12.0 AIR QUALITY AND CLIMATE

12.1 INTRODUCTION

This chapter assesses the likely air quality and climate related impacts associated with the proposed Oweninny Wind Farm Phase 3. Oweninny Wind Farm Phase 1 is also located on Oweninny Bog and was commissioned in 2019, with Phase 2 currently under construction.

The proposed development comprises the construction of 18 no. wind turbines and ancillary works. The turbines will have a blade tip height of 200m above the top of the foundation level and will be accessible from internal access routes within the Bord na Móna site. All works associated with the connection of the proposed wind farm to the national electricity grid, including a 110kV underground electrical cable from the proposed on-site electrical sub-station to the existing sub-station at Bellacorick.

The lands associated with the Oweninny Bog are owned by Bord na Móna Energy Ltd. Oweninny Bog is located in north County Mayo and encompasses a total of 5,090 hectares, all of which comprised primarily of cutaway bog, partly developed bog, yards, railway lines and areas of upland and undeveloped bog.

Full details of the proposed development can be found in Chapter 3.

12.1.1Statement of Authority

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12.2 METHODOLOGY

12.2.1 Criteria for Rating of Impacts

12.2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC which combines the previous air quality framework and subsequent daughter directives (see Table 12.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 12.1).

The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM_{10} (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and potentially cause adverse health impacts. The Directive also sets an ambient standard for $PM_{2.5}$ (particles less than 2.5 microns and form part of PM_{10}) which came into force in 2015 (see Table 12.1).

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/m^2/day averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government (DOEHLG, 2004) apply the Bergerhoff limit of 350 mg/m^2/day to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development as is considered best practice in the absence of site-specific guidance.

Table 12.1 Ambient Air Quality Standards & TA Luft

Pollutant	Regulation	Limit Type	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 $\mu g/m^3$
		Annual limit for protection of human health	40 $\mu g/m^3$
		Critical level for protection of vegetation	30 $\mu g/m^3$ NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 $\mu g/m^3$
		Annual limit for protection of human health	40 $\mu g/m^3$
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 $\mu g/m^3$
Dust Deposition	TA Luft, German VDI 2002	Annual limit value for dust soiling at the site boundary	350 $mg/m^2/day$

12.2.1.2 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$.

European Commission Directive 2001/81/EC and the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005. The data available from the EPA in 2020 (EPA, 2020a) indicated that Ireland complied with the emissions ceilings for SO_2 but failed to comply with the ceiling for NH_3, NO_X and NMVOCs in recent years. Directive (EU) 2016/2284 "*On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC*" was published in December 2016. The Directive applied the 2010 NECD limits until 2020 and established new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020 emission targets are 25.5 kt for SO_2 (65% on 2005 levels), 66.9 kt for NO_X (49% reduction on 2005 levels), 56.9 kt for NMVOCs (25% reduction on 2005 levels), 112 kt for NH_3 (1% reduction on 2005 levels) and 15.6 kt for $PM_{2.5}$ (18% reduction on 2005 levels). In relation to 2030, Ireland's emission targets are 10.9 kt (85% below 2005 levels) for SO_2, 40.7 kt (69% reduction) for NO_x, 51.6 kt (32% reduction) for NMVOCs, 107.5 kt (5% reduction) for NH_3 and 11.2 kt (41% reduction) for $PM_{2.5}$.

12.2.1.3 Significance Criteria for Air Quality

TII Ireland Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII, 2011) detail a methodology for determining air quality impact significance criteria for road schemes when considering impacts on sensitive receptors due to vehicle emissions on roads. The degree of impact is determined based on both the absolute and relative impact of the Proposed Project. TII significance criteria have been adopted for the

Project and are detailed in Table 12.2 to Table 12.4. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40µg/m^3). However, the criteria have also been applied to annual $PM_{2.5}$ concentrations for the purpose of this assessment. The TII Guidelines are applied to projects which have impacts due to traffic and therefore are applicable for any projects which result in traffic related impacts.

Table 12.2 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. Days with PM_{10} Concentration > 50µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase/decrease ≥ 4µg/m^3	Increase/decrease >4 days	Increase/decrease ≥ 2.5µg/m^3
Medium	Increase/decrease 2 - < 4µg/m^3	Increase/decrease 3 or 4 days	Increase/decrease 1.25 - <2.5µg/m^3
Small	Increase/decrease 0.4 - < 2µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25µg/m^3
Imperceptible	Increase/decrease < 0.4µg/m^3	Increase/decrease <1 day	Increase/decrease < 0.25µg/m^3

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)*

Table 12.3 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Moderate	Large
Increase with Proposed Project			
Above Objective/Limit Value With Proposed Project (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just Below Objective/Limit Value With Proposed Project (36 - <40µg/m^3 of	Slight adverse	Moderate adverse	Moderate adverse

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Moderate	Large
NO_2 or PM_{10}) (22.5 - <25μg/m^3 of $PM_{2.5}$)			
Below Objective/Limit Value With Proposed Project (30 - <36μg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well Below Objective/Limit Value With Proposed Project (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Proposed Project			
Above Objective/Limit Value With Proposed Project (≥40μg/m^3 of NO_2 or PM_{10}) (≥25μg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just Below Objective/Limit Value With Proposed Project (36 - <40μg/m^3 of NO_2 or PM_{10}) (22.5 - <25μg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below Objective/Limit Value With Proposed Project (30 - <36μg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well Below Objective/Limit Value With Proposed Project (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

Note 1 *Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible*

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)*

Table 12.4 Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Proposed Project			
Above Objective/Limit Value With Proposed Project (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Proposed Project (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Proposed Project (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Proposed Project (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Project			
Above Objective/Limit Value With Proposed Project (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Proposed Project (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Proposed Project (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Proposed Project (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 *Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible*

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)*

12.2.1.4 Climate

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013 (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland 'to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050' (section 3(1) of the Act). This is referred to in the Act as the 'national transition objective'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The 2019 Climate Action Plan (CAP) (Government of Ireland, 2019), outlined the status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlines the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The CAP also details the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The CAP has set a built environment sector reduction target of 40 - 45% relative to 2030 pre-NDP (National Development Plan) projections.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme in December 2019 followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021) (hereafter referred to as the 2021 Climate Act) in July 2021 (Government of Ireland, 2021a). The 2021 Climate Act was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act is to provide for the approval of plans 'for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'. The 2021 Climate Act also 'provides for carbon budgets and a decarbonisation target range for certain sectors of the economy'. The 2021 Climate Act defines the carbon budget as 'the total amount of greenhouse gas emissions that are permitted during the budget period'.

The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a 'local authority climate action plan' lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

The Government has published the second Climate Action Plan in November 2021 (Government of Ireland, 2021b). The plan aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050. In order to achieve these goals the target for renewables on the national grid has been increased from 70% by 2030 to up to 80%. This will include an increased target of up to 8 Gigawatts of onshore wind energy. Target 112 of the 2021 Climate Action Plan relates to this proposed development. It is "to develop the onshore electricity grid to support renewable energy targets".

The Climate Action Plan 2023 (CAP23) is the second annual update to Ireland's Climate Action 2019. This is the first CAP since the publication of the carbon budgets and sectoral emissions ceilings, and it aims to implement the required changes to achieve a 51% reduction in carbon emissions by 2030. The CAP has six vital high impact sectors where the biggest savings can be made: renewable energy, energy efficiency of buildings, transport, sustainable farming, sustainable business and change of land-use.

CAP23 states that the decarbonisation of Irelands manufacturing industry is key for Ireland's economy and future competitiveness. There is a target to reduce the embodied carbon in construction materials by 10% for materials produced and used in Ireland by 2025 and by at least 30% for materials produced and used in Ireland by 2030. CAP23 states that these reductions can be brought about by product substitution for construction materials and reduction of clinker content in cement. Cement and other high embodied carbon construction elements can be reduced by the adoption of the methods set out in the Construction Industry Federation 2021 report Modern Methods of Construction. In order to ensure economic growth can continue alongside a reduction in emissions, the IDA Ireland will also seek to attract businesses to invest in decarbonisation technologies.

CAP23 aims to bring 9 GW onshore wind, 8 GW solar, at least 7 GW of offshore wind and 2 GW green hydrogen into Irish energy production by 2030. In addition, the CAP aims to increase micro-generation and small-scale generation of renewables. CAP23 aims to phase out and end the use of coal and peat in electricity generation by 2030.

Mayo County Council published a Climate Adaptation Strategy in 2019 which illustrates how Mayo will adapt to potential risks due to climate change. Mayo is also innovating with respect to decarbonisation, the with implementation of decarbonisation zones. In May 2021 Mulranny was formally announced by Mayo County Council as Mayo's Initial Decarbonising Zone, aiming to reduce greenhouse gases by at least 51% by 2030 as required under Action 165 of the National Climate Action Plan. The aim is to reduce its greenhouse gas emissions by 7% per annum from 2021 to 2030.

12.2.1.5 Significance Criteria for Climate

There are three overarching principles that are relevant in considering the aspect of significance in the 2010 IEMA Principles Series on Climate Change Mitigation & EIA (IEMA, 2010):

- The GHG emissions from all projects will contribute to climate change, the largest interrelated cumulative environmental effect;
- The consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive (e.g. human health, biodiversity, water, land use, air quality); and
- GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit; as such any GHG emissions or reductions from a project might be considered to be significant. The environmental limit is the national global GHG emission budget that defines a level of dangerous climate change, and any GHG emission that contributes to exceedance of that budget or threatens efforts to stay within it can be considered as significant.

The 2022 Guidance (IEMA, 2022) document builds on those principles with three points:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project’s emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible;
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project’s residual emissions at all stages; and
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project’s remaining emissions should be considered.

The criteria for determining the significance of effects are a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Chapter 3: Environmental Assessment

Methodology. In relation to climate, there is no project specific assessment criteria, but the Project will be assessed against the recommended IEMA (IEMA, 2022) significance determination. This takes account of any embedded or committed mitigation measures that form part of the design should be considered.

- Major or moderate adverse impact (significant): A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the net zero[1] trajectory by 2050 or sectoral based transition to next zero targets, results in a significant adverse effect. It is down to the consultant completing the assessment to differentiate between the 'level' of significant adverse effects e.g. 'moderate' or 'major' adverse effects. A project's impact can shift from significant adverse to not significant effects by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing but declining emissions towards net zero. Meeting the minimum standards set through existing policy or regulation cannot necessarily be taken as evidence of avoiding a significant adverse effect. This is particularly true where policy lags behind the necessary levels of GHG emission reductions for a science based 1.5°C compatible trajectory towards net zero.
- Minor adverse impact (not significant): A project that is compatible with the budgeted, science based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that has a minor adverse effect that is not significant. The project may have residual impacts but is doing enough to align with and contribute to the relevant transition scenario. A 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the magnitude of GHG emissions being carbon neutral[2] (i.e. zero on balance) but refers to the likelihood of avoiding severe climate change and achieving net zero by 2050. A 'minor adverse' effect or better is a high bar and indicates exemplary performance where a project meets or exceeds measures to achieve net zero earlier than 2050.
- Negligible Impact (not significant): A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions, is

[1] Net Zero: "*When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.*" Net zero is achieved where emissions are first reduced in line with a 'science-based' trajectory with any residual emissions neutralised through offsets.

[2] Carbon Neutral: "*When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period irrespective of the time period or magnitude of offsets required.*"

assessed as having a negligible effect that is not significant.

- Beneficial Impact (significant): A project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is significant. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.

Where the fundamental reason for a proposed project is to combat climate change and this beneficial effect drives the project need, then it is likely to be significant.

12.2.2Construction Phase

12.2.2.1 Air Quality

The current assessment focuses on identifying the existing baseline levels of PM_{10} and $PM_{2.5}$ in the region of the Proposed Development by an assessment of EPA monitoring data. Thereafter, the impact of the construction phase of the development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the Proposed Development.

Construction phase traffic, including the delivery of the turbines has the potential to impact air quality. The UK design manual for roads and bridges (DMRB) guidance LA 105 (UK Highways Agency, 2019a), states that road links meeting one or more of the criteria below can be defined as being ‘affected’ by a proposed development and should be included in the local air quality assessment. The TII *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Scheme* (TII 2011) was based on the previous version of the UK DMRB guidance (UK Highways Agency, 2007) and notes that the TII guidance should be adapted for any updates to the DMRB (see Section 1.1 of *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, 2011)*.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band;
- A change in carriageway alignment by 5m or greater.

Applying the criteria above, there are no road links impacted as a result of the Proposed Development. Therefore, no assessment using the DMRB model was required for the Proposed Development as there is no potential for significant impacts to air quality as a result of traffic emissions.

12.2.2.2 Climate

Climate change is a result of increased levels of carbon dioxide and other GHGs in the atmosphere causing the heat trapping potential of the atmosphere to increase. GHGs can be emitted from vehicles and embodied energy associated with materials used in the construction of a development. Embodied energy refers to the sum of the energy needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site. There is the potential for a number of embodied GHGs and GHG emissions during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions as well as the large quantities of material such as stone, concrete and steel that will be required for a project of this magnitude. The Institute of Air Quality Management document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on climate. However, due to the nature of this project, climate impacts including the embodied energy from construction materials and site vehicles have been assessed.

The Institute of Environmental Management and Assessment (IEMA) guidance note on *"Assessing Greenhouse Gas Emissions and Evaluating their Significance"* (IEMA, 2022) states that the crux of significance regarding impact on climate is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050. A project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is significant. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect. Where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm or carbon capture and storage project) and this beneficial effect drives the project need, then it is likely to be significant.

The assessment commences with the high-level design, through the pre-construction (site clearance) stage, followed by the assessment of the embodied carbon associated with all materials used in the construction of the proposed development, the emissions during the construction phase activities and additionally emissions related to waste generated during the construction phase. As part of the proposed development, Construction Phase embodied GHG emissions are categorised under the following headings:

- Land clearance activities (i.e. peat movement, tree felling);
- Transport of excavated material within the site;
- Manufacture of materials and transport to site;
- Construction works; and
- Construction waste products (including transport off-site).

Detailed information for the proposed development, including volumes of materials, were obtained from the Project Team. All peat and spoil material will remain within the site boundary.

As part of the proposed development, a quantity of peat will be removed. As discussed in the *Best Practice Guidelines for the Irish Wind Energy Industry* (IWEA, 2012), excavation of peat can be a contributor to carbon losses associated with wind farm construction. The guidance states "*it is good practice to undertake a calculation of the carbon costs of the* construction *and operation of a wind farm. The carbon release associated with the excavation and oxidization of peat soils can be relatively significant and should be included in any carbon calculation"* (IWEA, 2012).

The GHG emissions associated with this peat excavation have been assessed using the IPCC methodology as outlined in *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (IPCC, 2013). The *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* states that there is no refinement required on this methodology (IPCC, 2019).

12.2.3Operational Phase

The assessment of baseline air quality in the region is conducted to review and ensure that the current levels of key pollutants are significantly lower than their limit values. The savings in NO_X emissions arising from the production of electricity using renewable sources were compared against those produced using non-renewable sources. The calculations were carried out using SEAI published emission rates from non-renewable energy sources (SEAI, 2022). This total NO_X saving annually and over the lifespan of the project relative to NO_X emissions from power generation was established.

12.2.3.1 Air Quality

Operational phase traffic has the potential to impact air quality. The UK DMRB scoping criteria (UK Highways Agency, 2019a) outlined in Section 12.2.2.1 was used to determine if any of the impacted road links required a detailed modelling assessment.

The operational phase of the development will involve only very occasional inspection and maintenance vehicles. By definition of the criteria in Section 12.2.2.112.2.2.1, there are no road links impacted as a result of the Proposed Development. Therefore, no assessment using the DMRB model was required for the Proposed Development as there is no potential for significant impacts to air quality as a result of vehicle emissions.

12.2.3.2 Climate

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency, 2019b). The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project during the operational stage. If any of the road links impacted by the proposed development meet or exceed the below criteria, then further assessment is required.

- A change of more than 10% in AADT;
- A change of more than 10% to the number of heavy duty vehicles; and
- A change in daily average speed of more than 20 km/hr.

None of the road links impacted by the Proposed Development meet the scoping criteria above and therefore a detailed assessment has been scoped out as there is no potential for significant impacts to climate as a result of vehicle emissions.

Information on the life cycle assessment undertaken for Vestas Wind Systems A/S, who are a major supplier of wind turbines, has been reviewed (Vestas, 2019). Using the data contained in the life cycle assessments (Vestas, 2019) the energy balance gives a payback which can be assessed.

12.3 EXISTING ENVIRONMENT

12.3.1Meteorological Data

A key factor in assessing temporal and spatial variations in air quality are the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO, 2006). Wind is of key importance in dispersing air pollutants and, for ground level sources such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ – PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Belmullet, Co. Mayo and is also the nearest weather and climate monitoring station to the proposed project site that has meteorological data recorded for the 30-year period from 1981-2010. The monitoring station is located approximately 30km west of the site. Belmullet met data has been examined to identify the prevailing wind direction and average wind speeds. Wind frequency is important as dust can only be dispersed by winds, and deposition of dust is a simple function of particle size, wind speed and distance. The closer the source of dust is to a receptor the higher the potential risk of impact of dust blow. The prevailing winds in the area are southerly in direction, thereby predominantly dispersing any potential dust emissions to the north of the site. The wettest months were October, November and January, and the driest month on average was May. July was the warmest month with a mean temperature of 15° Celsius.

Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under “wet day” conditions where rainfall greater than 0.2 mm has fallen. Information collected from Belmullet Meteorological Station in the absence of long-term data at Belmullet, identified that typically 246 days per annum are “wet” (Met

Eireann 2020, 30-year averages). Thus, almost 67% of the time no significant dust generation will be likely due to meteorological conditions.

12.3.2 Review of EPA Air Monitoring Data

Dust is present naturally in the air from a number of sources including weathering of minerals, pick-up across open land and dust generated from fires. Monitoring of dust deposition is not undertaken in the area and therefore background levels for the immediate vicinity of the site are not available.

However, a study by the UK ODPM (UK ODPM, 2002) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 $mg/m^2/day$ is typical, rising to 59 $mg/m^2/day$ on the outskirts of towns, and peaking at 127 $mg/m^2/day$ for a purely industrial area. A level of 39 $mg/m^2/day$ can be estimated as the background dust deposition level for the region of the wind farm at Oweninny due to its rural location.

In terms of NO_2, PM_{10} and $PM_{2.5}$ air quality monitoring programmes have been undertaken in recent years by the EPA. The most recent annual report on air quality, "*Air Quality Monitoring Report 2021*" (EPA 2021), details the range and scope of monitoring undertaken throughout Ireland. As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2022b). Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The rural area within which the wind farm is located is classed as Zone D.

In 2020 the EPA reported (EPA, 2021) that Ireland was compliant with EU legal limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA report details the effect that the Covid-19 restrictions had on stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason they have not been included in the baseline section.

NO_2 monitoring was carried out at two rural Zone D locations over the period 2015 - 2019, Emo and Kilkitt and the urban sites of Enniscorthy and Castlebar (EPA, 2021). Over the 2015 – 2019 period annual mean concentrations ranged from 2 – 5 µg/m^3 for the rural sites and 7 – 10 µg/m^3 for the urban sites (Table 12.5). Hence, long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m^3. The hourly limit value of 200 µg/m^3 was not exceeded in any year albeit 18 exceedances are permitted per year. The average results over the last five years at the rural Zone D locations suggest an upper average of no more than 3.4 µg/m^3 as a background concentration. Based on the above information a conservative estimate of the background NO_2 concentration in the region of the proposed development is 4 µg/m^3.

Table 12.5 Trends in Zone D Air Quality – Nitrogen Dioxide (NO_2)

Station	Averaging Period Notes 1, 2	Year				
		2015	2016	2017	2018	2019
Castlebar	Annual Mean NO_2 (µg/m^3)	8	9	7	8	8
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	65.6	59.8	60.2	58.9
Kilkitt	Annual Mean NO_2 (µg/m^3)	2	3	2	3	5
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	26.1	17.0	22.3	42.3
Emo	Annual Mean NO_2 (µg/m^3)	3	4	3	3	4
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	35.5	27.5	41.6	27.8
Enniscorthy	Annual Mean NO_2 (µg/m^3)	9	10	-	-	-
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	72.5	-	-	-

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 Hourly limit value - 200 µg/m^3 measured as a 99.8th percentile (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Long-term PM_{10} monitoring was carried out at the Zone D locations of Castlebar, Kilkitt, Enniscorthy and Claremorris over the period 2015–2019 (EPA, 2021). Annual mean concentrations range from 10 – 18 µg/m^3 for the urban sites and 7 – 9 µg/m^3 for the rural site at Kilkitt (Table 12.6). Hence, long-term average PM_{10} concentrations measured at these locations were significantly lower than the annual average limit value of 40 µg/m^3. The 90.4th percentile of 24-hour values was well below the limit value of 50 µg/m^3 reaching at most 33.8 µg/m^3 in Enniscorthy in 2015. Data for the rural site at Kilkitt suggests an upper average annual mean of no more than 8.2 µg/m^3 as a background value. Based on the above data a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 10 µg/m^3.

Table 12.6 Trends in Zone D Air Quality – PM_{10}

Station	Averaging Period Notes 1, 2	Year				
		2015	2016	2017	2018	2019
Castlebar	Annual Mean PM_{10} (μg/m^3)	13	12	11	11	16
	90th %ile 24-hr PM_{10} (μg/m^3)	22.2	20.0	19.1	19.9	23.8
Kilkitt	Annual Mean PM_{10} (μg/m^3)	9	8	8	9	7
	90th %ile 24-hr PM_{10} (μg/m^3)	17.7	15.0	14.0	15.3	13.2
Claremorris	Annual Mean PM_{10} (μg/m^3)	10	10	11	12	11
	90th %ile 24-hr PM_{10} (μg/m^3)	16.5	17.4	17.3	19.9	19.7
Enniscorthy	Annual Mean PM_{10} (μg/m^3)	18	17	-	-	18
	90th %ile 24-hr PM_{10} (μg/m^3)	33.8	32.3	-	-	-

Note 1 Annual average limit value - 40 μg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 Daily limit value - 50 μg/m^3 measured as a 90.4th percentile (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

The results of $PM_{2.5}$ monitoring at Claremorris over the period 2015 – 2019 ranged from 4 – 6 μg/m^3 (EPA, 2021), with an average $PM_{2.5}/PM_{10}$ ratio between 0.4 – 0.6. Long-term average $PM_{2.5}$ concentrations measured at this location were significantly lower than the annual average limit value of 25 μg/m^3. Based on this information, a ratio of 0.7 was used to generate a rural background $PM_{2.5}$ concentration of 7 μg/m^3.

In summary, existing baseline levels of NO_2, PM_{10} and $PM_{2.5}$ based on extensive long-term data from the EPA are well below ambient air quality limit values in the vicinity of the proposed wind farm development.

12.3.3 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014), prior to assessing the impact of dust from a proposed development, the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed construction works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity, while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are between 1-10 no. high sensitivity residential properties within 350m of the site boundary. Some of these are receptors related to the existing Bord na Móna activities. The residential properties on the N59 are also within 50m of the main access road to the site on which site vehicles will travel. Therefore, the worst-case sensitivity of the area to dust soiling is considered to be low as per Table 12.7.

Table 12.7 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Source: Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected within various distance bands from the construction boundary. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is estimated to be 10 $\mu g/m^3$. There are between 1-10 high sensitivity residential properties within 350m of the site boundary and works area. Therefore, the worst-case sensitivity of the area to human health impacts is considered to be low as per Table 12.8.

The sensitivity of the area to human health impacts associated with the proposed windfarm is also considered low due to the number of properties impacted at any one time and the low background concentrations of PM_{10}.

Table 12.8 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)			
			<20	<50	<100	<200
High	< 24 µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	< 24 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	< 24 µg/m³	>1	Low	Low	Low	Low

Source: Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

The IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to ecological impacts from dust. The criteria take into consideration whether the receiving environment is classified as a Special Area of Conservation (SAC), a Special Protected Area (SPA), a Natural Heritage Area (NHA) or a proposed Natural Heritage Area (pNHA) as dictated by the EU Habitats Directive or whether the site is a local nature reserve or home to a sensitive plant or animal species.

The following designated sites are within 50m of the Oweninny Wind Farm Phase 3 redlineboundary, the distance to the nearest proposed infrastructure is indicated in brackets:

- Carrowmore Lake Complex SAC (4.5km);
- Bellacorick Bog Complex SAC (225m);
- Lough Dahybaun SAC (partly located within Oweninny Bog) (130m);
- Bellacorick Iron Flush SAC (located in Oweninny Bog) (400m); and
- Bellacorick Bog Complex pNHA (225m).

The IAQM guidance states there is potential for ecological impacts in relation to dust up to 50m from the works and access routes to the site. Therefore, there is a high sensitivity to ecological dust impacts from the proposed wind farm development (see Table 12.9).

Table 12.9 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance to Source	
	<20m	<50m
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Source: Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

12.3.4 Climate

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of GHGs in the atmosphere. These GHGs come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

For the purposes of this assessment, the definition outlined in Council Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (European Parliament and Council of Europe 2009) for GHGs has been used. In 'Annex V, C. Methodology Point 5' the relevant GHGs are defined as CO_2, CH_4 and N_2O. Climate is defined as the average weather over a period of time, whilst climate change is a significant change to the average weather. Climate change is a natural phenomenon but in recent years human activities, through the release of GHGs, have impacted on the climate (IPCC, 2015). The release of anthropogenic GHGs is altering the Earth's atmosphere resulting in a 'Greenhouse Effect'. This effect is causing an increase in the atmosphere's heat trapping abilities resulting in increased average global temperatures over the past number of decades. The release of CO_2 as a result of burning fossil fuels, has been one of the leading factors in the creation of this 'Greenhouse Effect'. The most significant GHGs are CO_2, methane (CH_4) and nitrous oxide (N_2O).

CO_2 accounted for 60.9% of total GHG emissions in Ireland in 2020 while CH_4 and N_2O combined accounted for 37.7%. The main source of CH_4 and N_2O is from the agriculture (~93%) sector (EPA, 2022a).

Given Ireland's declaration of a climate and biodiversity emergency in May 2019 and the November 2019 European Parliament approval of a resolution declaring a climate and environment emergency in Europe, in addition to Ireland's current failure to meet its EU binding targets under Regulation (European Union, 2018), changes in GHG emissions either beneficial or adverse are of more significance than previously considered prior to these declarations.

Data published in 2022 (EPA 2022a, 2022d) predicts that Ireland will exceed its 2020 annual limit set under EU's Effort Sharing Decision (ESD) No 406/2009/EC by 6.75 million tonnes CO_2 equivalent (Mt CO_{2eq}). For 2020, total national emissions are estimated to be 57.716 Mt CO_{2eq} as shown in Table 12.10. The sector with the highest emissions in 2020 was agriculture at 37.1% of the total, followed by transport at 17.6%. GHG emissions from the transport sector reduced by 15.7% in 2020. Due to COVID-19 lockdowns 2020 may be considered an atypical year with respect emissions. In 2019 the sector with the highest emissions is agriculture at 35.3% of the total, followed by transport at 20.3%. Greenhouse gas emissions decreased by 7.9% in 2020 due to the reduction in peat use and an increase in renewable energy for electricity generation. Based on the exceedances of limit values and climate emergency declaration, climate is considered a highly sensitive receptor.

Table 12.10:Total National GHG Emissions In 2020

Category	Kilotonnes CO_{2eq}	% of Total GHG emissions
Waste	906	1.6%
Energy Industries	8,739	15.1%
Residential	7,115	12.3%
Manufacturing Combustion	4,521	7.8%
Commercial Services	938	1.6%
Public Services	896	1.6%
Transport	10,296	17.8%
Industrial Processes	2,111	3.7%
F-gases	784	1.4%
Agriculture	21,411	37.1%
Total	57,716	100%

12.4 POTENTIAL EFFECTS

12.4.1Do Nothing Scenario

Under the Do-Nothing Scenario no construction works will take place and the identified impacts of fugitive dust and particulate matter emissions and emissions from equipment and machinery will not occur. The ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from any new developments in the surrounding area, changes in road traffic, etc.). Therefore, this scenario can be considered neutral in terms of air quality.

Under the Do Nothing Scenario no construction works will take place and the calculated embodied CO_2 emissions will not occur, in addition there will be no peat removal in the Do Nothing scenario. The proposed development is predicted to generate 268 GWh per annum (using a capacity factor of 34% from Eirgrid and installed capacity of 90 MW) of renewable, clean wind energy. Under the Do Nothing scenario this will not occur. The EPA have predicted that

Ireland will continue to exceed its climate targets in future years and therefore reduction measures are required in all sectors (EPA, 2022c). The proposed development will help in Ireland meeting its climate targets for future years at both a national and EU level, under the Do-Nothing scenario this will not occur. The Do-Nothing scenario is considered significant, long-term and negative in terms of climate.

12.4.2 Construction Phase

12.4.2.1 Air Quality

Construction Traffic & Materials

This assessment focuses on identifying the existing baseline levels of PM_{10} and $PM_{2.5}$ in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the effect of the construction phase of the proposed development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the proposed development based on the guidance issued by the IAQM (2014).

LA 105 - Air Quality (UK Highways Agency, 2019a) states that the following scoping criteria shall be used to determine whether the air quality impacts of a project can be scoped out or require an assessment based on the changes between the 'Do-Something' traffic scenario (with the proposed development) compared to the 'Do-Minimum' traffic scenario (without the proposed development):-

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band; and
- A change in carriageway alignment by 5m or greater.

The above scoping criteria have been used in the current assessment to determine the road links required for inclusion in the modelling assessment. The construction stage traffic is, as described in detail at Chapter 17 Traffic and Transport, below the above criteria therefore no further impact assessment is required and impacts are considered temporary and imperceptible and do not need to be considered further.

Construction Dust

In terms of air quality, the greatest potential impact during the construction stage will be from dust emissions associated with the construction works. The key works included in this development with the potential for dust emissions include earthworks and excavation activities, construction of hardstanding areas and movement of vehicles on and off site. In addition, there is the removal of the 21 existing Bellacorick Wind Farm turbines which are to be decommissioned.

During construction, the primary source of dust emissions with potential to impact sensitive receptors will be movement of vehicles on and off site. Materials with the highest potential for dust emissions will be concrete and aggregates for the construction of the hardstanding areas and access tracks. The construction period is expected to last 24 months and there will be approximately 100 staff involved in the construction. The ground works phase, during which the main truck movements will take place, is estimated to last 600 days. Stockpiling of excavated materials will be limited to the volumes required to practically meet the construction schedule. There will be no crushing of material onsite.

According to the IAQM guidance (page 15, IAQM, 2014), this maximum (10-50 per day) number of truck movements is classified as medium scale in terms of dust emissions. When combined with the previously established sensitivity of the area (medium sensitivity to dust soiling, low sensitivity in terms of human health and ecological impacts) the overall risk of significant dust impacts as a result of vehicle movement prior to mitigation is medium with the overall risk of human health impacts predicted to be low.

Construction works taking place within the wind farm site will result in some dust emissions, particularly during earthwork activities. However, the majority of properties which border the site are a significant distance from the actual works areas. In terms of air quality, the greatest likelihood of effects during the construction stage will be from dust emissions associated with the construction works. The key works likely to be associated with dust emissions include earthworks and excavation activities, construction of hardstanding areas and movement of vehicles on and off site.

During construction, the primary source of dust emissions with potential to impact sensitive receptors will be movement of vehicles on and off site. Materials with the highest potential for dust emissions will be concrete and aggregates for the construction of the hardstanding areas and access tracks. However, only ready-mix concrete will be used on site and all concrete will be delivered in enclosed trucks which will reduce the potential for dust emissions.

Earthworks (i.e. movement of peat and soil) taking place within the proposed development site will result in some dust emissions, particularly during earthwork activities. However, the majority of properties which border the site are a significant distance from the actual works areas. The potential magnitude of impact according to IAQM guidance (IAQM, 2014) is large due to the site area being greater than 10,000 m^2 and when combined with the previously established sensitivity of the area (low sensitivity to dust soiling, low sensitivity in terms of human health and high in terms of ecological impacts) the potential risk can be found. The risk of significant nuisance dust impacts as a result of earthworks prior to mitigation is low with respect to nuisance dust and human health. With respect to ecology impacts the potential risk is considered to be high.

Table 12.11 Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Construction works taking place within the wind farm site will result in some dust emissions. However, the majority of properties which border the site are a significant distance from the actual works areas. Work areas that are in closer proximity to sensitive receptors along the grid connection will have more limited activities and short construction periods. The potential magnitude of impact according to IAQM guidance (IAQM, 2014) is medium (due to type of building i.e. premade turbines with low dust potential) and when combined with the previously established sensitivity of the area (low sensitivity to dust soiling, low sensitivity in terms of human health and high in terms of ecological impacts) the potential risk can be found. The risk of significant nuisance dust impacts as a result of construction prior to mitigation is low with respect to nuisance dust and human health. With respect to ecology impacts the potential risk is considered to be medium.

Table 12.12 Risk of Dust Impacts - Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

The potential for trackout for vehicles leaving the site has also been assessed. According to the IAQM guidance (page 15, IAQM, 2014), the number of one-way vehicle movements per day is classified as medium in terms of potential dust emission magnitude (10-50 HGVs per day). When combined with the previously established sensitivity of the area (low sensitivity to dust soiling, low sensitivity in terms of human health and high in terms of ecological impacts) the risk of significant human health and nuisance dust impacts as a result of vehicle movement prior to mitigation is low with the overall risk of ecology impacts predicted to be medium.

Table 12.13 Risk of Dust Impacts - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

To ensure any potential impacts are minimised, a Dust Management Plan will be formulated based on best practice measures associated with high risk of dust impacts, due to the potential of ecological impacts. The Dust Management Plan will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. When the dust mitigation measures detailed in the mitigation section of this chapter (Section 12.5) and Appendix 12.2 are implemented, fugitive emissions of dust from the site will be imperceptible and temporary and will pose no nuisance or human health impacts at nearby receptors.

12.4.2.2 Climate

Construction Materials & Peat Removal

The construction phase of the proposed development will result in a number of GHG emissions from various sources. Embodied carbon is carbon dioxide emitted during the manufacture, transport and construction of building materials, together with end of life emissions. As part of the proposed development, construction stage embodied GHG emissions are categorised under the following headings:-

- Manufacture of materials
- Materials transport to site; and
- Construction works (including personnel travel and project size);

Detailed project information including volumes of materials was obtained for the purposes of this assessment. For the purposes of this assessment, it is assumed that concrete will be sourced from McGraths in Cong, 83 km from the site. It is also assumed that any stone transported to the site will be taken from Bangor Erris quarry, 14km west of the site along the N59.

While these are the assumed source of material other locations in the area may be utilised to supply materials during the construction stage.

The proposed locations have been used to provide an estimate of the distance travelled to site for materials. The distances to site for these materials have been used in the calculations. Approximately 381,971m^3 of rock and fill material will be required for the hardstanding areas, access tracks, substation compound ground works and contractor compound ground works. An approximate total of 10,800m^3 of concrete plus 1,800m^3 of blinding concrete will be required in the construction of the turbine bases.

Table 12.14 details the embodied carbon emissions associated with each category. The proposed development is expected to have a construction phase of 24 months approximately and an operational lifespan of 30-years. The predicted embodied emissions can be averaged over the full construction phase and the lifespan of the proposed development to give the predicted annual emissions to allow for direct comparison with national annual emissions and targets. Emissions have been compared against the total national GHG emissions in Ireland for 2020 (57,716,091 tonnes CO_2eq) (EPA, 2022c) and against Ireland's EU 2030 target of a 30% reduction in non-ETS sector emissions based on 2005 levels (32 million tonnes CO_2eq) (set out in Regulation EU 2018/842 of the European Parliament and of the Council).

There is no forestry loss associated with the proposed development.

During the construction phase of the proposed development, peat will be excavated in order to build the required infrastructure. The total estimated peat volume to be excavated is 435,159 m^3. Excavation of peat can be a contributor to carbon sink losses associated with construction. The carbon release associated with the excavation and oxidization of peat soils can be relatively significant and should be included in any carbon calculation (IPCC 2006). The GHG emissions associated with this peat excavation have been assessed using the 2006 IPCC *Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 7 Wetlands* (IPCC, 2006). The 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories states that there is no refinement required on this methodology (IPCC, 2019). The on-site removal and subsequent abandonment of peat can be calculated and based on an assumption for the extracted peat of an average 1.7m peat depth (IPCC, 2006). CO_2 emissions from peat removal & abandonment due to the construction phase are estimated to be 914 tonnes CO_2eq.

The total construction phase embodied emissions totals 7,088 tonnes CO_2eq; which equates to 0.012% of Ireland national GHG emissions in 2020 or 0.022% of Ireland's 2030 GHG emission target.

The significance criteria for impacts (IEMA, 2022) states that the impact significance must be taken from the project as a whole over its lifecycle rather than individual elements.

Table 12.14 Predicted Construction Stage GHG Emissions

	Construction Phase Embodied Emissions (tonnes CO_2eq)
Manufacture of materials, transport and construction works	5,956
Emissions from forestry loss	N/A
Emissions from peat loss	913
Total Construction Phase Emissions	6,869
Total Annual Emissions as % of Irelands Total GHG emissions (2020 actual)	0.011%
Total Annual Emissions as % of Irelands 2030 GHG emission target	0.021%

Decommissioning of Bellacorick Turbines

The decommissioning phase will involve the removal of the 21 No. turbines (6.45MW) and associated infrastructure from the site. Decommissioning of these turbines will result in the loss of 19 GWh of electricity per annum however it facilitates the proposed project which has the potential to generate significantly more renewable electricity annually (268 GWh). Vehicles and generators associated with the removal of the turbines have the potential to cause a temporary negative impact on local air quality in the short term. However, due to the short-term nature of any associated works and low background concentrations in the vicinity of the site it is predicted to have an imperceptible, temporary, negative impact on local air quality.

Wind Turbine Manufacture

The proposed development will involve the erection of up to 18 No. wind turbines (turbines will have a blade tip height of 200m) and an approximate export capacity of 90 MW. For the purposes of this assessment a capacity factor for wind generation of 34% was used based on future capacity factors for windfarms in this region provided in the Eirgrid report "*Enduring Connection Policy 1 Constraints Report for Area A Solar and Wind*" (Eirgrid, 2020). Based on a conservative export capacity of approximately 90 MW and a capacity factor of 34% the expected electricity production is approximately 268,056 MWh per annum. Information on the life cycle assessment undertaken for Vestas Wind Systems A/S, who are a major supplier of wind turbines, has been reviewed (Vestas, 2019). While other turbines may be procured it is likely that the payback periods are similar. The payback period should be considered during the procurement process. Using the data contained in the life cycle assessments (Vestas, 2019) the energy balance gives a payback period for the current site of approximately 6 months.

12.4.3 Operational Phase

12.4.3.1 Air Quality

The assessment of baseline air quality in the region of the proposed development has shown that current levels of key pollutants are significantly lower than their limit values. Due to the size, nature and remote location of the proposed development, increased road traffic emissions resulting from the proposed development are expected to have an imperceptible impact on air quality during the operational phase.

However, the generation of electricity due to the installation of the wind farm will lead to a net saving in terms of NO_X emissions. The wind farm will have an export capacity of up to approximately 90 MW and an assumed capacity factor of 34%, therefore the power generation from the development is expected to be approximately 268 GWh per annum. The capacity factor of 34% is based on an Eirgrid study for future windfarm developments in Region J (Page 33, Eirgrid, 2020).

The supply of 268 GWh of renewable electricity to the national grid will lead to a net saving in terms of NO_X emissions which may have been emitted from fossil fuels to produce electricity. Results, outlined in Table 12.15, indicate that the impact of the wind farm on Ireland's obligations under the Gothenburg Protocol and the Directive (EU) 2016/2284 targets are positive. The annual impact of the development is to decrease annual NO_X emission levels by 0.05% of the ceiling levels (relative to the NO_X emissions associated with power generation in Ireland 2020 (EPA, 2022d)). The total NO_X emissions savings over its 30-year life-span will amount to over 880 tonnes of NO_X which is equivalent to 19.5% of the total NO_X emissions from power generation in 2020 or 1.6% of the total Irish NO_X emissions in 2020. This is considered a slight positive, long-term impact to air quality.

Table 12.15 Predicted Impact of Oweninny Windfarm on Ireland's National Emissions Ceiling Obligations

Scenario	NO_X (tonnes/annum)
Emissions Saved Due To Wind Farm Note 1	53.5
National Emission Ceiling Note 2	66,913
Positive Impact of Wind farm (%) (as a percentage of National Emission Ceiling on an annual basis)	0.05%
Total NO_X Saving (%) Over 30 Years Relative To NO_X Emissions From Power Generation in 2020	19.5%

Note 1 For NO_X emissions associated with power generation in Ireland (taken from EPA (2022a) Ireland's Air Pollutant Emissions 1990 – 2030)

Note 2 National Emission Ceiling (EU Directive 2016/2284) applicable from 2020

12.4.3.2 Climate

During the operational phase there will be no likely significant GHG emissions from the operation of the wind turbines. There are no emissions associated with the proposed grid connection during operation. Furthermore, due to the displacement of 268 GWh of electricity per annum which otherwise would have been produced from fossil fuels, there will be a net benefit in terms of GHG emissions.

GHG emissions, as a result of this development, will be imperceptible in terms of Ireland's obligations under the European Union's Effort Sharing Regulation (Regulation 2018/842). However, as stated above, the generation of 268 GWh of renewable electricity to the national grid will lead to a net saving in terms of GHG emissions. The Climate Action Plan (Government of Ireland, 2021b) states a RES-E target of up to 80% by 2030 with wind power being the primary source to achieve this.

In order to calculate the net benefit in terms of GHG emissions, the GHG emissions from the average fossil fuel electricity mix in 2020 has been calculated (Table 12.16). The production of wind power for export to the national grid transforms the site from negative in terms of GHGs (associated with embodied energy from construction) to having a net positive annual impact on GHG emissions of the order of 0.14% of the annual Total GHG Emissions in Ireland in 2020. The total annual GHG emission savings over 30 years will amount to approximately 79,899 tonnes of CO_2eq which is equivalent to 20% of the total predicted annual GHG emissions from the energy sector in 2020 (EPA, 2022b). This is a slight, positive, long-term impact to climate as a result of the proposed development.

Table 12.16 GHG Benefit from Proposed Development as A Result of Exporting 268 GWh per annum

	CO_2	N_2O	CH_4	% Of Irelands Total Emissions[(1)]
CCGT Producing 268 GWh (tonnes)	79,345	3.86	28.95[(4)]	
CCGT Producing 268 GWh (tonnes CO_2 Equivalent)	79,345	1022.9	665.9	
Total Energy Consumed During Manufacture / Disposal of 21 Wind Turbines (averaged over 30 years)([3)] (tonnes CO_2 Equivalent)	646			
Total / Annum (tonnes CO_2 Equivalent) Savings Due To Wind farm	79,899			0.14%
Total GHG Saving (%) Over 30 Years Relative To GHG Emissions From Power Generation in 2020[(2)]	20.05%			

(1) Based on an electricity generation of 0.296 tonnes CO_2/MWh (SEAI 2022) and Irelands total 2020 GHG emissions

(2) Estimated GHG Emissions From Energy Sector (With Measures) of 13.3 Mtonnes in 2020.

(3) Based on ((268,056 x 0.296)/30)

(4) N_2O & CH_4 based on Volume 2 Table 2.2 of IPCC Guidelines (2006)

A flood risk assessment has been carried out as part of the proposed project, Section 2.2 of the FRA is The Flood Risk Management Climate Change Adaptation Plan. This plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS); and
- High-End Future Scenario (HEFS)

These scenarios account for future climate change impacts by apply additional allowances that should be used to estimates extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

- Extreme Rainfall Depths (20% to 30%);

- Peak River Flood Flows (20% to 30%) and
- Mean Sea Level Rise (0.5m to 1m).

The details of the assessment can be found within the project FRA but when future mid and high-end climate change scenarios are taken into account it is estimated that the risk of pluvial, groundwater and fluvial flooding associated with the proposed development is minimal once mitigation is put in place.

The design of the turbine foundations and ancillary works include within their design consideration for loadings due to wind, cold and hot weather extremes. Detailed design will consider medium and high-risk future climate change scenarios.

12.4.4Decommissioning Phase

At the end of the project life the 18 Oweninny Wind Farm Phase 3 turbines they will require decommissioning. The lifecycle assessment of the turbines includes for decommissioning and end-of-life treatment of the turbines. The lifecycle assessment (Vestas, 2019) which was used when considering the payback period for disposal accounts for specific recycling rates of different components, depending on their material purity and ease of disassembly, based upon industry data. Vehicles and generators associated with the removal of the turbines have the potential to cause a temporary negative impact on local air quality in the short term. However, due to the short-term nature of any associated works and low background concentrations in the vicinity of the site it is predicted to have an imperceptible, temporary, negative impact on local air quality and climate.

12.4.5Cumulative Impacts

According to the IAQM guidance (2014) there is the potential for cumulative construction dust impacts to nearby sensitive receptors if the construction of the proposed development coincides with the construction phase of other developments within 350m of the site. A review of recent planning permissions for the area was conducted as outlined in Chapter 5 of this report and it was found that there are no developments of significance with regard to potential construction dust impacts within 350m of the proposed development. Therefore, there is no potential for cumulative dust impacts. The dust mitigation measures outlined in Section 9.5.1

and Appendix 9.2 will be applied throughout the construction phase of the proposed development which will avoid significant impacts on air quality.

The supply of 268 GWh of renewable electricity to the national grid will lead to a net saving in terms of CO_2 and NO_X emissions which would otherwise likely have been emitted from fossil fuels to produce electricity. On a cumulative basis, the proposed development in conjunction with the other existing wind farm developments (available at SEAI website Wind Mapping System) within Ireland will cumulatively aid in reducing NO_X emissions from burning of fossil fuels for electricity production by providing clean, renewable electricity to the national grid. This will aid in Ireland achieving the national targets set out under the Gothenburg Protocol, Directive (EU) 2016/2284 and the 2023 CAP. Therefore, the proposed development will result in an overall, slight positive and long-term cumulative impact to air quality.

12.5 MITIGATION MEASURES

12.5.1 Construction Phase

12.5.1.1 Air Quality

In terms of mitigation, only potential impacts associated with dust emissions on site and the grid connection require mitigation measures to be implemented. The proactive control of fugitive dust, rather than an inefficient attempt to control them once they have been released will ensure the prevention of significant emissions. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the Dust Management Plan. The key aspects of controlling dust are listed below. A detailed dust management plan, which will be incorporated into the Construction Environmental Management Plan (CEMP) for the site, is included in Appendix 12.2 of this chapter.

In summary, the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic;
- Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions;
- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads;
- Vehicles using site access tracks will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site access track, this will be 20 kph, and on hard surfaced access tracks as site management dictates;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary;
- No crushing will take place on-site;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

12.5.1.2 Climate

The construction phase of the proposed development is predicted to have an imperceptible impact on climate and therefore no mitigation measures are required. However, to ensure impacts are minimised as much as possible during the construction phase of the proposed development, all contractors will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from construction traffic. Consideration will be given to the reuse and recycling of materials where possible in order to reduce waste from the site.

There is the potential for exhaust emissions from vehicles accessing site to impact climate however this is predicted to be imperceptible. The 21 no. existing wind turbines (including tower sections, nacelle, hub, and rotor blades) that will be decommissioned and removed should be recycled where possible. Consideration should be made during construction planning on the recycling of these decommissioned turbines.

12.5.2Operational Phase

During the operational phase of the proposed development, the works onsite will be limited to maintenance associated with the wind farm components. Although the intensity of activity will be only a small fraction of the construction phase, all employees and contractors that are on site will ensure that machinery used is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from maintenance traffic.

No further mitigation measures are required during the operational phase of the proposed development as it is predicted to have a slight positive and long-term potential effect on ambient air quality at a national level. Potential effects to local air quality and climate as a result of emissions associated with site maintenance vehicles are predicted to be neutral and imperceptible in the long-term as the number of vehicles is predicted to be low and infrequent in nature.

12.5.3Decommissioning

At the end of the project life the 18 Oweninny Wind Farm Phase 3 turbines will be decommissioned. Vehicles and generators associated with the removal of the turbines have the potential to cause a temporary negative impact on local air quality in the short term. However, due to the short-term nature of any associated works and low background concentrations in the vicinity of the site no specific mitigation measures will be required.

12.6 RESIDUAL EFFECTS

With effective implementation of the Dust Management Plan, outlined in Section 12.5 and Appendix 12.2, the proposed wind farm is expected to have an imperceptible impact on air quality during the construction phase. No residual adverse impacts from the proposed development are predicted for the operational or decommissioning phases.

There are no predicted adverse potential effects to climate during the operational phase of the Proposed Development. IMEA significance (IEMA, 2022) states that where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm) and this beneficial effect drives the project need, then it is likely to be significant. The significance is based around a project's ability to contribute to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050. This project will assist in the CAP 2023 goal of producing up to 80% renewables for the grid. Therefore, its potential effect can be classed as long-term, beneficial and significant.

12.7 SUMMARY

During the construction phase of the proposed development there is the potential for construction dust emissions to impact nearby sensitive receptors. The sensitivity of the area to dust soiling and human health impacts has been reviewed. There is an overall high sensitivity, due to the potential of ecological impacts. It is predicted that once the dust mitigation measures outlined in Section 12.5 and Appendix 12.2 are implemented construction phase potential effects will be short-term and imperceptible at nearby sensitive receptors.

During construction there is the potential to impact climate through embodied GHG emissions associated with construction materials and their transport to site as well as site activities. The embodied GHG emissions associated with the proposed development have been quantified and it is predicted that the proposed development will have an imperceptible, temporary, negative impact on climate during construction.

During operation there is predicted to be an overall positive impact to air quality due to the displacement of NOx emissions which otherwise would be generated through the use of fossil fuels for electricity generation. The operation of the proposed development is predicted to have a slight positive, long-term impact to air quality.

Once operational the proposed development will provide renewable electricity to the grid and thus reduce the reliance on fossil fuels as an energy source. It is predicted that the proposed development will provide up to approximately 268 GWh of renewable electricity once operational. This will be an overall slight, positive long-term impact on climate. In addition, the proposed development will contribute to Ireland meeting its up to 80% renewable electricity (RES-E) target as set out in the Climate Action Plan (Government of Ireland, 2022).

The overall potential effect on air quality and climate can be classed as long-term, beneficial and significant.

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