	482755	721411	Lettermullan 1	10.5
	482899	721672	Lettermullan 2	10.5
	483439	723768	Lettermullan 3	10.6
	483018	725258	Lettermullan 4	10.2
	479086	711893	Aran 1	13.8
	479410	712116	Aran 2	13.8

*Representing holiday cottages used occasionally.
**Non-residential receptors.

The measured background noise levels were analysed in accordance with ETSU-R-97 and IOA GPG guidance to exclude atypical periods and measurements affected by rainfall. The measured noise levels were related to wind speeds measured on the coastline location using a Light Detection and Ranging sensor, which was considered to provide a reasonable representation of winds which would be experienced by the proposed WTGs. The main influence on background noise levels were coastal water movements, as well as wind around buildings and structures. Background noise levels were generally higher in winds from a broadly westerly direction, which corresponds to relevant conditions when the survey locations of Table 19-11 would be downwind of the Offshore Site WTGs. Therefore, periods of broadly easterly wind conditions were excluded from the analysis. The resulting derived background noise levels, based on a best-fit line analysis of the data (representing typical conditions) as a function of wind speed, are set out in Table 19-12 below.

Table 19-12 Day and night-time background noise levels derived from the baseline survey (Hoare Lea (2024); Appendix 19-1) – L_{A90}, dB

Sampling location		Standardised 10m height wind speed (m/s)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	QD*	42.8	43.5	44.2	44.9	45.6	46.3	47.1	47.8	48.5	49.2	49.9	50.6
	N**	39.6	40.5	41.3	42.2	43	43.9	44.7	45.6	46.4	47.3	48.1	49
2	QD*	39.6	40.7	41.8	42.9	44	45.1	46.2	47.2	48.3	49.4	50.5	51.6
	N**	39.3	39.8	40.4	41.1	41.9	42.8	43.8	44.9	46.1	47.4	48.8	50.3
*QD Quiet Day-time; **N Night-time													

Noise limits were derived for the day-time and night-time periods and set to a level of 5 dB above the derived background noise levels of Table 19-12, for wind speeds up to 12 m/s (Table 19-13). This was done in accordance with the methodology of the 2006 WEDG and ETSU-R-97, described in Section 19.3.3.

Table 19-13 Day and night-time noise limits derived from the baseline background noise survey (Hoare Lea (2024); Appendix 19-1) – L_{A90}, dB

Sampling location		Standardised 10m height wind speed (m/s)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	QD*	47.8	48.5	49.2	49.9	50.6	51.3	52.1	52.8	53.5	54.2	54.9	55.6
	N**	44.6	45.7	46.8	47.9	49.0	50.1	51.2	52.2	53.3	54.4	55.5	56.6
2	QD*	44.6	45.5	46.3	47.2	48.0	48.9	49.7	50.6	51.4	52.3	53.1	54.0
	N**	44.3	44.8	45.4	46.1	46.9	47.8	48.8	49.9	51.1	52.4	53.8	55.3
*QD Quiet Day-time; **N Night-time													

19.6.3 Baseline Summary

Airborne pollutant levels are not collected offshore. Nonetheless, based on terrestrial air quality data available from the EPA in the vicinity of the Offshore Site, it is inferred that air quality at the Offshore Site is of high quality. The meteorological conditions at the Offshore Site can be characterised by southwest to west wind speeds with wind speeds ranging from 0 to 40 m/s, but typically less than 17.0 m/s.

The terrestrial environment within the study area is generally characterised by natural sound sources, such as wind disturbed vegetation, birds, farm animals, and coastal water movements (e.g. breaking waves at the shore). Other sources of noise include intermittent local road and agricultural vehicle movements in the area. In westerly wind conditions, ambient noise levels at the onshore monitoring locations closest to the OAA typically vary between 40 to 50 dB L_{A90} in windy periods even during relatively quiet times of the day or night. Baseline noise levels experienced at sea by offshore receptors are considered likely to be similar or higher due to increased levels of noise from waves and wind.

19.7 Likely Significant Effects and Associated Mitigation Measures

19.7.1 Do Nothing Scenario

If the Offshore Site is not developed, the result will be a greater reliance on existing fossil fuel power plants to meet current energy demands. It will also have implications for longer-term energy security and could conceivably require commissioning additional fossil-fuel power stations to meet future energy requirements. Electricity usage, based on past evidence and future scenarios, is increasing swiftly, further contributing to increased emissions without large-scale renewable energy projects such as the Project. Under these considerations, the 'Do Nothing' scenario would contradict the objectives of CAP23 (GOI, 2022), and hamper Ireland's progress towards achieving its obligations under the Climate Action and Low Carbon Development (Amendment) Act 2021.

The implications of this would likely be a net increase in emissions, as the effective zero-emission energy generation benefits of the Offshore Site during operation (excluding maintenance) would not be realised, and with any energy deficit instead being generated by non-renewable means which directly contribute to emissions. Additionally, alternative non-renewable developments would inevitably result in significant emissions during the construction, maintenance, and decommissioning phases, and thus likely offer no significant comparative benefit during these phases relative to the Offshore Site.

The noise baseline would likely remain similar with relatively high levels of background noise in the study area, due to the coastal location and wind effects. Mace Head Atmospheric Research Station would continue to operate as it does for the foreseeable future.

19.7.2 Construction Phase

19.7.2.1 Impacts to Mace Head Atmospheric Research Station

Description of effect

During the construction stage, there will be a small increase in localised vessel traffic associated with the Project, which could result in an increase in emissions. Vessel emissions could cause contamination of background baseline GHG emissions and background baseline aerosol signatures measured at Mace Head. This may affect the background reference for the North Atlantic Ocean used in climate models, leading to erroneous estimations of GHG emissions in Europe.

Characterisation of the unmitigated effect

Shipping has a minor, localised impact on air quality, PM concentrations and other GHG emissions. Measurements carried out at Dublin port by NUIG have indicated that ship emissions account for over 75% of pollution events in the area (O'Dowd, et al., 2024). These are generally not captured in climate modelling due to the difficulties in accounting for relevant emissions. Inferred terrestrial air quality data in proximity to the Offshore Site suggests that air quality in the area is high.

The increase in Project vessel traffic, which will result in increased emissions, will have a likely, short-term, negative effect on Mace Head. Increased vessel traffic will occur throughout the Offshore Site, including vessels present within the OAA and transiting to and from the Offshore Site, on a seasonal basis. Up to 11 vessels are expected within the Offshore Site at any time during construction. The effect will be short-term (up to 4 years) and will cease following the completion of construction activities. Due to the dispersive nature of the offshore winds at the Offshore Site, it is likely that the levels of atmospheric pollutants would return to background levels rapidly. Nevertheless, staff at Mace Head Atmospheric Research Station have indicated during consultation that their monitoring instruments are so sensitive that these vessel emissions would be detectable and could affect their monitoring. Overall, the effect of vessel emissions is expected to occur at a localised extent within a small part of the Study Area, mostly around the OAA where vessels are operating, and including the monitoring station at Mace Head. Furthermore, any impacts at Mace Head Atmospheric Research Station would only occur under certain wind conditions. Effects will also be reversible upon departure of construction phase vessels. The magnitude of this effect is therefore **medium**.

Mace Head is a leading climate and air pollution monitoring and research station, part of an international network of such facilities collecting data on, but not limited to, atmospheric composition, ozone depletion, and air quality. Its location in mid-latitude Europe is unique in its ability to measure air conditions upwind of the region where the majority of the population lives, making it both regionally and globally important. Therefore, Mace Head is considered to be of **high** sensitivity as it is unable to accommodate to this effect and is of international importance.

Assessment of significance prior to mitigation

Prior to mitigation, any effects on Mace Head resulting from exhaust emissions from Project vessels during the construction activities is assessed as a **significant, negative effect** which is Significant.

Mitigation

Following extensive consultation with NUIG, the research institution operating the Mace Head Atmospheric Monitoring Station, as a means of mitigating the potential effects of the construction and operation of Project, Fuinneamh Sceirde Teoranta (FST) (the Applicant), will provide for the relocation of relevant measurement equipment to a location which will not be affected by the presence of the Offshore Site. This will require a period of dual monitoring between the existing and new monitoring locations, to ensure continuity in the atmospheric measurement records. There is an agreement in place between the Applicant and the University to ensure continuity of the excellent research associated with this institution and its contribution to global knowledge of atmospheric conditions and climate trends. This collaborative approach will effectively mitigate the effect in the long term.

Residual effect following mitigation

There will be some disruption to the activities of Mace Head Atmospheric Monitoring Station, particularly during the dual monitoring period, but it should not affect the research or participation in the networks that the institution is involved in. Following mitigation, the residual effect will be unlikely, short-term and occasional, **slight, negative effect** which is Not Significant.

19.7.2.2 Airborne noise and vibration generated from construction vessel movements and Project construction activities

Description of effect

During installation, there will be an increase in vessel movements and the presence of Project-specific machinery which have the potential to generate noise and vibration. The increase in airborne noise

could affect sensitive receptors, both onshore and other sea users, by causing interference to specific activities, such as sleep or disturbance to concentration, or an annoyance response.

Cable laying activities have the potential to generate airborne noise during surveying, trenching, and from the presence of vessels. Other construction activities will include construction at the Landfall which will require the presence of vessels during drilling of the cable. Any onshore works (including drilling activities at the Onshore Landfall Location (OLL)) are not considered within the scope of this assessment and are considered in Chapter 26: Onshore Noise and Vibration. Installation of the OSS, foundations and WTGs may also generate airborne noise through the presence of vessels and Project specific machinery on the vessels.

Characterisation of unmitigated effect

Cable laying activities have the potential to generate airborne noise during surveying, trenching, and from the presence of vessels. These activities are expected to last approximately four months across the OECC and the OAA. Increased vessel traffic will occur throughout the Project(OAA and OECC), including vessels present within the OAA and transiting to and from the Offshore Site. Pre-construction works (e.g. seabed preparation prior to the installation of GBS foundations) and cable protection installation (e.g. rock placement) will be required within the OAA and along the IACs and OECs during the construction period. GBS foundation installation and WTG installation, both requiring multiple vessels, will also occur within the OAA. One cable lay vessel is expected to be operational within the Offshore Site (including OAA and OECC) at any time during the construction phase. For all vessel-based construction activities, the effect will be temporary (up to four months per campaign), often intermittent dependent on weather conditions, and will cease following the completion of construction activities.

Other construction activities have potential to cause an increase in airborne noise and vibration from Project specific machinery and vessel movements. This can include pre-construction surveys, seabed preparation, and installation of foundations and WTGs. Up to 11 construction support vessels are expected within the Offshore Site are at any time during the installation phase. The effect will be short-term (mostly seasonal, up to four years) and will cease following completion of construction. The use a GBS system means that airborne noise emissions will be substantially lower than with piled foundations, as the latter require impulsive piling with very high corresponding noise emission levels. The assessment of associated effects has therefore been undertaken on this basis.

The airborne noise from the cable installation could have an effect on the residential properties along the shoreline (such as the properties considered in Table 19-11) and residents and members of the public which may recreationally use the area near to the Landfall. Based on the use of these properties as residence or temporary holiday homes and users of the area near the Landfall, onshore sensitive receptors are considered of low to medium sensitivity. Other sea users, assessed in Chapter 18: Other Sea Users, primarily consist of aquaculture sites directly to the northeast of the Offshore Site and of Mace Head. Coastal vessel traffic around the west of Ireland, including the wider Galway Bay area overlapping with the Study Area, is considered to be moderate, and it is unlikely the addition of Project vessels or use of specific machinery during the construction phase would result in a significant effect from airborne noise and vibration. Other sea users would be present in the vicinity of airborne noise emissions, however the sensitivity of these other sea users to airborne noise from construction is considered to be low due to their transient nature and location on noise-generating boats.

The majority of the works will be conducted in waters >5km from the coast and will be highly unlikely to impact onshore receptors. Overall, the effect of vessel noise and Project-specific machinery is expected to occur to a local extent within a small part of the Study Area, mostly around the OAA and OECC. Noise emissions associated with some of these vessels may be slightly increased from those of current vessels circulating in these waters, however this would be marginal and likely to be comparable to the existing variability between different vessels currently circulating in this area, based on their type and relative location. Noise levels from this type of source at a distance of 5km or more are expected to be negligible for all onshore receptors based on professional judgement. Receptors located on Mason

Island would be located 4km from some of the works, but likely noise levels would still be very low, and these receptors are of lower sensitivity (see discussion in Section 19.6.2.4). Receptors on St MacDaras Island are located closer but would be of lower sensitivity due to their transient (short duration visitor) nature. In all cases, the associated effects are considered negligible. Any sensitive receptors located at sea would experience the noise in a transient manner and in such a way that no significant impacts are expected.

Cable installation works will occur around the Landfall, which is located at Killard, which is composed of fields up to the "Killard Road" (350m from coastal landfall). Within 350m of the Landfall, only a few houses and Killard Cemetery are located. . Source noise from the cable laying sea vessel has been estimated by assuming that it is similar to a dredging vessel for which BS 5228-1 provides example source noise information, equivalent to a sound power of L_{wA} 110 dB (which is considered precautionary). The position of the cable laying sea vessel may vary and for the purpose of assessment it has been taken as being 100m offshore from the shore. It would therefore be expected to be located 450m or more from the nearest noise-sensitive receptors. Using the methodology of BS 5528-1, predicted noise levels of no more than 50 dB L_{Aeq} are predicted at this distance. This would be more than 10 dB below the applicable criteria for construction noise (based on standard daytime working hours, see Chapter 26 for more information). Total cumulative whole Project effects, in combination with the onshore activities (including drilling at the Landfall) are considered further in Chapter 26: Onshore Noise and Vibration.

These construction activities could potentially have a short-term adverse effect on noise receptors. However, due to the distance from the Offshore Site there is a very small risk of any effect other than short-term mild behavioural disturbance from construction airborne noise and the magnitude of the effect on receptors is considered to be **negligible**.

Assessment of Significance prior to mitigation

Significant effects due to airborne noise from construction activities are not anticipated on receptors during the installation phase of the Project. Therefore, any effects are assessed as a **not significant, negative effect** which is Not Significant.

Mitigation

Vessels operating within the Offshore Site will do so in adherence to a Vessel Management Plan (Appendix 5-10), which outlines measures to restrict speed to <6 knots. These speed restrictions will reduce the level of noise associated with vessel operations.

Residual effect following mitigation

The residual effect will be likely, short-term and occasional, and will be a **not significant, negative** effect which is Not Significant.

19.7.2.3 Exhaust emissions from Offshore Site vessels

Description of effect

During the construction phase, there will be a localised, temporary and intermittent increase in vessel traffic associated with the Project, with up to 11 vessels within the Offshore Site at any time. Emissions from these vessels will vary with their mode of operation during their time on the Offshore Site. As such there is the potential for an increase in vessel exhaust emissions from the Project vessels. This assessment does not include impacts on Mace Head Atmospheric Research Station which are considered separately (Section 19.7.2.1).

Characterisation of the unmitigated effect.

The vessel emissions during the offshore construction period will have the potential to increase local concentrations of SO_2, NO_x, PM10 and $PM_{2.5}$. During the construction phase, there will be a small and temporary increase in localised vessel traffic associated with the Project. This increase in pollutant concentrations will be localised to the offshore environment with only the most sensitive equipment onshore potentially detecting emissions depending on wind direction and atmospheric mixing of any exhaust emissions.

There are potential impacts which may occur to human health as a result of a decrease in air quality associated with the Offshore Site construction activities. There are no known sensitive receptors in the offshore environment (typically these would be hospitals, nursing homes and schools) where the highest pollutant concentrations are to be expected. Concentration of pollutants that reach the onshore environment after dispersion from the Offshore Site will not significantly increase the high-quality background air quality experienced onshore near to the development (as detailed in Section 19.6.2.1). The potential adverse conditions which may arise from the pollution have been considered noting the ability to tolerate changes as highlighted in the CAFE Directive 2008/50/EC detailed in Table 19-1. Therefore, the sensitivity of air quality receptors is considered to be **medium** (this is based on the presence of schools, hospitals and nursing homes in the onshore environment as the most relevant receptors for local air quality impacts).

There will be a localised increase in vessel traffic associated with the Offshore Site over a period of four years, with a maximum of 11 construction support vessels at one time. The majority of the works will be conducted within the Offshore Site (other than some time that vessels spend in transit from ports and harbours, e.g. Rossaveel) and will be highly unlikely to impact air quality receptors due to the intervening distance between the Offshore Site and any onshore receptors, whereby any pollutants in vessel exhaust will be very dispersed by wind before reaching the shore.

Construction activities at the Landfall will be highly localised and temporary, and up to four months in duration, and the Landfall is located at Killard, the onshore environment located adjacent to the Landfall comprises fields until “Killard Road” (350m from coastal landfall). There are some houses along Killard Road, ca. 300m from the shore (i.e. ca. 1.3km from offshore construction operations for the Landfall) and Killard Cemetery is ca. 500m from the shore.

Given the limited scale and nature of the offshore works assessed in this Chapter, the distance from the coast, the minor increase in vessel traffic, and the few receptors within the Landfall Study Area, along with the rapid dispersal of exhaust emissions from construction vessels, the magnitude of the effect is considered **negligible.**

Assessment of significance prior to mitigation

Prior to mitigation, any effects on the offshore air quality resulting from exhaust emissions from Project vessels during the construction activities are assessed as a **not significant, negative effect** which is Not Significant.

Mitigation

As per the embedded mitigations (as detailed in Section 19.5.6), support and installation vessels operating during the construction phase will operate in accordance with maritime best practice and conventions including the MARPOL convention (Appendix 5-10: Vessel Management Plan). Adherence to these conventions, as described in detail within the Vessel Management Plan seek to minimise the likelihood that vessel operations result in pollution events to the marine environment.

Residual effect following mitigation

Given the temporary nature of the work, the residual effect will be of a short duration, temporary and occasional, and the exhaust emissions would be dispersed rapidly to imperceptible levels, the residual effect is therefore assessed as an **imperceptible, negative effect** for all receptors which is Not Significant.

19.7.3 Operational Phase

19.7.3.1 Impacts to Mace Head Atmospheric Research Station

19.7.3.1.1 *Increased emissions from the presence of vessels associated with the operational phase*

Description of effect

An increase in localised vessel traffic during the operational phase could result in an increase in emissions and affect the baseline conditions measured at Mace Head. This may affect the background reference for the North Atlantic Ocean used in climate models, leading to erroneous estimations of GHG emissions in Europe. It should be noted that during routine operations, the slight increase in vessel activity would not be dissimilar to existing background levels from fishing vessels and vessels in transit.

Characterisation of the unmitigated effect

Disturbance from the physical presence of vessels around the Offshore Site will have a likely, long-term adverse effect on Mace Head. As described in Section 19.6.2, vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline and the area surrounding the Offshore Site currently experiences some vessel traffic. Increased vessel traffic will occur throughout the Offshore Site: mostly within the OAA due to WTG maintenance and servicing, and occasional vessels within the OECC for e.g. cable inspection. This vessel traffic includes vessels present within the Offshore Site, and those transiting to and from the Offshore Site. There are up to 3 vessels expected within the area at any time during the operational phase, including an average of 2 Crew Transfer Vessels (CTVs) with up to four daily return vessel movements and 1 Service Operations Vessel (SOV), which given their fuel consumption would have a very small impact on baseline conditions within the study area. Other operational phase campaigns expected during the lifetime of the Project include:

- Up to 2 campaigns of annual jackup interventions for major component replacement;
- Repair platform (blades): up to 1 campaign per year for a repair platform (blades);
- Cable repair vessels: expected to be less than 5 unscheduled interventions over the operational life of the Project;
- Cable survey vessels: up to annual requirement; and
- Oil exchange vessels/plant may be required for certain WTG models: approximately every 10 years.

The effects would be occasional, short term, temporary and intermittent over the lifetime of the Project (38 years) and will cease following the operational phase. Overall, the effect of vessel emissions is expected to occur to a local extent within a small part of the Study Area, mostly around the OAA and to a significantly lesser extent along the OECC and is expected to be reduced in comparison to the construction phase, as fewer, smaller vessels will be onsite for shorter durations. However, given the sensitivity of the Mace Head monitoring equipment, the very slight change to the baseline air quality from the limited vessels in operation may still be detectable depending on wind conditions. As such, conservatively, the magnitude of this effect is considered to be **low**. Mace Head, as previously described in Section 19.7.2.1, is considered to be of **high** sensitivity.

Assessment of significance prior to mitigation

Prior to mitigation, any effect on Mace Head resulting from exhaust emissions from Project vessels during the operational phase is lower than during the construction phase due to the lower number and scale of vessel operations within the Offshore Site and is assessed as a **moderate negative effect** which is Not Significant.

Mitigation

Following extensive consultation with NUIG, the research institution operating the Mace Head Atmospheric Monitoring Station, as a means of mitigating the potential effects of the construction and operation of the Project, the Applicant will provide for the relocation of relevant measurement equipment to a location which will not be affected by the presence of the Offshore Site. This will require a period of dual monitoring between the existing and new monitoring locations, to ensure continuity in the atmospheric measurement records. There is an agreement in place between the Applicant and the University to ensure continuity of the excellent research associated with this institution and its contribution to global knowledge of atmospheric conditions and climate trends. This collaborative approach will effectively mitigate the effect in the long term.

Residual effect following mitigation

The residual effect will be likely, short-term and occasional, **imperceptible, negative effect** which is Not Significant.

19.7.3.1.2 *Disruption of meteorological conditions from the presence of WTGs*

Description of effect

The positioning of Mace Head on the western coast of Ireland means that it receives prevailing clear air which has travelled 4–5 days over the clean North Atlantic Ocean before touching land, making it mostly anthropogenically undisturbed. The presence of the WTGs directly upwind of the station will perturb the natural system of air flow prior to reaching Mace Head, creating wakes (i.e. disturbances in the air) that can extend for several kilometres downwind of a WTG. Additionally, the windspeed downwind of the WTGs will also be lower due to the turbulent air. The turbulence can lead to a disrupted sea surface, where the whitecaps of waves can entrain air into the breaking waves. Wind-induced wave breaking produces more sea spray and can lead to indirect effects for aerosol production and gas transfers.

Mace Head investigates the natural cloud baseline, and the changes in aerosol production could have an effect on cloud cover and cloud lifetime and may lead to slight changes to localised precipitation onset and quantity. Overall, the aerosols and the effects of aerosol-cloud interactions, measured by Mace Head, may have an effect on the validity of the baseline data collected and its use in climate modelling.

Characterisation of the unmitigated effect

Disturbance from the physical presence of the WTGs will have a likely, long-term adverse effect on Mace Head. There will be 30 WTGs operating over the 38-year lifetime of the Project which are expected to operate continuously, although not all WTGs may be operational at the same time, or for 24 hours per day, and their rotational speed will vary with wind conditions. The effect will cease once the operational phase is complete and the WTGs are decommissioned. The impact is considered to occur over a local spatial extent (over the Study Area) and is likely to occur. The effect is expected to cause an alteration to the meteorological features which will have an effect on the baseline data

measured by Mace Head, however it is not expected that the effect on overall meteorological conditions will alter the character of the environment over a large spatial extent. Overall, the effect on Mace Head is defined as being of medium magnitude. Mace Head, as previously described in Section 19.7.2.1, is considered to be of high sensitivity.

Assessment of significance prior to mitigation

Prior to mitigation, the effect of the presence of WTGs on air quality receptors is assessed as a significant negative effect which is Significant.

Mitigation

Following extensive consultation with NUIG, the research institution operating the Mace Head Atmospheric Monitoring Station, as a means of mitigating the potential effects of the construction and operation of the Project, the Applicant will support the relocation of some of the measurement equipment to a location which will not be affected by the presence of the Offshore Site. This will require a period of dual monitoring between the existing and new monitoring locations, to ensure continuity in the atmospheric measurement records. There is an agreement in place between the Applicant and the University to ensure continuity of the excellent research associated with this institution and its contribution to global knowledge of atmospheric conditions and climate trends. This collaborative approach will effectively mitigate the effect in the long term.

Residual effect following mitigation

In the event that the Mace Head meteorological station is moved elsewhere with support from the Project, the residual effect will be an **imperceptible negative effect** which is Not Significant.

19.7.3.2 Production of airborne noise during WTG operation

Description of effect

WTGs will generate airborne noise during operation when the rotating blades pass through the air. Depending on the level of background noise, the wind farm noise may increase airborne noise within the Study Area and may be audible depending on the wind conditions and for a certain proportion of time. During high winds, WTGs will reach maximum generating output and rotational speed, therefore generating higher noise levels. The energy levels in most environmental sounds are too low to cause a physical disruption to the body, such that the main effects on people are either possible interference to specific activities, or an annoyance response. Health effects could include sleep disturbance or disturbance to concentration. These effects are generally quantified within the context of the existing noise environment, where the A-weighted (the measure of subjective perception of sound) 'specific' noise level of the new source is compared to the existing A-weighted 'background' noise level.

Characterisation of unmitigated effect

The emitted noise of the wind farm received by onshore noise-sensitive areas must remain within levels acceptable under the 2006 WEDG guidelines. As discussed in Appendix 19-1 and Section 19.6.2.4, robust noise limits derived in accordance with this guidance and that of ETSU-R-97 have been determined and set to a level of 5 dB above typical background noise levels experienced at the coastal locations closest to the WTGs. The resulting acceptable limits for operational noise generated by the SROWF array are defined in Table 19-13. The operational airborne WTG noise assessment (Hoare Lea, 2024) calculated the potential wind farm incident noise levels at nearby sensitive properties to see whether limits were exceeded under different wind conditions.

The assessment used a sound power level based on manufacturer data. A further 2 dB of noise was also added to the manufacturer data to obtain robust noise emission levels in line with IOA GPG guidance. The calculated noise levels at the representative assessment properties (Table 19-11, see Section 19.6.2.4) from the operation of the SROWF for wind speeds up to 12 ms^{-1} are provided in Table 19-14, assuming worst-case downwind or westerly conditions (wind blowing from the WTGs to the nearest receptors). It is also likely that actual levels would be 3dB lower than those shown due to reflection effects at the shoreline.

Table 19-14 Predicted wind farm noise levels (dB) at the representative assessment properties along the shoreline near the Development – L_{A90}, dB.

Property	Standardised 10m Wind Speed (m/s)									
	3	4	5	6	7	8	9	10	11	12
Mweenish 1	22.4	27.5	32.4	36.3	37.8	39.8	39.8	39.8	39.8	39.8
Mweenish 2	22.5	27.5	32.4	36.4	37.9	39.9	39.9	39.9	39.9	39.9
Mweenish 4	21.8	26.9	31.8	35.7	37.2	39.2	39.2	39.2	39.2	39.2
Mweenish 3	21.8	26.9	31.8	35.7	37.2	39.2	39.2	39.2	39.2	39.2
Ard 1	22.6	27.7	32.6	36.5	38.1	40.1	40.1	40.1	40.1	40.1
Ard 2	21.9	27.0	31.9	35.8	37.3	39.3	39.3	39.3	39.3	39.3
Ard 3	21.6	26.7	31.6	35.5	37.0	39.0	39.0	39.0	39.0	39.0
Ard 4	22.5	27.6	32.5	36.4	38.0	40.0	40.0	40.0	40.0	40.0
Lettermullan 1	16.6	21.7	26.6	30.5	32.0	34.0	34.0	34.0	34.0	34.0
Lettermullan 2	16.6	21.6	26.5	30.5	32.0	34.0	34.0	34.0	34.0	34.0
Lettermullan 3	16.5	21.5	26.4	30.4	31.9	33.9	33.9	33.9	33.9	33.9
Lettermullan 4	16.8	21.8	26.7	30.7	32.2	34.2	34.2	34.2	34.2	34.2
Aran 1	15.2	20.3	25.2	29.1	30.7	32.7	32.7	32.7	32.7	32.7
Aran 2	15.2	20.3	25.2	29.1	30.7	32.7	32.7	32.7	32.7	32.7
Mason 1	25.1	30.2	35.1	39.0	40.6	42.6	42.6	42.6	42.6	42.6
Mason 2	25.2	30.3	35.2	39.1	40.6	42.6	42.6	42.6	42.6	42.6
St MacDaras 1	27.9	33.0	37.9	41.8	43.3	45.3	45.3	45.3	45.3	45.3
St MacDaras 2	27.9	33.0	37.9	41.8	43.4	45.4	45.4	45.4	45.4	45.4

The precautionary predictions of incident noise levels at all the properties meet the derived noise limits (Table 19-13) under all wind speeds. The predictions for receptors on Lettermullan and Aran are below 35 dB, which is the lowest noise limits applicable under the WEDG and ETSU-R-97 and which are considered acceptable regardless of background noise levels. Predictions for Mweenish, Ard and

Mason Island meet the derived noise limits by at least 10 dB[3]. The difference between the predicted incident noise levels and the derived noise limits at these receptors is shown in Table 19-15.

Given that St MacDara's Island is not inhabited/residential, the derived noise limits are not applicable for occasional visitors to this island, but Appendix 19-1 shows that the predicted levels are still below those likely to be typically experienced by visitors to the Island during day-time periods, based on measurements made at a comparable receptor location during quiet day-time periods. On this basis, although noise from the WTGs may potentially be audible, it is considered unlikely to represent a significant disturbance for visitors to the Island.

Table 19-15 Difference between the predicted incident noise levels (Table 19-14) and the derived day-time noise limits (Table 19-13) at the representative assessment properties. Negative values indicate that the predicted noise levels are below the limit.

Property	Standardised 10m Wind Speed (ms^{-1})								
	4	5	6	7	8	9	10	11	12
Mweenish 1	-22.4	-18.2	-15.0	-14.2	-12.9	-13.6	-14.3	-15.1	-15.8
Mweenish 2	-22.4	-18.2	-15.0	-14.2	-12.9	-13.6	-14.3	-15.0	-15.7
Mweenish 4	-23.0	-18.8	-15.6	-14.8	-13.5	-14.2	-14.9	-15.7	-16.4
Mweenish 3	-23.1	-18.9	-15.7	-14.9	-13.6	-14.3	-15.0	-15.7	-16.4
Ard 1	-19.5	-15.4	-12.3	-11.7	-10.5	-11.4	-12.2	-13.0	-13.9
Ard 2	-20.2	-16.2	-13.1	-12.4	-11.3	-12.1	-13.0	-13.8	-14.7
Ard 3	-20.5	-16.4	-13.4	-12.7	-11.5	-12.4	-13.2	-14.1	-14.9
Ard 4	-19.6	-15.5	-12.4	-11.8	-10.6	-11.5	-12.3	-13.1	-14.0
Mason 1	-17.0	-12.9	-9.8	-9.2	-8.0	-8.9	-9.7	-10.5	-11.4
Mason 2	-16.9	-12.9	-9.8	-9.1	-8.0	-8.8	-9.7	-10.5	-11.3

The operational noise could have adverse effects on sensitive receptors across the entirety of the operational phase and will cease once the operational phase is complete. The effect is considered to occur almost continuously, although not all WTGs may be operational at the same time, or for 24 hours per day. The variation in wind speed will cause the noise levels to vary, causing changes in incident noise levels throughout the day. Based on the results of the noise assessment, given that the predicted noise levels are both 8 to 10 dB below the derived noise limits and are also below existing background noise levels at the receptors considered the incident noise levels from the operation of the Development will be below or at background noise levels for the properties considered, the effect is defined as being of **negligible magnitude.**

The representative residential properties, which are sufficient to be representative of noise levels typical of all receptors requiring consideration along the shoreline of the islands of Ard, Mweenish and Mason. Mason Island is generally uninhabited with two holiday cottages that are used for limited periods of time in the year, and thus would be considered less noise sensitive. St MacDaras Island is uninhabited

[3] A reduction of 10 dB would generally be considered to correspond to a subjective halving of loudness.

with no residential properties and has occasional visitors to a monastery on the island. Therefore, St MacDaras Island is also considered to be less noise sensitive than the other representative residential properties.

Mason Island is approximately 4km from the closest WTG, while all other sensitive receptor (i.e., dwellings) are at least 5.5km away. Properties on Lettermullan and Aran Islands are more than 10km away from the nearest WTG. Based on the use of these properties as residence or temporary holiday homes, or as tourism areas, all receptors are considered of **medium sensitivity.**

Assessment of significance prior to mitigation

Significant effects due to airborne noise from operational WTGs are not anticipated on receptors during the operational phase of the Project. Therefore, any effects are assessed as an **imperceptible negative effect** which is Not Significant.

Mitigation

No mitigation measures are required for this effect.

Residual effect following mitigation

The residual effect will be likely, long-term and continuous (although variable with changing wind conditions), **imperceptible, negative effect** which is Not Significant.

19.7.3.3 Increase in noise, vibration and vessel emissions from Project vessels

During the operational phase, there will be a small and long-term increase in localised vessel traffic associated with the Project. As such there is the potential for an increase in noise, vibration, and exhaust emissions from the Project vessels.

Characterisation of unmitigated effect

Disturbance from the presence of vessels around the Offshore Site will have a likely, long-term adverse effects on noise and pollution receptors. As described above in Section 19.7.2.2, vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline and the area surrounding the Offshore Site currently experiences some vessel traffic. Increased vessel traffic will occur throughout the Project area (primarily within the OAA and to a limited extent along the OECC), including vessels present on within the OAA and transiting to and from the Offshore Site. There are up to 3 vessels expected within the area at any time, including an average of 2 CTVs with up to four daily return vessel movements and 1 SOV, which would have an imperceptible effect on baseline noise conditions within the study area. For sensitive receptors on land, and transient sensitive receptors offshore, similar to the assessment of noise from construction vessels described in Section 19.7.2.2, it is unlikely that noise and vibration from offshore activities during the operation phase will be significant

Baseline air quality around the Project area and in adjacent onshore areas is very good (as detailed in Section 19.6.2.1) predominantly because the prevailing winds brings air masses from the Atlantic. Additionally, there are limited onshore emissions sources in the proximity of the Project to cause a significant reduction in baseline air quality when the wind is blowing offshore. Vessel emissions will be relatively small and cause a localised offshore increase in pollutant concentrations which will not approach the local air quality standards. Onshore the dispersed emissions will not significantly increase baseline pollutant concentrations. The effects would be rare and intermittent over the lifetime of the Project (38 years) and will cease following the operational phase. Overall, the effect of emissions,

airborne noise and vibration from Project vessels is expected to occur to a local extent within a small part of the Study Area, mostly around the OAA and to a lesser extent along the OECC and is expected to be reduced in comparison to the construction phase, as fewer, smaller vessels will be onsite for shorter durations. The magnitude of this effect is therefore **negligible**.

The potential adverse conditions which may arise from the pollution have been considered noting the ability to tolerate changes as highlighted in the CAFE Directive 2008/50/EC detailed in Table 19-1. These air quality standards are designed to protect sensitive receptors (hospitals, schools, nursing homes) which are not present in the offshore environment but could receive dispersed emissions from the Project once they reach shore. Therefore, the sensitivity of air quality receptors is considered to be **medium,** in order to account for the onshore receptors.

The airborne noise from Project vessels during maintenance could impact the representative residential properties along the shoreline and residents and users of the area near to the Landfall when vessels are transiting to and from the Offshore Site. Based on the use of these properties as residence or temporary holiday homes and users of the area near the Landfall and assuming the vessel activities generating the greatest levels of noise, onshore sensitive receptors are considered of **medium sensitivity.** Other sea users, assessed in Section 19.7.2.2, are assessed to be of **low** sensitivity.

Given the intervening distance between vessels operating within the Offshore Site and the nearest sensitive receptors, the magnitude of the effect of vessel noise during construction is **negligible**.

Assessment of significance prior to mitigation

Significant effects due to emissions, vibrations, and airborne noise from Project vessels during maintenance works are not anticipated on receptors during the operational phase of the Project. Therefore, this is assessed as a **not significant negative effect** which is Not Significant.

Mitigation

No mitigation measures are required for this effect.

Residual effect following mitigation

Given the temporary nature of the work, the residual effect will be likely, temporary and occasional, and therefore is assessed as a **not significant negative effect** for all receptors which is Not Significant.

19.7.4 Decommissioning Phase

At the end of the operational life of the Project, the Project will be decommissioned in accordance with the decommissioning plan. The approach to decommissioning will consider technical and environmental constraints (e.g., safety and liability) before finalising the decommissioning plan for the Project. The decommissioning phase will involve a temporary increase in vessels and subsequent increase in airborne noise and exhaust emissions. It is considered that the effects on air quality and airborne noise during decommissioning will be akin to or of a lower magnitude than those assessed as part of the construction phase.

The decommissioning methodology for the Offshore Site will generally be the reverse of the installation process. Firstly, the WTG towers, blades, nacelle and internal cabling are dismantled and removed from the Offshore Site. The OSS is separated from the GBS structure and removed from the Offshore Site. Then the GBS foundations are de-ballasted, re-floated and towed from the Offshore Site. Stonebeds both for the GBS foundations and the Wind Turbine Installation Vessel (WTIV) operations will be decommissioned in situ. The IAC and OEC decommissioning plans that any exposed or unburied and accessible cable will be cut and removed. However, any buried cables will be

decommissioned in situ. Cable protection will be decommissioned *in situ*, as this method is likely to result in the lowest environmental impact.

The Rehabilitation Schedule is detailed within Appendix 5-18 of Chapter 5: Project Description.

It is considered that all methods of decommissioning and associated impacts for the Project are comparable to those assessed as part of the construction phase. The approach to decommissioning is set out in the Decommissioning Plan for the Project. It is considered that potential impacts during the decommissioning phase of the Project will likely be less than those of the construction stage, as there will be fewer operations required (e.g. no seabed preparation or installation of cable protection). As such, decommissioning effects are considered to be Not Significant.

19.8 Residual Effects

19.8.1 Construction and Decommissioning Phase

Table 19-16 Residual effect of construction and decommissioning phase impacts on air quality and noise receptors

Impact	Receptor	Magnitude	Sensitivity	Significance Prior to Mitigation	Mitigation	Residual Effect
Impacts to Mace Head Atmospheric Research Station	Mace Head Atmospheric Research Station	Medium	High	Significant negative effect; Significant	As per mitigation in Section 19.7.3.1.1.	Slight negative effect; Not significant.
Airborne noise generated from cable installation, vessel movements and Project specific machinery	Onshore sensitive receptors	Negligible	Medium	Not significant negative effect; Not Significant	None proposed	Not significant negative effect; Not significant.
Exhaust Emissions from Offshore Site vessels	Air quality receptors	Negligible	Medium	Not significant negative effect; Not Significant	As per mitigation in Section 19.7.2.3.	Imperceptible negative effect; Not significant.

19.8.2 Operational Phase

Table 19-17 Residual effect of operational phase impacts on air quality and noise receptors

Impact	Receptor	Magnitude	Sensitivity	Significance Prior to Mitigation	Mitigation	Residual Effect
Increased emissions from the presence of vessels associated with the operational phase	Mace Head Atmospheric Research Station	Low	High	Moderate negative effect; Not Significant	As per mitigation in Section 19.7.3.1.1.	Imperceptible negative effect; Not significant.
Disruption of meteorological conditions from the presence of WTGs	Mace Head Atmospheric Research Station	Medium	High	Significant negative effect; Significant	As per mitigation in Section 19.7.3.1.2.	Imperceptible negative effect; Not significant.
Production of airborne noise during WTG operation	Onshore sensitive receptors	Negligible	Medium	Not significant negative effect; Not Significant	As per mitigation in Section 19.7.3.2.	Not significant negative effect; Not Significant.
Increase in noise, vibration and vessel emissions from Project vessels	Air quality receptors	Negligible	Medium	Not significant negative effect; Not Significant	None proposed	Not significant negative effect; Not significant.
	Onshore sensitive receptors (noise)	Negligible	Medium	Not significant negative effect; Not Significant	None proposed	Not significant negative effect; Not Significant
	Other Sea Users (noise)	Negligible	Low	Imperceptible negative effect; Not Significant	None proposed	Imperceptible negative effect; Not Significant

19.9 Assessment of Cumulative Effects

Potential effects from the Project have the potential to interact with those from other projects (developments), plans and activities, resulting in cumulative effects on air quality and noise receptors. The general approach to the cumulative effects assessment (CEA) is described in Chapter 4: EIA Methodology and further detail is provided below.

The list of relevant developments for inclusion within the cumulative effects assessment is presented in Table 19-18. This has been informed by a review, undertaken to identify relevant developments for consideration within the cumulative effects assessments for each EIA topic. The *Cumulative Study Area* for offshore air quality, airborne noise and vibration is defined as a 15km buffer has been defined in consideration of the maximum plausible range of effect on air quality and airborne noise from the Offshore Site, which is the same as the study area. Because of the likely scale of the effects on receptors as a result of changes to air quality and airborne noise due to the Offshore Site it is considered that this *Cumulative Study Area* will allow identification of all projects and developments which have the potential to affect receptors within the study area cumulatively with Offshore Site construction, operational and decommissioning activities. The Shannon Estuary has also been considered as part of the cumulative projects assessment in consideration of the temporary anchorage facility and movement of Project vessels within the estuary.

It is important to note that there are no projects/developments of an equivalent scale or type to the Project within 30km. To date, there has been little large-scale construction on the west coast of Ireland generally. Therefore, many of the relevant developments in Table 19-18 represent short-term, localised activities which are not generally associated with any long-term infrastructure presence.

There are 97 aquaculture sites within 30km of the Offshore Site, with 74 of those licensed for shellfish production. The remaining 23 aquaculture sites are licenced for finfish production. The closest aquaculture site (the Udaras na Gaeltachta site) is located 2.64km from the OAA. These operational developments are considered part of the baseline environment and while they may have ongoing or future operational activities, the negligible magnitudes of these activities are not likely to result in significant changes to air quality and airborne noise cumulative with the Project, therefore are not considered further within CEA.

A number of wave buoys, navigation buoys, and sea temperature probes are located within 30km of the Offshore Site. These are grouped together given their similarities as small pieces of sea surface infrastructure. There are 14 navigational buoys within 30km of the Offshore Site, the closest of which is at Killeaney. This buoy is 15.36km from the OECC. There are 15 sea temperature probes within 30km of the Offshore Site. These probes occur at a high density amongst the islands along the coast of the mainland, northeast of the OAA. The closest probe was installed in Kilkieran Bay in 2004 and is 7.97km from the OAA. There is a single (Westwave) wave buoy located 7.66km due west of the Landfall. These operational buoys are considered part of the baseline environment and, though they remain present within 30km of the Offshore Site, they have no associated continuous operational impact on the environment. Therefore, these buoys and moorings are not likely to result in significant changes to air quality and airborne noise cumulative with the Project. Consequently, wave buoys, navigation buoys, and sea temperature probes are not considered further within CEA.

There are a number of ports located within 30km of the Offshore Site which are considered as part of the baseline. Ports are therefore not considered further within the CEA. It should be noted that Galway Port and Shannon Port both currently have active planning applications for significant expansions, but these ports lie outside of the Cumulative Study Area of the Project.

Two wave test sites are located within 50km of the Offshore Site. The wave test sites are considered part of the baseline environment and, though they remain present within 50km of the Offshore Site, they have no associated continuous operational impact on the environment. Therefore, there is no

opportunity for in-combination effects together with the impacts associated with the Project. Consequently, operational wave test sites are not considered further within CEA.

Urban waste water treatment locations are located along the coast within 30km of the Offshore Site, in particular close to the Landfall. As these locations are all terrestrial and cannot give rise to effects on offshore air quality, airborne noise and vibration, these waste water treatment locations are not considered further in this CEA.

The Project is the only Relevant Project / Phase 1 offshore renewable development in the region with a Maritime Area Consent (MAC), the only offshore wind development in the region which was successful in Offshore Renewable Electricity Support Scheme (ORESS) 1 and the only offshore wind development in the region, which is permitted to make a planning application.

A number of planned offshore renewable developments (at various levels of inception) were proposed to be developed off the western coast of Ireland before the State's policy changed to a plan-led regime. Current policy is such that none of these projects are permitted to seek a MAC or make a planning application. However, whether any of them may progress in the future is entirely dependent on future policy decisions. Several foreshore licence applications have been made, primarily in relation to environmental surveys in support of these renewables developments. In this context, we do not have sufficient information to consider these renewables developments, or associated foreshore licences for survey works any further.

The list of relevant developments for inclusion within the cumulative effects assessment is outlined in Table 19-18.

Table 19-18 Developments considered in the offshore air quality, airborne noise and vibrations cumulative effects assessment

Location	Development Type	Development Name	Distance to OAA (km)	Distance to OECC (km)	Status	Additional Information	Considered further
Foreshore Licences							
Galway	Cable	IRIS sub-sea fibre optic cable system	0.00	71.87	Operational	Licence for Construction of Cable. 2022- overall duration 2-3 months	**No** – operational project is considered part of baseline conditions.
Galway	Scientific research	UCD Research Experiments, Inishmaan	13.12	28.21	Operational	Licence for Data Monitoring Equipment. 2022-2027.	**No** – operational project is considered part of baseline conditions.
Clare / Kerry	Cable	Cross Shannon Cable Project	21.54	80.04	Approved	Licence for Construction of Cable. Duration of construction 12 months.	**No** – no impact pathway.
Dumping at Sea							
Shannon Estuary	Dredged material	Shannon Foynes Port Company	86.61	32.48	Permit valid through 31/12/2026	Permit No. S0009-03	**No** – there is no temporal overlap between the Project's offshore activities and this dredging permit.
Foynes Harbour	Dredged material	Shannon Foynes Port Company	88.85	34.89	Permit valid through 31/12/2026	Permit No. S0009-03	**No** – there is no temporal overlap between the Project's offshore activities and this dredging permit.

19.9.1 Cumulative construction effects

No other projects were screened in for cumulative assessment, because there is either no temporal overlap with the Project, or there is no pathway to cumulative effects. Therefore, there will be no cumulative effects with the construction phase of the Project.

19.9.2 Cumulative operational effects

No other projects were screened in for cumulative assessment, because there is either no temporal overlap with the Project, or there is no pathway to cumulative effects. Therefore, there will be no cumulative effects with the operational phase of the Project.

19.9.3 Cumulative decommissioning effects

No other projects were screened in at this stage for cumulative assessment with the decommissioning phase, because there is either no temporal overlap with the Project, or there is no pathway to cumulative effects. Therefore, there will be no cumulative effects with the decommissioning phase of the Project.

19.10 Conclusion

In summary, the offshore air quality and airborne noise impact assessment has assessed the potential for changes to air quality from Offshore Site activities to affect Mace Head Atmospheric Monitoring Station, the effects of exhaust emissions from vessels operating in the Offshore Site and the effects of airborne noise originating from the WTGs and vessels on onshore receptors. The baseline air quality and airborne noise levels were considered within the Chapter, in particular the results of an airborne noise survey at the location of several habitations which are located close (ca. 5 km) from the OAA. Mitigation by design has been included during Project design and additional mitigation measures are proposed and considered within the assessment; in particular, a commitment to work with NUIG to relocate sensitive monitoring equipment currently housed at Mace Head. In conclusion, the assessment found that the residual effect pathways will be Not Significant for all air quality and noise receptors. The cumulative effects assessment did not carry forward any other projects or developments, as there were none with the potential to have effects on receptors cumulative with the Project, so there were no cumulative effects.

ACRONYM/ABBREVIATION

ACRONYM/ABBREVIATION	DEFINITION
AEROCE	Atmospheric/Ocean Chemistry Experiment
AGAGE	Advanced Global Atmospheric Gases Experiment
AR6	IPCC Sixth Assessment Report
CAFE	Clean Air For Europe
CFC	Chlorofluorocarbon
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CTV	Crew Transfer Vessel
dB	Decibel
dB(A)	A-Weighted Decibels
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
GAW	Global Atmospheric Watch
GBS	Gravity Based Structure Fixed-Bottom Foundations
GHG	Greenhouse Gas
GPG	Good Practice Guide
GWP	Global Warming Potential
IAPP	International Air Pollution Prevention
IAQM	Institute of Air Quality Management
IOA	Institute of Acoustics
IPCC	Intergovernmental Panel on Climate Change
km	Kilometres
$LA_{90,10min}$	Decibel level exceeded For 90% of a 10-minute sample

m	Metre
MARPOL	International Convention for the Prevention of Pollution From Ships
mm	Millimetres
MPCP	Marine Pollution Contingency Plan
ms^{-1}	Metres per second
MW	Megawatt
NMVOC	Non-Methane Volatile Organic Compound
NO_2	Nitrogen Dioxide
NO	Nitric Oxide
NO_x	Nitrogen Oxide
NRA	Navigational Risk Assessment
O_3	Ozone
OAA	Offshore Array Area
OEC	Offshore Export Cable
OECC	Offshore Export Cable Corridor
OSS	Offshore 220kV Electrical Substation
PEMMP	Project Environmental Management and Monitoring Plan
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter < 2.5 Micrometres
PM_{10}	Particulate Matter < 10 Micrometres
SOV	Service Operations Vessel
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxide
SROWF	Sceirde Rocks Offshore Windfarm
μgm^{-3}	Micrograms per cubic metre
UK	United Kingdom
WEDG	Wind Energy Development Guidelines

WGNWT	Working Group on Noise From Wind Turbines
WMO	World Meteorological Organisation
WTG	Wind Turbine Generator
WTIV	Wind Turbine Installation Vessel