8 AIR QUALITY AND CLIMATE

8.1 Introduction

This chapter describes and assesses the potential impacts on air quality and climate associated with the Proposed Development.

Taking into account Ambient Air Quality Standards[1], the baseline air quality was examined along with the potential for release of emissions to the atmosphere and associated effects prior to and following mitigation measures. This chapter also describes and assesses the potential impacts on micro and macro-climate as a result of the Proposed Development. Attention will be focused on Ireland's obligations under the Paris Agreement in the context of the overall climatic impact of the presence and absence of the Proposed Development.

8.1.1 Quality Assurance and Competence

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This chapter has been reviewed and approved by Harry Parker, Technical Director and EIA Lead at Enviroguide. Harry is an environmental consultant with 17 years' experience in consultancy, specialising in EIAs for large-scale residential and commercial developments, working closely with a range of developers, planning consultants and architects within the public and private sector.

8.1.2 Ambient Air Quality Standards

For the protection of health and ecosystems, EU directives apply air quality standards in Ireland and other EU member states for a range of pollutants. These rules include requirements for monitoring, assessment and management of ambient air quality. The first major instrument in tackling air pollution was the Air Quality Framework Directive 96/62/EC and its four daughter Directives. Each of these instruments was repealed with the introduction of Directive 2008/50/EC on ambient air quality and cleaner air for Europe in 2008 (as amended by Decision 2011/850/EU and Directive 2015/1480/EC) (the "CAFE Directive"), save for the "Fourth Daughter Directive" (Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air).

The CAFE Directive lays down measures aimed at:

1) defining and establishing objectives for ambient air quality designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole;

[1] Air Quality Standards Regulations 2011 (S.I No. 180 of 2011) Irish Statute Book.

2) assessing the ambient air quality in Member States on the basis of common methods and criteria and, in particular, assessing concentrations in ambient air of certain pollutants;
3) providing information on ambient air quality in order to help combat pollution and nuisance and to monitor long-term trends and improvements resulting from national and Community measures;
4) ensuring that such information on ambient air quality is made available to the public;
5) maintaining air quality where it is good and improve it in other cases;
6) promoting increased cooperation between the Member States in reducing air pollution.

Ambient air quality monitoring and assessment in Ireland is carried out in accordance with the requirements of the CAFE Directive. The CAFE Directive has been transposed into Irish legislation by the Air Quality Standards Regulations (S.I. No. 180 of 2011). The CAFE Directive requires EU member states to designate 'Zones' reflective of population density for the purpose of managing air quality. Four zones were defined in the Air Quality Standards Regulations (2011) and subsequently amended in 2013 to account for 2011 census population counts and to align with coal restricted areas in the Air Pollution Act (Marketing, Sale, Distribution and Burning of Specified Fuels) Regulations 2012. (S.I. No. 326 of 2012) (the 2012 Regulations).

The main areas defined in each zone are:

- **Zone A:** Dublin Conurbation
- **Zone B:** Cork Conurbation
- **Zone C:** Other cities and large towns comprising Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, Balbriggan, Greystones, Leixlip and Portlaoise.
- **Zone D:** Rural Ireland, i.e., the remainder of the State excluding Zones A, B and C.

The site is located in Kilternan, Dublin 18 and falls under the 'Zone A' category based on the Air Quality Standards Regulations.

The CAFE Directive outlines certain limit or target values specified by the five published directives that apply limits to specific air pollutants. These limits, outlined in Table 8-1, will be referred to as part of the Proposed Development assessment with respect to air quality.

Table 8-1 Limit Values of Cleaner Air for Europe (CAFE) Directive 2008/50/EC (Source: EPA, 2020)

Pollutant	Limit Value Objective	Averaging Period	Limit Value µg/m3	Limit Value ppb	Basis of Application of the Limit Value	Limit Value Attainment Date
SO_2	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
SO_2		24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1 Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value µg/m3	Limit Value ppb	Basis of Application of the Limit Value	Limit Value Attainment Date
SO_2	Protection of vegetation	Calendar year	20	7.5	Annual mean	19 July 2001
SO_2		1 Oct to 31 Mar	20	7.5	Winter mean	19 July 2001
NO_2	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
NO_2		Calendar year	40	21	Annual mean	1 Jan 2010
NO + NO_2	Protection of ecosystems	Calendar year	30	16	Annual mean	19 July 2001
PM10	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
PM10		Calendar year	40	-	Annual mean	1 Jan 2005
PM2.5 - Stage 1		Calendar year	25	-	Annual mean	1 Jan 2015
PM2.5 - Stage 2		Calendar year	20	-	Annual mean	1 Jan 2020
Lead		Calendar year	0.5	-	Annual mean	1 Jan 2005
Carbon Monoxide		8 hours	10,000	8,620	Not to be exceeded	1 Jan 2005
Benzene		Calendar year	5	1.5	Annual mean	1 Jan 2010

The EPA is the competent authority for the purpose of the CAFE Directive and is required to send an annual report to the Minister for Environment and the European Commission. The regulations further provide for the distribution of public information. This includes information on any exceedances of target values, the reasons for exceedances, the area(s) in which they occurred, and the relevant information regarding effects on human health and environmental impacts.

8.1.3 Climate Agreements

Climate change is recognised as one of the most serious global environmental problems and arguably the greatest challenge facing humanity today. While natural variations in climate over time are normal, anthropogenic activities have interfered greatly with the global atmospheric system by emitting substantial amounts of greenhouse gases (GHGs). This has caused a discernible effect on our global climate system, with continued change expected due to current and predicted trends of GHG emissions. In Ireland this is demonstrated by rising sea levels, changes in the ecosystem, and extreme weather events.

In March 1994, the United Nations Framework Convention on Climate Change (UNFCCC) was established as an intergovernmental effort to tackle the challenges posed by climate change. The Convention membership is almost universal, with 197 countries having ratified. Under the Convention, governments gather and share information on GHG emissions, national policies, and best practices. This information is then utilised to launch national strategies and international agreements to address GHG emissions. Following the formation of the UNFCCC, two major international climate change agreements were adopted: The Kyoto Protocol, and the Paris Agreement.

In April 1994, Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) and subsequently signed the Kyoto Protocol in 1997. The Kyoto Protocol is an international agreement linked to the UNFCCC which commits its parties to legally binding emission reduction targets. To ensure compliance with the protocol, the Intergovernmental Panel on Climate Change (IPCC) has outlined detailed guidelines on compiling National Greenhouse Gas Inventories. These are designed to estimate and report on national inventories of anthropogenic GHG emissions and removals. Under Article 4 of the Kyoto Protocol, Ireland agreed to limit the net anthropogenic growth of the six named GHGs to 13% above the 1990 level, spanning the period 2008 to 2012.

The second commitment period of the Kyoto Protocol was established by the Doha amendment which was adopted in extremis on the 8th of December 2012, to impose quantified emission limitation and reduction commitments (QELRCs) to Annex I (developed country) Parties during a commitment period from 2013 to 2020. The Doha Amendment came into force on ratification on 31 December 2020. However, this has now been superseded by the Paris Agreement.

In December 2015, the Paris Climate Change Conference (COP21) took place and was an important milestone in terms of international climate change agreements. The Paris Agreement sets out a global action plan to put the world on track to mitigate dangerous climate change by setting a global warming limit not to exceed 2°C above pre-industrial levels, with efforts to limit this to 1.5°C. As a contribution to the objectives of the agreement, countries have submitted national climate action plans (nationally determined contributions, NDCs). Under this agreement, governments agreed to come together every 5 years to assess the collective progress towards the long-term goals and inform Parties in updating and enhancing their nationally determined contributions. Ireland will contribute to the Paris Agreement through the NDC tabled by the EU on behalf of Member States in 2020, which commits to a 55% reduction in EU-wide emissions by 2030 compared to 1990. This is considered to be the current NDC maintained by the EU and its Member States under Article 4 of the Paris Agreement.

The EU has set itself targets for reducing its GHG emissions progressively up to 2050, these are outlined in the 2020 climate and energy package and the 2030 climate and energy policy framework. These targets are defined to assist the EU in transitioning to a low-carbon economy, as detailed in the 2050 low carbon roadmap. The 2020 package is a set of binding legislation to ensure that the EU meets its climate and energy targets for the year 2020. There are three key targets outlined in the package which were set by the EU in 2007 and enacted in legislation in 2009:

- 20% reduction in GHG emissions from 1990 levels;
- 20% of EU energy to be from renewable sources; and
- 20% improvement in energy efficiency.

The 2030 climate and energy framework builds on the 2020 climate energy package and was adopted by EU leaders in October 2014. The framework sets three key targets for the year 2030:

- At least 40% cuts in GHG emissions from 1990 levels;
- At least 32% share for renewable energy; and
- At least 32.5% improvement in energy efficiency.

The EU has acted in several areas in order to meet these targets, including the introduction of the Emissions Trading System (ETS). The ETS is the key tool used by the EU in cutting GHG emissions from large-scale facilities in the power, industrial, and aviation sectors. Around 45% of the EU's GHG emissions are covered by the ETS.

As part of the European Green Deal, the EU Commission proposed in September 2020 to raise the 2030 greenhouse gas emission reduction target, including emissions and removals, to at least 55% compared to 1990. The European Climate Law came into force in July 2021 and writes into law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

8.1.3.1 National Policy Position in Ireland

National climate policy in Ireland recognises the threat of climate change to humanity and supports mobilisation of a comprehensive international response to climate change, and global transition to a low-carbon future.

The Climate Action and Low Carbon Development (Amendment) Act 2021 was enacted in 2021 and sets Ireland on a legally binding path to net-zero emissions no later than 2050, and to a 51% reduction in emissions by the end of this decade. The Act provides the framework for Ireland to meet its international and EU climate commitments and to become a leader in addressing climate change.

The Climate Action Plan 2024 (CAP24) is the third annual update to Ireland's Climate Action 2019 (the plans are to be updated annually to ensure alignment with Ireland's legally binding economy-wide carbon budgets and sectoral ceilings). A draft plan was agreed by the Irish Government in December 2023 and, following the completion of Strategic Environmental Assessment and Appropriate Assessment (in accordance with the European Union Directives), the finalised version of the CAP24 was approved by the Irish Government on 21st May 2024.

CAP24 builds on the previous plans by refining and updating the measures and actions required to deliver the carbon budgets and sectoral emissions ceilings and is focused on:

- Underpinning delivery of the established pathways by conducting a stock-take of progress to date, in order to identify gaps and potential corrective actions;
- Identifying measures to address unallocated emission savings; and
- Identifying an approach to achieving emissions reduction and to reporting in the Land Use, Land Use Change and Forestry (LULUCF) sector.

The supplementary Annex of Actions which accompanies the Climate Action Plan has also been approved by the Irish Government. For 2024, a new approach to the Annex has been implemented that will see only new, high-impact actions included in the Annex, while the full roadmap of actions to support the delivery of our climate targets remains within the Climate Action Plan itself.

The Environmental Protection Agency (EPA) Ireland published Ireland's first Climate Change Impact Assessment Report (ICCA) in January 2024. This major scientific assessment serves to complement and localise the global assessments undertaken by the Intergovernmental Panel on Climate Change (IPCC). Its findings build upon these assessments and add important local and national context. The ICCA is the first comprehensive and authoritative assessment of knowledge of climate change in Ireland.

More action is needed to meet Ireland's legally binding emissions targets including large-scale and immediate emissions reductions across the energy system, which is currently heavily dependent (86%) on fossil fuels. Ireland needs to be resilient to ongoing and future climate change impacts. Implementation of climate adaptation measures is currently too slow and fragmented.

Immediate and sustained transformative mitigation and adaptation actions are likely to yield substantial benefits for health, wellbeing and biodiversity in Ireland while reducing vulnerability to the adverse impacts of climate change.

In May 2019, Dún Laoghaire-Rathdown County Council adopted the Dún Laoghaire Rathdown Climate Change Action Plan 2019 – 2024 (DLR CCAP). The DLR CCAP is the climate adaptation and mitigation strategy for the County. Included in the actions set out in the DLR CCAP is the requirement to prepare a climate change chapter in the County Development Plan.

The DLR CCAP provides information on climate change predictions, impacts, and adaptation and mitigation measures, for the Dún Laoghaire Rathdown Local Authority area. The overarching targets of the DLR CCAP are:

- To achieve a 40% reduction in the Council's greenhouse gas emissions by 2030;
- To make Dublin a climate resilient region, by reducing the impacts of future climate change related events; and
- To actively engage and inform citizens on climate change.

The impacts and adaptation and mitigation measures outlined in the DLR CCAP relate specifically to the Dún Laoghaire Rathdown regional area. The DLR CCAP is broken down into five key action areas, namely: Energy and Buildings, Transport, Nature-Based Solutions, Resource Management and Flood Resilience (See Figure 8-1). The DLR CCAP sets out the baseline climate adaptation and mitigation assessment, risk and vulnerability assessment, and ambitious target actions for the Council's activities under these five headings.

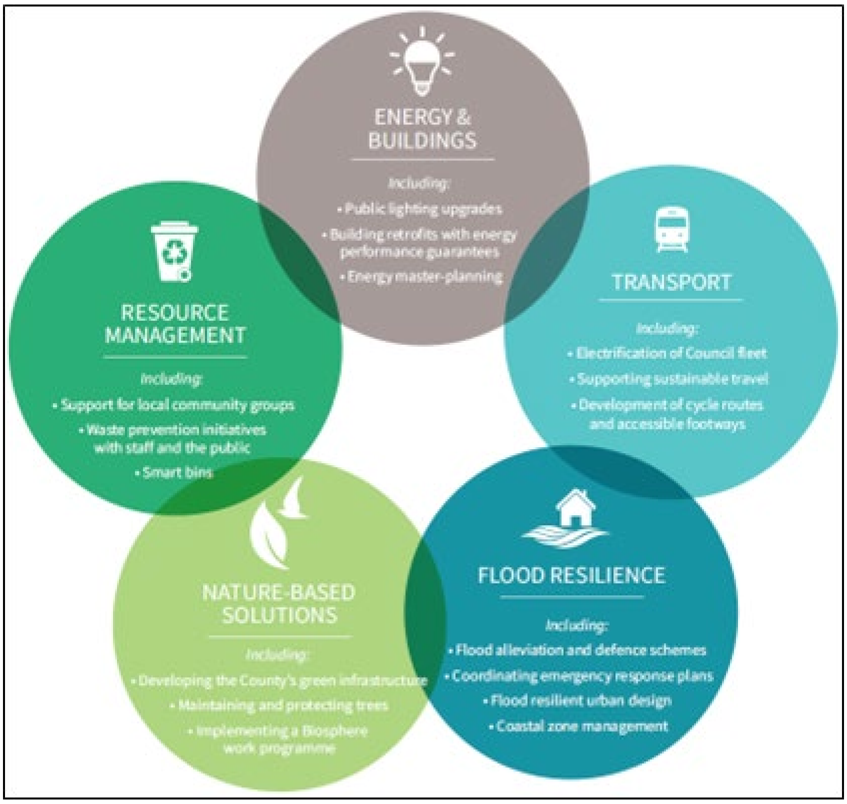

Figure 8-1 The Five Key Action Areas of the CCAP (Source: DLR CCAP)

As a part of the DLR CCAP, a climate change risk and vulnerability assessment was carried out to determine which sectors in Dún Laoghaire Rathdown would be the most vulnerable to the impacts of Climate Change, and what climate impacts held the highest risk.

In order to determine the effects of a changing climate on Dún Laoghaire Rathdown, five impact areas were identified that include the different sectors in the County:

1. Critical infrastructure and the built environment;
2. Transport;
3. Biodiversity;
4. Resource management; and
5. Water resources.

The impact areas chosen are reflective of the action areas used throughout the CCAP (Energy and Buildings, Transport, Nature-Based Solutions, Resource Management and Flood Resilience), which reflect Dún Laoghaire Rathdown County Council's (DLRCC's) remit. Once the impact areas were identified, the risk of these areas to a changing climate was determined.

The implementation of the measures promoted in the DLR CCAP will enable DLR to adapt to climate change and will assist in bringing Ireland closer to achieving its climate related targets in future years. New developments need to be cognisant of the DLR CCAP and incorporate climate friendly designs and measures where possible.

Ireland's latest greenhouse gas (GHG) emissions 1990-2022 are provisional figures based on the Sustainable Energy Authority Ireland's (SEAI's) final energy balance released in September 2023 (EPA, 2024). In 2022, Ireland's GHG emissions are estimated to be 60.60 million tonnes carbon dioxide equivalent (Mt CO_2 eq), which is 1.9% lower (or 1.15 Mt CO_2 eq) than emissions in 2021 (61.75 Mt CO_2 eq) and follows a 5.1% increase in emissions reported in 2021. Emissions are 0.4% below pre-COVID, 2019 figures.

In 2022, emissions in the stationary Emissions Trading Scheme (ETS) sector decreased by 4.1% and emissions under the ESR (Effort Sharing Regulation) decreased by 1.1%. When Land Use, Land Use Change and Forestry (LULUCF) is included, total national emissions decreased by 2.7%.

Decreased emissions in 2022 compared to 2021 were observed in the largest sectors except for transport and waste. These two sectors showed increases in emissions (+6.0%, +6.6%, respectively).

Emissions per capita decreased from 12.4 tonnes CO_2 eq per person in 2021 to 11.9 tonnes CO_2 eq per person in 2022. Ireland's average tonnes of GHG per capita over the last ten years were 12.7 tonnes. With recent Central Statistics Office (CSO) preliminary 2022 census data showing a population of 5.12 million people and with population projected to increase to 5.5 million in 2030, 5.9 million in 2040 and 6.2 million by 2050, per capita emissions need to reduce significantly. At current per capita emission levels, each addition 500,000 people would contribute an additional 6 million tonnes of CO_2 eq annually.

Arresting growth in emissions is a challenge in the context of a growing economy but one which must continue to be addressed by households, business, farmers and communities if Ireland is to reap the benefits of a low-carbon economy.

The greenhouse gas emission inventory for 2022 is the second of ten years over which compliance with targets set in the European Union's Effort Sharing Regulation (EU 2018/842) will be assessed. This Regulation sets 2030 targets for emissions outside of the Emissions Trading Scheme (known as ESR emissions) and annual binding national limits for the period 2021-2030. Ireland's target is to reduce it's greenhouse gas emissions by at least 42% by 2030 compared with 2005 levels, with a number of flexibilities available to assist in achieving this. The ESR includes the sectors outside the scope of the EU Emissions Trading System (ETS) (such as Agriculture, Transport, Residential, Public Services and Commercial Services and Waste).

Ireland's ESR emissions annual limit for 2022 is 42.36 Mt CO_2 eq. Ireland's final 2022 greenhouse gas ESR emissions are 45.90 Mt CO2eq, this is 3.54 Mt CO2eq more than the annual limit for 2022. This value is the national total emissions less emissions generated by stationary combustion i.e. power plants, cement plants, and domestic aviation operations that are within the EU's emissions trading scheme. Using both the ETS and LULUCF flexibilities, Ireland is in compliance with its 2022 Effort Sharing Regulation annual limit with a surplus of 1.05 Mt CO_2 eq. It should be noted that using the ETS flexibility alone Ireland would be in non-compliance, exceeding the allocation by 1.63 Mt CO2eq, and that the final quantity of LULUCF flexibility available to Ireland will be finalised in 2032. Agriculture and Transport accounted for 76.4% of total ESR emissions in 2022.The latest projections (May 2024) indicate that currently implemented measures (With Existing Measures) will achieve a reduction of 9% on 2005 levels by 2030, significantly short of the 42% reduction target. If measures in the higher ambition (With Additional Measures) scenario are implemented, EPA projections show that Ireland can achieve a reduction of 25% by 2030, still short of the 42% reduction target.

In terms of the 2030 targets, the ESR provides two flexibilities (use of ETS allowances and credit from action undertaken in the land use, land use change and forestry (LULUCF) sector) to allow for a fair and cost-efficient achievement of the targets. New regulations in 2023 mean there are new rules around LULUCF flexibility that incorporates split budget 2021-2025 to 2026-2030[2]. Additional analyses are needed to estimate the impact of the new rules on flexibilities. In the interim, based on latest LULUCF inventory and projections data, the maximum amount of LULUCF flexibility now projected to be available is 13.4 Mt CO_{2eq} in the first 5-year period (or 2.68 Mt CO_{2eq} per annum), with no flexibility available in the second 5-year period.

Ireland's greenhouse gas (GHG) emissions increased in the period from 1990 to 2001 where it peaked at 71.48 Mt CO_2 equivalent, before displaying a downward trend to 2014. Emissions increased by 4.2% and 3.7%, respectively in the years, 2015 and 2016 and remained relatively stable in 2017 and 2018, followed by a 4.1% decrease in 2019. In 2020 total national GHG emissions were 3.5% lower than 2019 emissions largely driven by the covid restrictions. The gradual lifting of covid restrictions in 2021 along with an increase in the use of coal and less renewables within electricity generation resulted in a 5.1% increase in emissions in 2021 compared to 2020. A 1.9% decrease in emissions was seen in 2022 compared to 2021, mainly due to a substantial decrease in residential sector emissions combined with decreases from industry, agriculture and electricity generation. Ireland's GHG emissions have increased by 9.7% from 1990-2022.

In relation to the greenhouse gases; carbon dioxide (CO_2) accounted for 60.6% of the total, with methane (CH_4) and nitrous oxide (N_2O) contributing 29.1% and 9.1% as CO2 equivalent, respectively and F-gases contributing 1.2% of the total as CO_2 equivalent.

In 2022, the energy industries, transport and agriculture sectors accounted for 74.6% of total GHG emissions. Agriculture is the single largest contributor to the overall emissions, at 38.5%. Transport, energy industries and the residential sector are the next largest contributors, at 19.4%, 16.6% and 9.5%, respectively (EPA, 2024).

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02018R0842-20230516&qid=1710343267770 Article 7 (1) (a) and (aa)

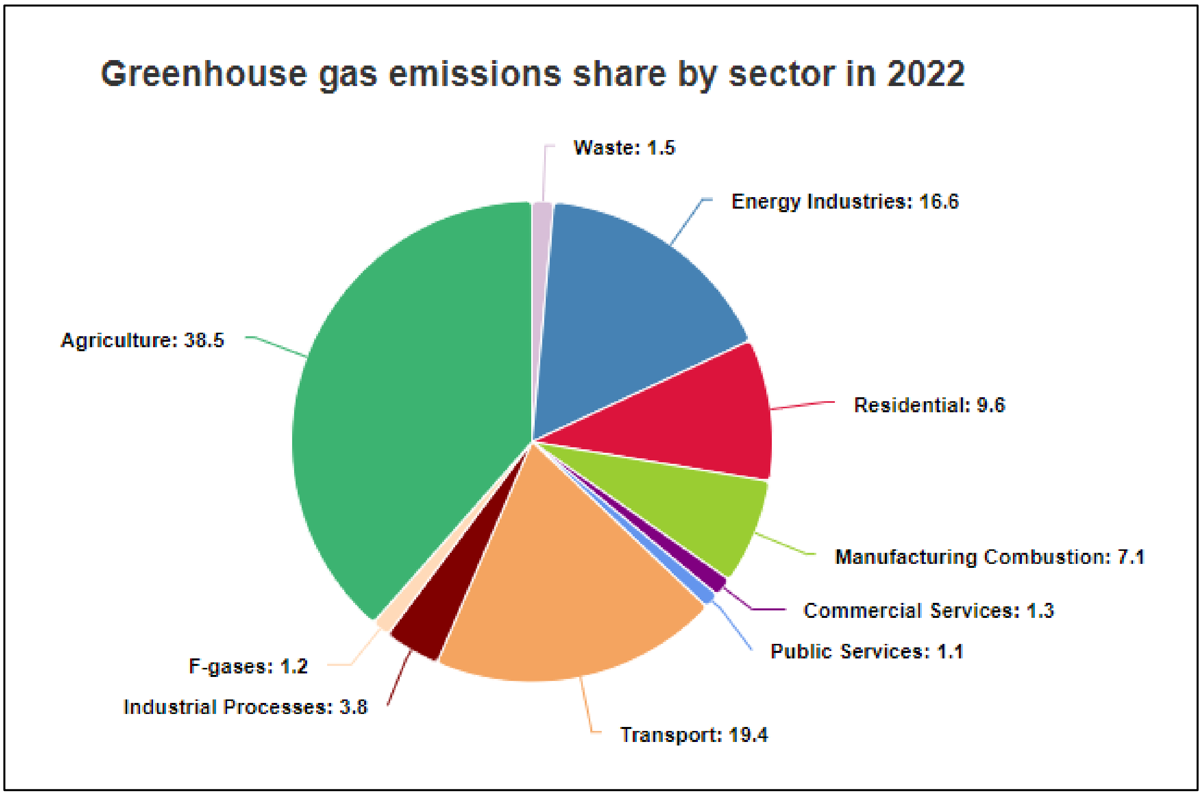

Figure 8-2 Ireland's Greenhouse Gas Emissions Share by Sector for 2022 (EPA, 2023)

The Climate Change Advisory Council submitted their Annual Review 2023 to the Minister of the Environment, Climate and Communications on 21st of July 2023. Detailed key messages, including observations and recommendations for each sector (electricity; transport; built environment; enterprise and waste; agriculture, forestry and other land use; and biodiversity), can be found at the beginning of each chapter in the annual review. The overall recommendations are as follows:

- Government needs to identify and remove barriers to policy implementation by ensuring adequate funding and planning reform at scale and speed;
- Key actions need to be implemented now to prevent longer term drainage and increased costs to society and the economy;
- Government must adopt new approaches to address emission reductions, creating investment and enhancing skills across the economy, particularly in areas such as retrofitting and renewable energy;
- The establishment of a Just Transition Commission is recommended to ensure that Ireland achieves its climate objectives in a way that is fair and equitable and protects vulnerable people and communities; and
- The Government should support opportunities that reduce emissions and make Ireland better prepared for the impacts of climate change.

8.2 Study Methodology

This study methodology is in line with accepted practices. Taking into account Ambient Air Quality Standards, the baseline air quality of the site is examined using EPA monitoring data.

Air quality impacts from the Proposed Development are then determined by a qualitative assessment of the nature and scale of dust and emission generating activities associated with the construction phase of the Proposed Development in accordance with relevant guidance (Institute of Air Quality Management (IAQM) 2024).

A desktop study involving various national and international documents on climate change and analysis of synoptic meteorological data from the nearest Met Éireann station (Baldonnel (Casement) Aerodrome) was also carried out to compile this report. Attention has been focused on Ireland’s obligations under the Paris Agreement in the context of the overall climatic impact of the presence and absence of the Proposed Development.

8.2.1 Construction Phase

8.2.1.1 Construction Dust Impact Assessment

The main air quality impacts that may arise during demolition and construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10}, $PM_{2.5}$ concentrations from demolition and construction activities (including earthworks and trackout); and
- An increase in concentrations of PM_{10}, $PM_{2.5}$ and nitrogen dioxide due to exhaust emissions from vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the site.

As with any impact, the risk will be determined by the magnitude of the source, the effectiveness of the pathway and the sensitivity of the receptor.

The IAQM *Guidance on the assessment of dust from demolition and construction* (2024) provides a framework for the assessment of risk.

Activities on construction sites have been divided into four types:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions is assessed for each activity that is likely to take place.

The assessment methodology considers three separate dust impacts:

- Annoyance due to dust soiling;
- The risk of health impacts due to an increase in exposure to PM_{10}; and
- Harm to ecological receptors with account being taken of the sensitivity of the area that may experience these effects.

The assessment is used to define appropriate mitigation measures to ensure that there will be no significant impact.

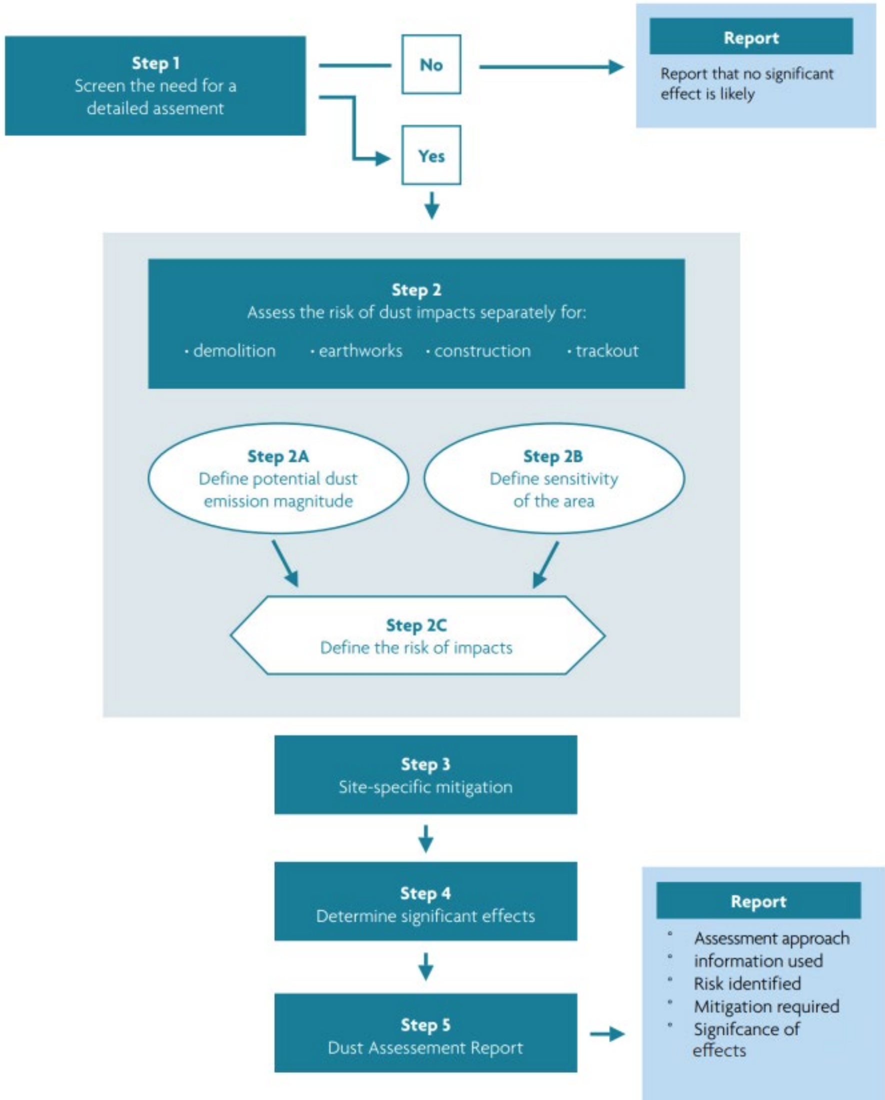

Figure 8-3 Steps to Perform a Dust Assessment (IAQM, 2024)

Step 1 - Screening the Need for a Detailed Assessment

Step 1 is to screen the requirement for a more detailed assessment. An assessment will normally be required where there is:

- A human receptor within:
  - 250m of the boundary of the site; and/or
  - 50m of the route(s) used by the construction vehicles on the public highway, up to 250m from the site entrance(s).
- An ‘ecological receptor’ within:
  - 50m of the boundary of the site; and/or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s).

A review of publicly available information indicates that there are no statutory (international or national) ecological receptors within 50m of the site or applicable construction routes. There is woodland located to the east of the the site boundary.

Table 8-2: Human Sensitive Receptors within 250m of the Site Boundary

Distance to Site Boundary	Number of Receptors
20m	10-100
50m	10-100
100m	>100
250m	>100

Figure 8-4 Map Showing 20m Buffer from Site Boundary

Figure 8-5 Map Showing 50m Buffer from Site Boundary

Figure 8-6 Map Showing 100m Buffer from Site Boundary

Figure 8-7 Map Showing 250m Buffer from Site Boundary

Step 2 - Assess the Risk of Dust Impacts

Step 2 is to assess the risk of dust impacts. This is carried out separately for each of the four activities (demolition; earthworks; construction; and trackout). According to the IAQM (2024), the risk of dust arising in sufficient quantities to cause annoyance and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the potential dust emission magnitude as small, medium and large (Step 2A); and
- The sensitivity of the area to dust impacts (Step 2B), which is defined as low, medium or high sensitivity.

These two factors are combined in Step 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time. Risks are described in terms of there being a low, medium and high risk of dust impacts for each of the four separate potential activities. Where there are low, medium and high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Step 2A – Define the Potential Dust Emission Magnitude

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium or Large.

Demolition: Definitions for demolition as follows:

- Large: Total building volume >75,000m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >12m above ground level;
- Medium: Total building volume 12,000m^3 – 75,000m^3, potentially dusty construction material, demolition activities 6-12m above ground level; and
- Small: Total building volume 12,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <6m above ground, demolition during wetter months.

Minor demolition is proposed including the demolition of an existing derelict dwelling known as Rockville along with associated derelict outbuildings (c. 573 sq m) and the former Kilternan Country Market (wooden structure) (c. 167 sq m) and therefore, the dust emission magnitude for demolition is defined as small.

Earthworks: Earthworks will primarily involve excavating material, haulage, topping and stockpiling. Activities such as levelling the site and landscaping works are also considered under this category. The dust emission magnitude from earthworks can be classified as small, medium and large based on the definitions from the IAQM guidance:

- Large: Total site area >110,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >6m in height;
- Medium: Total site area 18,000m^2 – 110,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 3m – 6m in height; and
- Small: Total site area <18,000m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds >3m in height.

The dust emission magnitude for the proposed earthwork activities can be classified as large as a worst-case scenario, as the total site area is 14.2 hectares.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. The IAQM example definitions for construction are:

- Large: Total building volume >75,000 m^3, on site concrete batching, sandblasting;
- Medium: Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- Small: Total building volume <12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Due to the size of the Proposed Development, as well as the fact that potentially dusty construction material (e.g. concrete) will be used, the dust emission magnitude for the proposed construction activities can be classified as medium.

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. IAQM definitions for trackout are:

- Large: >50 HDV (>3.5t) outward movements[3] in any one day[4], potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- Medium: 20-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- Small: <20 HDV (3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

The dust emission magnitude for the proposed trackout activities can be classified as large as a worst-case scenario.

Table 8-3 provides a summary of the dust emission magnitude for the site.

Table 8-3: Dust Emission Magnitude for the site

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Medium
Trackout	Large

Step 2B – Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Sensitivities of People to Dust Soiling Effects

For the sensitivity of people and their property to soiling, the IAQM (2024) recommends that the air quality practitioner uses professional judgment to identify where on the spectrum

[3] A vehicle movement is a one-way journey i.e., from A to B, and excludes the return journey.
[4] HDV movements during the construction project vary over its lifetime, and the number of movements is the maximum, not the average.

between high and low the sensitivity of a receptor lies, taking into account the following general principles set out in Table 8-4.

Table 8-4 Sensitivities of People to Dust Soiling Effects (Source: IAQM, 2024)

Sensitivity	Features	Indicative Examples
High	• Users can reasonably expect enjoyment of a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling; and • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of the use of the land.	• Dwellings; • Museums and other culturally important collections; and • Medium and long term car parks and show rooms.
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	• Parks; and • Places of work.
Low	• The enjoyment of amenity would not reasonably be expected; or • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is a transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use for the land.	• Playing fields; • Farmland (unless commercially sensitive horticultural); • Footpaths; • Short-term carparks[5] • Places of work.

[5] Car parks have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with workplace or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

Sensitivities of People to Health Effects of PM_{10}

For the sensitivity of people to the health effects of PM_{10}, the IAQM (2024) recommends that the air quality practitioner assumes that there are three sensitivities based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period, consistent with the Defra's advice for local air quality management, Defra LAQM Technical Guidance LAWM.TG (2022).

Table 8-5 Sensitivities of People to the Health Effects of PM_{10} (Source: IAQM, 2024)

Sensitivity	Features	Indicative Examples
High	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day)[6].	• Residential properties; • Hospitals; • Schools; and • Residential care homes.
Medium	• Locations where the people exposed are workers[7], and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Office and shop owners. (Workers occupationally exposed to PM_{10} are generally not included as protection is covered by Health and Safety at Work Legislation)
Low	• Locations where human exposure is transient[8].	• Public footpaths; • Playing fields; and • Shopping streets.

[6] This follows Defra guidance as set out in LAQM.TG (2022)
[7] Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected by the exposure of PM_{10}. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.
[8] There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health impacts, albeit less certain.

Sensitivities of Receptors to Ecological Effects

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

Table 8-6 provides an example of possible sensitivities:

Table 8-6 Sensitivities of Receptors to Ecological Effects

Sensitivity	Features	Indicative Examples
High	• Locations with an international designation and the designated features may be affected by dust soiling; or • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Ireland.[9]	• A Special Area of Conservation (SAC) designated for acid heathlands, or a local site designated for lichens adjacent to the demolition of a large site containing (alkali) buildings).
Medium	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition.	• A Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	• Locations with a local designation where the features may be	• A local Nature Reserve with dust sensitive features.

[9] A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e., Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

	affected by dust deposition.	

Table 8-7 – Table 8-9 illustrate how the sensitivity of the area may be determined for dust soiling,human health impacts and ecological impacts, respectively. It should be noted that the highest level of sensitivity from each table should be considered, as recommended by the IAQM.

The criteria detailed in Table 8-7 – Table 8-9 was used to determine the sensitivity of the area to dust soiling effects and human health impacts.

Table 8-7 Sensitivity of Dust Soiling Effects on People and Property

Receiver Sensitivity	Number of Receivers	Distance from the Source (m)			
		<20m	<50m	<100m	<250m
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

Table 8-8 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)			
			<20	<50	<100	<250
High	>32 µg/m^3	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>32 µg/m^3	>100	High	Medium	Low	Low
		10-100	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low
	28-32 µg/m^3	>100	Low	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	24-28 µg/m^3	>100	Low	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<24 µg/m^3	>100	Low	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low

Table 8-9 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C – Define the Risk of Impacts

In accordance with the IAQM Guidance, the dust emission magnitude (Step 2A) and sensitivity of the area (Step 2B) have been combined and the risk of impacts from demolition, construction, earthworks and trackout have determined (before mitigation is applied).

Table 8-10 to 8-13 illustrate how the dust emission magnitude should be combined with the sensitivity of the area to determine the risk with no mitigation measures applied.

Table 8-10 Risk of Dust - Demolition

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 8-11 Risk of Dust – Earthworks

Potential Impact	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

Table 8-12 Risk of Dust – Construction

Potential Impact	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

Table 8-13 Risk of Dust – Trackout

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

The risk of dust impacts is based on the potential dust emissions magnitude and the sensitivity of the area. These two factors are then combined to determine the risk of dust impacts with no mitigation applied. In the absence of any site-specific information, a higher risk category has been applied to represent a worst-case scenario.

The risk of dust soiling,the impact on human health and the risk of ecological impacts before mitigation, is summarised in Section 8.5.1.

8.2.1.2 Construction Phase Traffic Emissions

Construction vehicles and machinery during this phase will temporarily and intermittently generate exhaust fumes and consequently potential emissions of volatile organic compounds, nitrogen oxides, sulphur oxides, and particulate matter (dust). Dust emissions associated with vehicular movements are largely due to the resuspension of particulate materials from ground disturbance. According to the IAQM (2024), experience from the assessment of exhaust emissions from on-site machinery and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. Air pollutants may increase marginally due to construction-related traffic and machinery from the Proposed Development. However, any such increase is not considered significant and will be well within relevant ambient air quality standards. According to TII (2011), the significance of impacts due to vehicle emissions during the construction phase will be dependent on the number of additional vehicle movements, the proportion of HGVs and the proximity of sensitive receptors to site access routes. If construction traffic would lead to a significant change (> 10%) in Annual Average Daily Traffic (AADT) flows near to sensitive receptors, then concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ should be predicted in line with the methodology as outlined within TII guidance.

The estimated vehicle trips that will be generated by the Proposed Development during the construction phase has been estimated by AtkinsRéalis Ireland; A full copy of the annual average daily traffic (AADT) generated during the construction phase of the Proposed Development can be found in Volume 3 – Appendices (Appendix 8-1). The impact of the construction traffic on AADT flows is expected to be below 10% on the road network, however, an increase of above 10% has been recorded for the internal access road link (Access Road Junction 3) during Phase 2 and Phase 3 and Phase 4.

Table 8-14 Baseline Traffic Data

Link Number	Road Name	Base Year
		2023
1	Golden Ball Access Road	135 (0% HGV)
2	R117 Enniskerry Road South	9,117 (1% HGV)
3	Between Glenamuck Road East	8,734 (1% HGV)
4	R117 Enniskerry Road South	2,682 (1% HGV)
5	Access Road Junction 2	0
6	Access Road Junction 1	0

Link Number	Road Name	Base Year
		2023
7	R117 Enniskerry Road	10,413 (2% HGV)
8	Access Road to Circle K	1,133 (0% HGV)
9	R117 Enniskerry Road South	8,723 (2% HGV)
10	R116 Ballybeatagh Road	2,778 (5% HGV)
11	R117 Enniskerry Road North	8,638 (2% HGV)
12	Ballycorus Road	3,725 (1% HGV)
13	R117 Enniskerry Road South	6,987 (1% HGV)
14	Access Road Junction 4	0
15	Proposed GLDR	4,328 (N/A HGV)
16	Access Road Junction 3	0
17	Proposed GLDR	4,328 (N/A HGV)

Table 8-15 Construction I Traffic Data Applied to the DMRB Model

Road Name	Phase 2 and Phase 3 (2028)		Phase 4 (2029)		Speed (Kph)
	Do Nothing	Do Something	Do Nothing	Do Something	
	AADT	AADT	AADT	AADT	
Access Road Junction 3	761 (1% HGV)	961 (5% HGV)	761 (1% HGV)	865 (4% HGV)	30

The construction phase traffic impact assessment involved air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (DMRB, UK Highways Agency 2007) (Version 1.03c), the NO_x to NO_2 Conversion Spreadsheet (UK Department for Environment, Food and Rural Affairs, 2017), and following all relevant guidance (TII, 2011; HA, 2007; EPA; UK DEFRA; IAQM).

The UK Highways Agency Design Manual for Roads and Bridges (DMRB) air quality guidance (LA 105) provides a framework for assessing, mitigating, and reporting the effects of road schemes on air quality; however, this can be adapted to any development which results in a change in traffic.

The criteria as set out in Table 8-16 have been used to determine the project's risk potential to the receiving environment, and whether a simple or detailed air quality assessment is required. If the receiving environment is determined to be of low sensitivity, then the project's risk potential is low.

Table 8-16 Receiving Environment Sensitivity (Source: DMRA LA 105)

Sensitivity	Features of receiving environment
High	1) Large number of receptors (human and / or ecological) within 50m of roads triggering traffic screening criteria; 2) Baseline monitoring data indicates concentrations above the AQS Objective / EU limit value; 3) Monitoring indicates exceedances of short term AQS Objectives / EU limit value; 4) Projecting forward monitored concentrations to the opening year, indicates exceedances of AQS Objectives / EU limit value; 5) AQMAs or reported EU limit value exceedances within project's study area.
Medium	1) Receptors (human or ecological) within 50m of roads triggering traffic change criteria; 2) Baseline monitoring data illustrates annual mean NO2 concentrations >36µg/m³; 3) Projections indicate annual mean NO2 concentrations>36µg/m³ in opening year; 4) AQMAs or EU limit value exceedances within project's study area.
Low	1) Few receptors located close to roads triggering traffic change criteria; 2) Baseline monitoring data illustrates concentrations in base year below an annual mean of 36µg/m³; 3) No AQMAs or EU limit value exceedances within project's study area.

The baseline pollutant concentrations are well below an annual mean of 36 µg/m³ and there are no exceedances of EU limit values within the study area. Therefore, in accordance with Table 8-16, it is considered that the receiving environment of the Proposed Development is of a 'Low Sensitivity' and the inclusion of the Proposed Development can be considered low risk. Therefore, in line with DMRB LA 105 guidance, it has been determined that simple air quality assessment is required in this case.

8.2.1.3 UK Design Manual for Roads and Bridges Screening Model (V. 103C 2007)

The impact of the construction phase of the Proposed Development has been assessed by use of the UK DMRB screening model (Version 1.03c 2007). The DMRB screening model provides a simple and straightforward means of predicting pollutant concentrations associated with road traffic emissions from the Proposed Development. According to Transport Infrastructure Ireland Guidelines (TII, 2011), this method is a suitable approach in circumstances where the predicted environmental concentrations (i.e., ambient background + predicted concentration) lie sufficiently below the air quality standards (<90% of the standard).

Where predicted concentrations approach or exceed the air quality standards/limit values, a detailed air quality assessment must be carried out.

The DMRB modelling tool requires the following inputs to complete the assessment: road types, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles (%HGV), annual traffic speeds and background pollutant concentrations. This input data is utilised by the model in predicting the Proposed Development's road traffic contribution to ambient ground level concentrations at the nearest affected sensitive air quality receptor. The DMRB modelling tool predicts annual mean concentrations of NO_x and PM_{10}. The road NO_x concentration is then converted to NO_2 using the latest-available version of the UK Department for Environment, Food and Rural Affairs (DEFRA) NO_x to NO_2 conversion spreadsheet (version 8.1). Concentrations of carbon monoxide (CO) and benzene (Bz) are consistently and significantly below their air quality limit values, even in urban centres, therefore modelling of these pollutants is no longer necessary (EPA Annual Air Quality Reports).

As the tool does not account for electric or hybrid vehicle use, vehicle emissions applied in this study are likely to overestimate the actual vehicle emissions experienced from the Proposed Development. The worst-case scenario contributions predicted by the tool are added to the existing background concentration to provide a worst-case scenario predicted ambient concentration.

8.2.1.4 Sensitive Receptors

TII (2011) define sensitive receptor locations as: residential housing, schools, hospitals, places of worship, sports centres, and shopping areas, i.e., locations where members of the public are likely to be regularly present. According to the DMRB LA 105 guidance, sensitive receptors shall be chosen within 200m of the Affected Road Network (ARN) (i.e., internal access road link (Access Road Junction 3)) and include residential properties, schools and hospitals for the assessment of annual mean air quality thresholds. Where there is a risk of the short-term air quality thresholds being exceeded, then sensitive receptor locations including gardens and playing fields shall be assessed. In the current assessment, eleven high-sensitivity receptors such as residential properties and schools were identified within 200m of the ARN.

According to the DMRB LA 105 guidance, it is not necessary to model all receptors within 200m or an excessive number of receptors in the same area to determine whether there is likely to be any exceedances in the do minimum or do something scenarios.

For the purpose of determining local air quality impacts, two (2) receptors were included in this modelling assessment and have been identified in Table 8-17. The receptors modelled will represent the worst-case location in the vicinity the Proposed Development and was chosen based on proximity (within 200m) to the road links affected by the Proposed Development:

Table 8-17 Sensitive Receptors

Name	Type	ITM Coordinates	
		X	Y
SR1	Residential	720728	722490
SR2	Residential	720702	722600

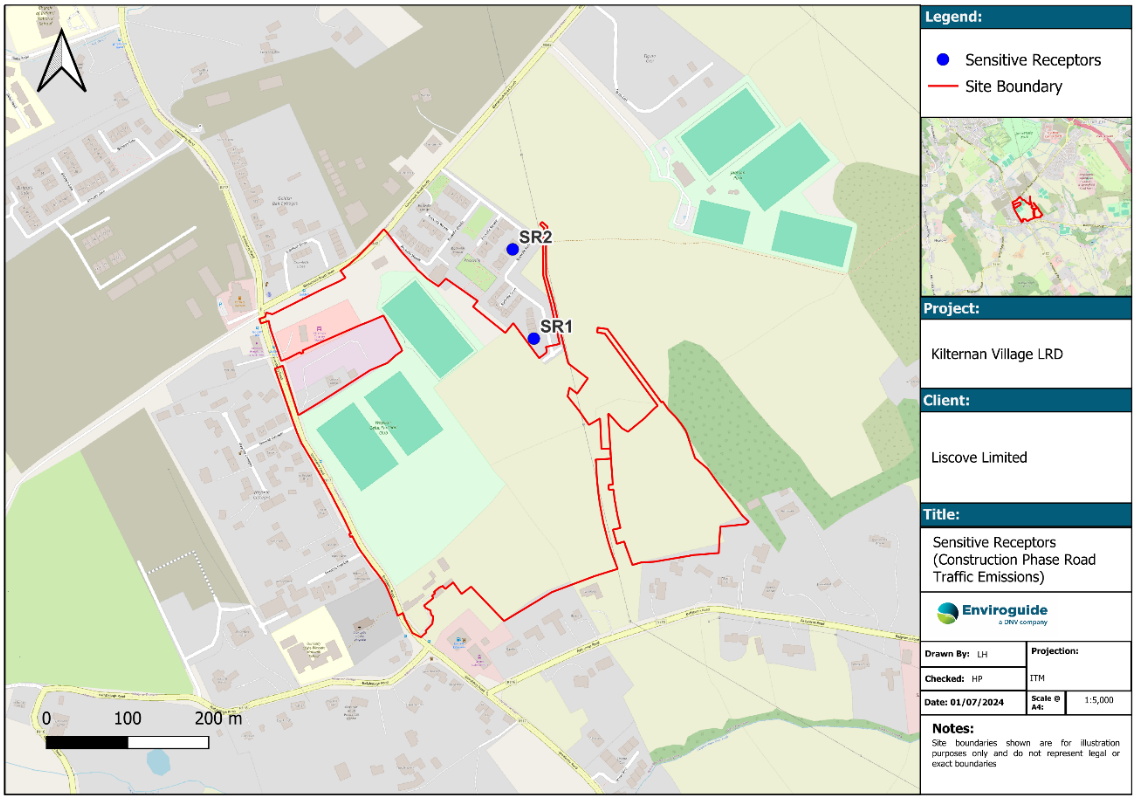

Figure 8-8 Sensitive Receptor Map

Designated sites of ecological conservation importance within 200m of the ARN are required to be included in the air quality assessment. This includes Special Protection Areas, Special Areas of Conservation, Natural Heritage Areas, and nature reserves. Only sites that are sensitive to nitrogen deposition are included in the assessment, it is not necessary to include sites such as those which have been designated as a geological feature. No sites of ecological conservation importance have been identified within 200m of the ARN; therefore, this analysis has been excluded in the air quality assessment.

8.2.1.5 Pollutants and Background Concentrations

The DMRB modelling tool predicts annual mean concentrations of NO_x and PM_{10}. The road NO_x concentration has then been converted to NO_2 using the latest published version of DEFRA's NO_x to NO_2 conversion spreadsheet (version 8.1). Concentrations of carbon monoxide (CO), and benzene (Bz) are consistently and significantly below their air quality limit values, even in urban centres, therefore modelling of these pollutants is no longer necessary (EPA Annual Air Quality Reports). According to the DMRB LA 105 guidance, it is only necessary to model PM_{10} for the base year to demonstrate that there is no impact on achievements of the PM_{10} air quality thresholds as a result of the project. Where air quality monitoring indicates exceedances of the PM_{10} air quality thresholds in the base year, PM_{10} should then be included in the model for both the ‘do nothing’ and ‘do something’ scenarios. As Ireland currently meets its legal requirements for the achievement of the $PM_{2.5}$ air quality thresholds, there is no requirement to model this parameter. Additionally, the modelling of PM_{10} can be used to demonstrate that the project does not impact on the $PM_{2.5}$ air quality threshold.

Annual mean of NO_2 and PM_{10} for the years 2021 and 2022 have been obtained for Zone A stations (see Section 8.3.1). For both parameters, annual limits are well below the threshold limits contained within the regulations.

Background concentrations for Phase 2 and Phase 3 (hereafter ‘P2/P3’) (2028) and Phase 4 (hereafter ‘P4’) (2029) have been predicted for the air quality assessment. Baseline year (2023) background concentrations have been used in combination with correction factors to estimate annual average NO_2 concentrations in future years. These factors have been adapted from both TII (2011) and DEFRA roadside NO_2 projection factors.

Adjustments to the verified modelled NO_2 concentrations are required to be made in order to account for future roadside NO_2 concentrations. An additional scenario known as the projected base year is to be included in the air quality modelling to enable a gap analysis to be completed. The gap analysis is the application of adjustment factors which take into consideration the assumed roadside rates of reduction in NO_x and NO_2 by DEFRA's modelling tools compared to observed roadside monitoring trend i.e., the gap between the predicted reductions and those observed (DMRB LA 105 guidance). This methodology has been applied to the current assessment in order to predict future NO_2 concentrations as a result of the Proposed Development and ensure that these concentrations are not underestimated.

8.2.1.6 Determining the Impact

The TII guidance document ‘Guidelines for the Treatment of Air Quality during the Planning and Construction of Road Schemes (2011)’ outlines a clear methodology for determining the magnitude and significance of air quality impacts associated with road schemes; however, this remains applicable to any project which results in a change to traffic volumes. The TII significance criteria have been applied to the Proposed Development and adapted as necessary within Tables 8-18 to 8-21.

Tables 8-18 to 8-21 describe the air quality impacts at each receptor. They are applicable to the pollutants which are relevant to the Proposed Development and the standards or limit values against which they are being assessed (TII, 2011). The criteria focus on NO_2 and PM_{10} as these pollutants are most likely to exceed the annual mean limit values (40 $\mu g/m^3$).

The definition of ‘impact magnitude’ is related to the degree of change in pollutant concentrations, expressed as micrograms per cubic metre ($\mu g/m^3$). ‘Impact description’ takes account of the impact magnitude and of the absolute concentrations and how they are linked to the air quality standards or limit values. The descriptors for the magnitude of change due to the Proposed Development are set out in Table 8-18:

Table 8-18 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations (Source: Adapted from TII, 2011)

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. days with PM10 concentration greater than 50 µg/m³
Large	Increase/decrease ≥4 µg/m³	Increase/decrease >4 days
Medium	Increase/decrease 2 - <4 µg/m³	Increase/decrease 3 or 4 days
Small	Increase/decrease 0.4 - <2 µg/m³	Increase/decrease 1 or 2 days
Imperceptible	Increase/decrease <0.4 µg/m³	Increase/decrease <1 day

The subsequent impact descriptors are set out in Table 8-19 and Table 8-20:

Table 8-19 Air Quality Impact Descriptors for Changes to Annual Mean NO_2 and PM_{10} Concentrations at Receptors (Source: Adapted from TII, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[10]		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value with Scheme (≥40 µg/m³ of NO_2 or PM_{10})	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme (36-<40 µg/m³ of NO_2 or PM_{10})	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme (30-<36 µg/m³ of NO_2 or PM_{10})	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme (<30 µg/m³ of NO_2 or PM_{10})	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value with Scheme (≥40 µg/m³ of NO_2 or PM_{10})	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with Scheme (36-<40 µg/m³ of NO_2 or PM_{10})	Slight Beneficial	Moderate Beneficial	Moderate Beneficial

[10] Where the impact magnitude is Imperceptible, then the impact description is negligible.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[10]		
	Small	Medium	Large
Below Objective/Limit Value with Scheme (30-<36 μg/m^3 of NO_2 or PM_{10})	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with Scheme (<30 μg/m^3 of NO_2 or PM_{10})	Negligible	Negligible	Slight Beneficial

Table 8-20 Air Quality Impact Descriptors for Changes to Number of Days with PM10 Concentration Greater than 50 μg/m^3 at a Receptor (Source: TII, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[11]		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value with Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme (32-<35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme (26-<32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value with Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with Scheme (32-<35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value with Scheme (26-<32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

In terms of 'significance of effects', professional judgment has been applied in making this determination. The TII Guidance (2011) outlines that the overall air quality impact of the Proposed Development should be described as either 'insignificant', 'minor', 'moderate', or

[11] Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible.

'major'; and a number of factors, as listed in Table 8-21, are set out which should be taken into account:

Table 8-21 Factors to Consider when Determining Air Quality Significance (Source: Adapted from TII, 2011)

Factors
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.
The magnitude of the changes and the descriptions of the impacts at the receptors i.e., using the findings based on Boxes Tables 8-18 to 8-20.
Whether or not an exceedance of a standard or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased.
Whether or not the study area exceeds a standard or limit value and this exceedance is removed, or the exceedance area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made
The extent to which a standard or limit value is exceeded, e.g., an annual mean NO_2 of 41 µg/m^3 should attract less significance than an annual mean of 51 µg/m^3

The modelling results are discussed in Section 8.5 of this Chapter.

8.2.2 Operational Phase

8.2.2.1 Traffic-Related Emissions

Operational phase traffic will use regional and local roads to access the facility with potential increases in traffic flows on some roads and subsequent associated emissions of VOCs, nitrogen oxides, sulphur dioxides and increased particulate matter concentrations.

In terms of associated impacts on air quality, Table 8-22 outlines the typical criteria that are prerequisite of an air quality assessment:

Table 8-22 Indicative Criteria for Requiring an Air Quality Assessment (Source: IAQM, 2017)

Potential change resulting from Proposed Development	Indicative Criteria to Proceed to an Air Quality Assessment
Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors	A change of LDV flows of more than 1000 Annual Average Daily Traffic (AADT)
Cause a significant change in Heavy Duty Vehicle (HGV) flows on local roads with relevant receptors	A change of HGV flows of more than 100 Annual Average Daily Traffic (AADT)

Potential change resulting from Proposed Development	Indicative Criteria to Proceed to an Air Quality Assessment
Realign roads, i.e., changing the proximity of receptors to traffic lanes	Where the change is 5m or more
Cause a change in Daily Average Speed (DAS)	Where the DAS will change by 10 km/h or more
Cause a change in peak hour speed	Where the peak hour speed will change by 20km/h or more.

The estimated vehicle trips that will be generated by the Proposed Development has been estimated by AtkinsRéalis Ireland; A full copy of the annual average daily traffic (AADT) generated during the operational phase of the Proposed Development can be found in Volume 3 – Appendices (Appendix 8-2). The criteria presented in Table 8-22 have not been met by the Proposed Development; it is therefore unlikely for significant air quality impacts to occur as a result of increased traffic flow, and an associated air quality assessment is not required.

8.2.2.2 Operational Plant and Machinery

The Proposed Development will be a Nearly Zero Energy Building (NZEB) in accordance with the Part L 2022 requirements. Each building will have a Building Energy Rating (BER) that will comply with the Part L requirements. A number of low energy technologies are being considered for the Proposed Development. The proposed approach to achieving Part L (2022) compliance will be based on a combination of the solutions, as detailed in the Energy Statement prepared for the Proposed Development by Waterman Moylan (2024) (Appendix 8-5). The following measures, or similar will be incorporated into the Proposed Development to achieve a more energy efficient (i.e., less carbon intensive) design:

- Mechanical heat recovery ventilation will be considered to provide ventilation with lower energy usage;
- Natural ventilation is being considered as a ventilation strategy to minimise energy usage;
- PV solar panels are being considered which will offset primary energy associated with electricity. The PV solar panels convert the electricity produced by the PV system (which is DC) into AC electricity. The panels are typically placed on the south facing side of the building for maximum gain and in some instances, can also be used to assist the heating system;

The passive measures included in the design, such as minimising solar gain (glazing selection), high performance U-values, improved air tightness, and improved thermal transmittance and thermal bridging contributes towards reducing the loads on the active systems within the building. The active measures have been designed to reduce the primary energy consumption through intelligent control and highly efficient plant and equipment.

The building fabric standards and technology solutions listed will be assessed in greater detail during the detailed design stage and the most appropriate options will be implemented to achieve an A2/A3 BER rating. Plant and machinery will not cause any likely significant air quality or climate effects due to the implementation of such measures as those listed.

8.3 The Existing and Receiving Environment (Baseline Situation)

The site is located 1.9 km to the south-west of the M50 and Carrickmines Retail Park. The site is currently largely greenfield with hedgerows and treelines, with hardstanding, derelict buildings and a football pitch. The former 'County Market', a wooden structure, is located in the northwest corner of the site.

8.3.1 Air Quality

According to the 2012 Regulations (S.I. No. 326 of 2012) the proposed site falls into 'Zone A' of Ireland which is described by the EPA as 'Dublin Conurbation'. It is expected that existing ambient air quality in the vicinity of the site is characteristic of a suburban location with the primary source of air emissions such as particulate matter, NO_2, and hydrocarbons likely to be of traffic, combustion and agriculture, and domestic fuel burning.

In conjunction with individual local authorities, the EPA undertakes ambient air quality monitoring at specific locations throughout the country in the urban and rural environment; an Air Quality Report based on data from monitoring stations and a number of mobile air quality units is developed on an annual basis. The EPA's most recent publication 'Air Quality in Ireland, 2022' reports the quality of the air in Ireland based on the data from the National Ambient Air Quality Monitoring Network throughout the year 2022.

When assessing air quality, the EPA focuses on two main pollutants: particulate matter and nitrogen oxides. Measured concentrations of NO_2 for the years 2021 and 2022 are presented in Table 8-23 for Zone A monitoring stations. These results show that current levels of NO_2 are well below the annual mean and 1-hour maximum limit values. In the year 2021, annual mean concentrations of NO_2 ranged from 11.4 – 36.1 ug/m^3 across all Zone A stations, with no exceedance of the maximum hourly limit (EPA, 2022). In the year 2022, annual mean concentrations of NO_2 ranged from 12.3 – 37.5 ug/m^3 across all Zone A stations, with no exceedance of the maximum hourly limit (EPA, 2023).

The closest representative suburban background monitoring to the site which continuously monitors for concentrations of nitrogen oxides (NO_2) and particulate matter ($PM_{2.5}$ and PM_{10}) is located in Dún Laoghaire (ca. 6.7km northeast of the site). Air quality monitoring carried out at this location is likely to be broadly representative of conditions that may be experienced at the site. Concentrations of NO_2 are also well below the threshold limits contained within the regulations at Dún Laoghaire monitoring station, with an annual mean of 15.5 ug/m^3 and 15.6 ug/m^3 measured in 2021 and 2022, respectively (EPA, 2022; EPA, 2023).

EPA 2022 background concentrations for Dún Laoghaire have been used in combination with correction factors to estimate annual average NO_2 concentrations in the region of the Proposed Development for the baseline year (2023). These factors have been adapted from both TII (2011) and DEFRA roadside NO_2 projection factors. Based on these correction factors, the estimated baseline year background NO_2 concentration in the region of the Proposed Development is 14.8 μg/m^3.

Table 8-23 Concentrations of NO_2 at Zone A Monitoring Stations

Station	Objective	Concentration (µg/m³)		Limit or Threshold Value
		2021	2022	
Winetavern St	Annual Mean NO_2	18	18.8	40 µg/m³
	Days >200µg/m³	0	0	35 days
Davitt Road	Annual Mean NO_2	15.2	16.5	40 µg/m³
	Days >200µg/m³	0	1	35 days
DAA	Annual Mean NO_2	19	19.8	40 µg/m³
	Days >200µg/m³	0	0	35 days
St. Johns Road	Annual Mean NO_2	33.2	32.5	40 µg/m³
	Days >200µg/m³	0	0	35 days
Rathmines	Annual Mean NO_2	14.4	14.2	40 µg/m³
	Days >200µg/m³	0	0	35 days
Dún Laoghaire	Annual Mean NO_2	15.5	15.6	40 µg/m³
	Days >200µg/m³	0	0	35 days
Ballyfermot	Annual Mean NO_2	13.2	12.7	40 µg/m³
	Days >200µg/m³	0	0	35 days
Blanchardstown	Annual Mean NO_2	30.6	23.9	40 µg/m³
	Days >200µg/m³	0	0	35 days
Swords	Annual Mean NO_2	11.4	12.3	40 µg/m³
	Days >200µg/m³	0	0	35 days
Dublin Port	Annual Mean NO_2	26.9	27.3	40 µg/m³

Station	Objective	Concentration (µg/m³)		Limit or Threshold Value
		2021	2022	
	Days >200µg/m³	0	0	35 days
Pearse St	Annual Mean NO_2	36.1	37.5	40 µg/m³
	Days >200µg/m³	0	0	35 days
Tallaght	Annual Mean NO_2	12.6	13.5	40 µg/m³
	Days >200µg/m³	0	0	35 days
Ringsend	Annual Mean NO_2	19.2	19.1	40 µg/m³
	Days >200µg/m³	0	0	35 days

Measured concentrations of PM_{10} for the years 2021 and 2022 are presented in Table 8-24 for Zone A monitoring stations. As is evident from these results, current levels of PM_{10} are well below the annual mean limit value. In the year 2021, annual mean concentrations of PM_{10} ranged from 9.6 – 20 ug/m³ across all Zone A stations, with no exceedance of short-term limit values (EPA, 2022). In the year 2022, annual mean concentrations of PM_{10} ranged from 10.9 – 18.1 ug/m³ across all Zone A stations, with no exceedance of short-term limit values (EPA, 2023).

Concentrations of PM_{10} at Dún Laoghaire monitoring station are also well below their respective limit values with an annual mean of 11.3 ug/m³ and 12.3 ug/m³ measured in 2021 and 2022 (EPA, 2022; EPA, 2023).

EPA 2022 background concentrations for Dún Laoghaire have been used in combination with correction factors to estimate annual average PM_{10} concentrations in the region of the Proposed Development for the baseline year (2023). These factors have been adapted from both TII (2011) and DEFRA roadside NO_2 projection factors. Based on these correction factors, the estimated baseline year background PM_{10} concentration in the region of the Proposed Development is 12.2 µg/m³.

Table 8-24 Concentrations of PM_{10} at Zone A Monitoring Stations

Station	Objective	Concentration (µg/m³)		Limit or Threshold Value
		2021	2022	
Winetavern St	Annual Mean PM_{10}	12.4	13.6	40 µg/m³

Station	Objective	Concentration (µg/m³) 2021	Concentration (µg/m³) 2022	Limit or Threshold Value
	Days >50µg/m³	0	1	35 days
Rathmines	Annual Mean PM_{10}	12.4	14.7	40 µg/m³
	Days >50µg/m³	0	4	35 days
Phoenix Park	Annual Mean PM_{10}	9.6	10.9	40 µg/m³
	Days >50µg/m³	0	0	35 days
Blanchardstown	Annual Mean PM_{10}	14.1	15.1	40 µg/m³
	Days >50µg/m³	1	3	35 days
Dún Laoghaire	Annual Mean PM_{10}	11.3	12.3	40 µg/m³
	Days >50µg/m³	0	1	35 days
Ballyfermot	Annual Mean PM_{10}	11.8	12.6	40 µg/m³
	Days >50µg/m³	0	1	35 days
Tallaght	Annual Mean PM_{10}	9.8	11.1	40 µg/m³
	Days >50µg/m³	0	1	35 days
Ringsend	Annual Mean PM_{10}	15.7	15.9	40 µg/m³
	Days >50µg/m³	6	11	35 days
Pearse Street	Annual Mean PM_{10}	-	16.1	
	Days >50µg/m³	-	2	
St. John's Road	Annual Mean PM_{10}	13	14.6	40 µg/m³
	Days >50µg/m³	0	1	35 days
St. Annes Park	Annual Mean PM_{10}	10.8	12.9	40 µg/m³

Station	Objective	Concentration ($\mu g/m^3$)		Limit or Threshold Value
		2021	2022	
	Days >50µg/m³	0	1	35 days
Dublin Airport	Annual Mean PM_{10}	11.2	11.7	40 µg/m³
	Days >50µg/m³	0	1	35 days
Davitt Road	Annual Mean PM_{10}	14	13.4	40 µg/m³
	Days >50µg/m³	2	4	35 days
Dublin Port	Annual Mean PM_{10}	20	18.1	40 µg/m³
	Days >50µg/m³	9	5	35 days
Finglas	Annual Mean PM_{10}	11.8	11.7	40 µg/m³
	Days >50µg/m³	0	1	35 days
Marino	Annual Mean PM_{10}	12.2	13.6	40 µg/m³
	Days >50µg/m³	0	3	35 days
Clonskeagh	Annual Mean PM_{10}	10.7	11.3	40 µg/m³
	Days >50µg/m³	0	1	35 days
Lucan	Annual Mean PM_{10}	-	12.7	40 µg/m³
	Days >50µg/m³	-	0	35 days

8.3.2 Macroclimate

Ireland has a typical maritime climate, largely due to its proximity to the Atlantic Ocean and the presence of the Gulf Stream. Due to the moderating effects of the Gulf Stream, Ireland does not suffer the temperature extremes that are experienced by many other countries at a similar latitude. Mean annual temperatures generally range between 9°C and 10°C. Winters tend to be cool and windy while summers are mostly mild and less windy. The prevailing wind direction is between the south and west with average annual wind speeds ranging between 6 knots in parts of south Leinster to over 15 knots in the extreme north. Rainfall in Ireland occurs throughout the year with reasonable frequency. The highest rainfall occurs in the western half of the country and on high ground; and generally, decreases towards the northeast. As the prevailing winds are from the west-southwest, the west of Ireland experiences the largest number of wet days. The area of least precipitation is along the eastern seaboard of the country.

8.3.3 Microclimate

The synoptic meteorological station at Baldonnel (Casement) Aerodrome is located approximately 18km northwest of the Proposed Development; and for the purposes of this chapter, weather data collected here may be considered similar to that which is experienced in the area of the site.

The weather in the area of the site is generally dominated by cool oceanic air masses, with cool winters, mild humid summers, and a lack of temperature extremes. Based on meteorological data at Baldonnel (Casement) Aerodrome over the last 3 years, the mean January temperature is 5 degrees Celsius (° C), while the mean July temperature is 16.3°C. The prevailing wind direction is from a quadrant centred on the southwest. These are moderately warm winds from the Atlantic and they habitually bring rain. The expected annual rainfall for the eastern half of the country ranges between 750mm and 1000mm. Easterly winds are less frequent, weaker, and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer.

Table 8-25 outlines the average climate conditions at Casement Aerodrome over a 30-year period:

Table 8-25 Latest 30-year Averages at Casement Aerodrome (1981-2010) (Source: Met Eireann)

Parameter	30 Year Average
Mean Temp (° C)	9.7
Mean Humidity at 0900UTC (%)	83.6
Mean Daily Sunshine (Hrs)	3.7
Mean Annual Rainfall (mm)	754.2
Mean Windspeeds (Knots)	10.7

8.3.3.1 Rainfall

Rainfall is a key indicator of changes in climate, as measurements of rainfall are fundamental to assessing the effects of climate change on the water cycle and water balance. Table 8-26 illustrates the monthly and annual rainfall data collected over a 3-year period (2021-2023) at Casement Aerodrome Station. The annual rates of precipitation ranged from 696.9 in 2021 to 870.0 in 2023 with distribution of the highest monthly rainfall values falling mainly in the autumn and winter months. This is broadly within the expected range of the eastern half of the country.

Table 8-26 Monthly Rainfall Values (mm) for Casement Aerodrome Weather Station from January 2021 to December 2023 (Source: Met Eireann)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	52.1	15.7	109.3	67.3	24.3	45.0	124.2	84.5	112.5	116.0	41.2	77.9	**870.0**
2022	21.0	99.3	40.1	46.9	59.6	78.3	40.4	18.7	119.2	100.6	51.9	92.2	**768.2**
2021	95.8	69.7	29.6	17.9	112.7	17.8	94.0	47.3	42.1	77.2	16.4	76.4	**696.9**
Mean	**63.8**	**48.5**	**50.7**	**51.9**	**59.1**	**62.5**	**54.2**	**72.3**	**60.3**	**81.6**	**73.7**	**75.7**	**754.3**

8.3.3.2 Wind

Wind at a particular location can be influenced by a number of factors, such as obstructions by trees or buildings, the nature of the terrain, and deflection by nearby mountains or hills. Wind blows most frequently from the south and west for open sites while winds from the northeast and north occur less often. The analysis of hourly weather data from Casement Aerodrome synoptic weather station over a period of 30 years suggests that the predominant wind direction blows from the southwest, with windspeeds of between 7 and 10 knots occurring most frequently.

Figure 8-9 provides a wind speed frequency distribution which represents wind speed classes and the frequency at which they occur (% of time) at Casement Aerodrome weather station over a period of 30 years. Wind speeds of 7 knots have the highest frequency, occurring approximately 6.7% of the time.

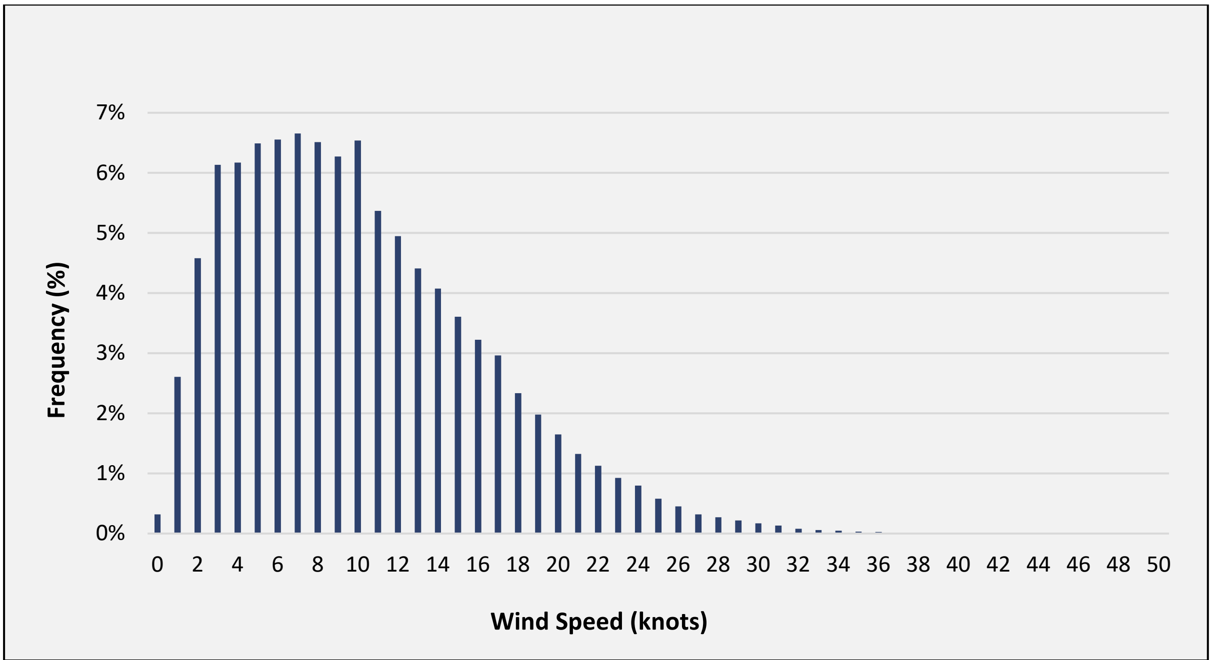

Figure 8-9 Wind Speed Distribution at Casement Aerodrome Synoptic Weather Station over 30 years (1991-2020)

Figure 8-10 provides a wind rose of the predominant wind directions and associated wind speeds at Casement Aerodrome. As is visible from Figure 8-10, the prevailing wind is from a south-westerly direction with an annual incidence of 45.86% for winds between 200 and 250 degrees. The most frequent wind speed associated with this wind direction is between 11 and 16 knots which is considered a 'moderate breeze' in terms of the Beaufort scale, this wind direction and wind speed occurs in combination approximately 15.45% of the time. The overall most common windspeed is between 7 and 10 knots, occurring in 25.98% of incidences, and wind speeds of between 11 and 16 knots occurring in 25.42% of incidences.

The lowest frequency is for winds blowing from the northern quadrant at approximately 2.4% of the time. The incidence of wind between 1 and 6 knots is about 32.53% with wind speeds of above 17 knots (8.7 m/s) occurring in just 15.53% of incidences. The influence of topography can be seen in the low frequency of winds from a southerly direction at Casement Aerodrome, which occur at 7.41% of the time; this is due to the sheltering effect of the mountains to the south. This wind rose is broadly representative of the prevailing conditions experienced at the site.

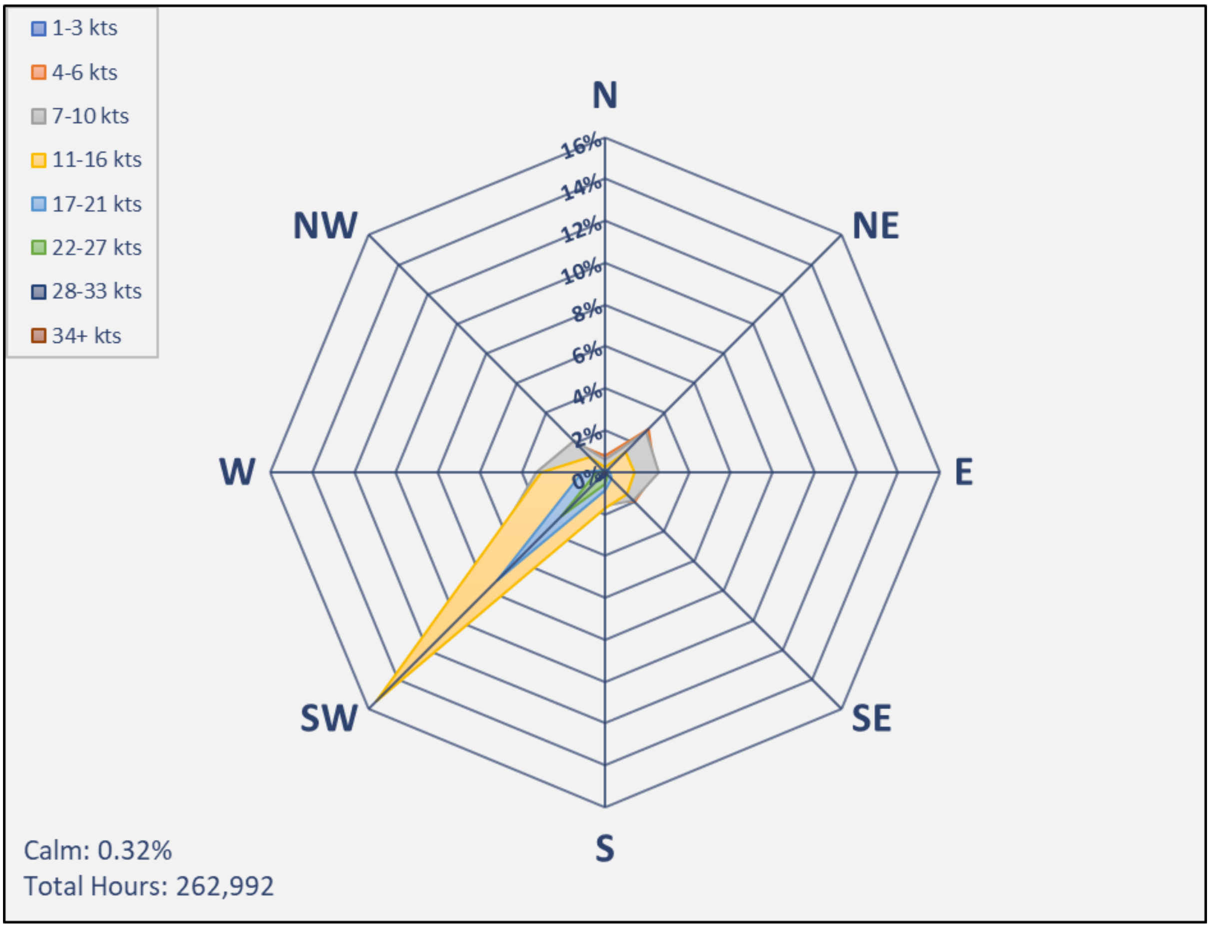

Figure 8-10 30-year Windrose at Casement Aerodrome Weather Station 1991-2020 (Developed using Met Eireann Hourly Data)

8.4 Characteristics of the Proposed Development

Chapter 2 sets out a description of the Proposed Development. The dwellings will be required to minimise overall energy use and to incorporate an adequate proportion of renewable energy in accordance with Building Regulations Part L 2022, Conservation of Energy and Fuel.

8.5 Potential Impact of the Proposed Development

8.5.1 Potential Impact on Air Quality

8.5.1.1 Construction Phase

8.5.1.1.1 Dust

There is potential for construction related air emissions to impact on local air quality due to the Proposed Development. The IAQM *Guidance on the assessment of dust from demolition and construction* (2024) provides a framework for the assessment of risk, details of which are provided in Section 8.2 of this chapter.

Potential Dust Emission Magnitude (Step 2A)

The potential magnitude of dust emissions from demolition, construction, earthworks and trackout has been assessed, as identified in Table 8-27.

Table 8-27: Dust Emission Magnitude for the site

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Medium
Trackout	Large

Sensitivity of the Area (Step 2B)

Table 8-28: Sensitivity of the Area

Sensitivity Type	Factors	Sensitivity of Area	
		On-Site	Trackout
Dust Soiling	Residential areas are considered to be highly sensitive to dust soiling. There are between 10-100 highly sensitive residential receptors within 20m of the site boundary. Therefore, the sensitivity of the area surrounding the site has been classified as high to dust soiling for on-site activity (demolition, earthworks and construction). With regard to trackout, construction traffic will access the site via Access Road Junction 3. There are between 1-10 highly sensitive receptors within 50m of Access Road Junction 3. Therefore, the sensitivity	High	Medium

Sensitivity Type	Factors	Sensitivity of Area	
		On-Site	Trackout
	has been classified as medium to dust soiling for trackout.		
Human Health	EPA 2022 background concentrations for Dún Laoghaire have been used in combination with correction factors to estimate annual average NO_2 concentrations in the region of the Proposed Development for 2026, when works are anticipated to start, is 11.9 µg/m^3. There are between 10-100 highly sensitive receptors within 20m of the site boundary and between 1-10 highly sensitive receptors within 50m of Access Road Junction 3 where people could be exposed to PM_{10} for an extended period of time. As the PM_{10} concentration is less than 24 µg/m^3, the sensitivity of the area to human health impacts is considered to be low.	Low	Low
Ecology	There is woodland located 20m east of the site. The woodland is located within 20m of Access Road Junction 3 which will be used by construction traffic. The woodland can be classified as a medium sensitivity receptor as per Table 8-6.	Medium	Medium

Risk of Dust Impacts (Step 2C)

The outcomes of the assessments of potential magnitude of dust emissions and the sensitivity of the area are combined to determine the risk of impact. This risk is then used to inform the selection of appropriate mitigation. Table 8-29 details the risk of dust impacts for demolition, earthworks, construction and trackout activities.

Table 8-29 Summary of Unmitigated Risks

Potential Impact	Sensitivity	Magnitude			
		Demolition	Earthworks	Construction	Trackout
		Small	Large	Medium	Large
Dust Soiling Impacts	High	Medium Risk	High Risk	Medium Risk	High Risk
Human Health Impacts	Low	Negligible	Low Risk	Low Risk	Low Risk
Ecological Impacts	Medium	Low Risk	Medium Risk	Medium Risk	Medium Risk

The dust risk categories for each of the four activities determined in STEP 2C have been used to define the appropriate, site-specific, mitigation measures to be adopted in Section 8.6.1 of this chapter (Step 3 as per the IAQM *Guidance on the assessment of dust from demolition and construction* (2024) (see Section 8.2 of this chapter)).

For those cases where the risk is assigned as 'negligible', no mitigation measures beyond those required by legislation are required. However, additional mitigation measures as defined in Section 8.2 may be applied as part of good practice.

8.5.1.1.2 Traffic Emissions

The DMRB LA 105 guidance has been outlined in Section 8.2 of this Chapter; in accordance with Table 8-16, it is considered that the receiving environment of the Proposed Development is of a 'Low Sensitivity' and the inclusion of the Proposed Development can be considered low risk. Therefore, it has been determined that a simple air quality assessment is required in this case, as per Table 8-30.

Table 8-30 Table for Determination of Simple or Detailed Assessment (Source: DMRB LA 105 Guidance)

Risk Potential of Project	Receiving Environment Sensitivity			
	Risk	**High**	**Medium**	**Low**
	High	Detailed	Detailed	Simpe
	Low	Detailed	Simple	Simple

8.5.1.1.2.1 Modelling Results

The impact of the Proposed Development on annual mean NO_2 concentrations has been determined by modelling traffic-related air emissions resulting from the presence (Do-Something Scenario) or absence (Do-Nothing Scenario) of the Proposed Development during P2/P3 and P4 of the construction phase.

Table 8-31 Modelled Baseline NO_2 and PM_{10} Concentrations (2023)

Receptor	ITM Coordinate	Receptor Type	Parameter	Total ($\mu g/m^3$)	Road Traffic Component
R1	720728, 722490	Residential	PM_{10}	12.21	0.01
			NO_2	14.83	0.03
R2	720702, 722600	Residential	PM_{10}	12.24	0.04
			NO_2	14.95	0.15

Concentrations of NO_2 and PM_{10} were modelled for the baseline year of 2023. As presented in Table 8-31, the model has indicated that concentrations for all pollutants were in compliance with the annual limit of 40 $\mu g/m^3$. Therefore, in line with DMRB LA 105 guidance, further modelling of PM_{10} is not required. The highest road increment of PM_{10} experienced at receptors was 0.04 $\mu g/m^3$. When this is assessed in combination with the 2023 background concentration of 12.2 $\mu g/m^3$ (total $\mu g/m^3$ is 12.24 $\mu g/m^3$), an overall impact of 30.6% of the annual limit is experienced at the worst-case receptor.

Table 8-32 Predicted Annual Mean Concentrations of NO_2 (P2/P3 (2028))

Receptor	Background ($\mu g/m^3$)	P2/P3 (2028) NO_2 $\mu g/m^3$				
		Do Nothing	Do Something	Proposed Development Contribution	Magnitude	Impact description
R1	11.5	11.55	11.59	0.04	Imperceptible	Negligible Increase
R2		11.51	11.51	-	-	-

Table 8-33 Predicted Annual Mean Concentrations of NO_2 (P4 (2029))

Receptor	Background ($\mu g/m^3$)	P4 (2029) NO_2 $\mu g/m^3$				
		Do Nothing	Do Something	Proposed Development Contribution	Magnitude	Impact description
R1	11	11.05	11.07	0.02	Imperceptible	Negligible Increase
R2		11.01	11.01	-	-	-

The results shown in Table 8-32 and 8-33 determine that there may be some 'imperceptible' increases in concentrations of NO_2 at worst-case receptors assessed when compared with 'Do Nothing' levels; with the highest predicted increase of 0.04 $\mu g/m^3$ and 0.02 $\mu g/m^3$ measured at R1 in P2/P3 and P4 'Do Something' scenarios, respectively. The results shown in Table 8-32 and 8-33 determine that concentrations of NO_2 at R2 will remain the same when compared with 'Do Nothing' levels. In relation to the NO_2 objective/limit value, concentrations of NO_2 at all sensitive receptors are less than 12 $\mu g/m^3$ with the inclusion of the Proposed Development in both P2/P3 and P4, and as such, are well below the objective/limit value of 40 $\mu g/m^3$. Therefore, it is considered that the impact of the Proposed Development is minor at sensitive receptors and insignificant in terms of overall ambient air quality standards.

Having regard to the assessment criteria set out in Section 8.2.1.6 and the modelling results outlined in Table 8-32 and 8-33, the impact of the Proposed Development on NO_2 concentrations in the locality is likely to be 'short-term', 'negative' and 'imperceptible'.

8.5.2 Potential Impact on Climate

A Climate Change Impact Assessment (CCIA) has been prepared for the Proposed Development by Enviroguide (2024) (see Volume 3 – Appendices) (Appendix 8-3). The contents of this report provide dual duty to the requirements as set out in Regulation (EU) 2020/852 of the European Parliament and of the Council (the 'Taxonomy Regulation') for a Climate Risk and Vulnerability Assessment and Dún Laoghaire Rathdown County Council (DLRCC) requirements for a Climate Change Impact Assessment.

Additionally, the CCIA provides information to support the relevant public body in carrying out its functions in a manner consistent with national climate plans and strategies and furthering the achievement of the national climate objective as set out under Section 15 of the Climate Action and Low Carbon Development Act 2015, as amended in 2021.

8.5.2.1 Construction Phase

There is the potential for combustion emissions from onsite machinery and traffic derived pollutants of CO_2 and Nitrous Oxide (N_2O) to be emitted during the construction phase of the development. However, due to the size and duration of the construction phase, and the mitigation measures proposed, the effect on national GHG emissions will not be significant in terms of Ireland's obligations under the Paris Agreement and therefore will have no considerable impact on climate. Overall, climatic impacts are considered to be short-term and imperceptible. The Contractor will seek to achieve the greatest standards of sustainable construction and design and will incorporate sustainable design criteria from the outset which supports overall climate change mitigation. The following mitigation measures will further reduce the effect on national GHG emissions:

- Ensure all vehicles switch off engines when stationary - no idling vehicles; and
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.

8.5.2.2 Operational Phase

8.5.2.2.1 Flood Risk

A Site-Specific Flood Risk Assessment (SSFRA) was undertaken by Roger Mullarkey and Associates Consulting Structural and Civil Engineers (2024) (Appendix 8-4). This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors. This report provides an assessment of the site for flood risk purposes only.

Table 8-34 presents the various residual flood risks involved:

Table 8-34 Residual Flood Risks (Source: Flood Risk Assessment)

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Tidal	>5.5km from the coast and elevated >142m above sea level	People/property	Remote	N/A	Very low
Fluvial	Overtopping of drainage channel on Gelnamuck Road	People/property	Remote	N/A	Low
Pluvial (Surface water)	Flooding from drainage systems	People/property	Possible	Low	Low
Groundwater	Rising water table	People/property	Possible	Low	Low

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Human/ Mechanical Error	Blockage of drainage	People/property	Possible	Moderate	Low

As indicated in Table 8-34, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. The assessment concluded that the site is suitable for development and has an overall low risk of being affected by flooding. The full SFRA Report can be found in Volume 3 - Appendices.

8.5.2.2.2 Energy Statement

Building energy has been long understood as contributing a major component of GHG emissions which was acknowledged within the 2030 Communication published by the European Commission (2014) which stated that "the majority of the energy-saving potential (for the EU) is in the building sector. The EU Energy Performance of Buildings Directive set out the target that all new developments should be Nearly Zero-Energy Buildings (NZEB) by the end of 2020.

Waterman Moylan Consulting Engineers Limited have prepared an Energy Statement for the Proposed Development (2024) (Appendix 8-5). This report identifies the energy standards with which the Proposed Development will have to comply and also sets out the overall strategy that will be adopted to achieve these energy efficiency targets.

The Proposed Development will be required to minimise overall energy use and to incorporate an adequate proportion of renewable energy in accordance with Building Regulations Part L 2022, Conservation of Energy and Fuel.

In developing the energy strategy for the Proposed Development, the incorporation of energy efficient strategies into the project deliverables will encourage the commitment to sustainable design at a very early stage and ensure that the Proposed Development will meet the principles of the Government's 'National Climate Change Policy' and the Nearly Zero Energy Building (NZEB) criteria as set out in the Part L Regulations 2022 and will maximise the reduction in Carbon Dioxide (CO_2) emissions thus demonstrating the commitment to Climate Change.

The full Sustainability Statement can be found in Volume 3 - Appendices.

8.5.2.2.3 Traffic

There will be an increase in LDV and HGV traffic flow on the local road network as a result of the Proposed Development is likely to contribute to increases in GHG emissions such as CO_2 and Nitrous Oxide (N_2O). However, these contributions are likely to be marginal in terms of overall national GHG emission estimates and Ireland's obligations under the Paris Agreement, and therefore unlikely to have an adverse effect on climate.

8.5.3 Potential Cumulative Impacts

Cumulative Impacts can be defined as "impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project". Effects which are caused by the interaction of effects, or by associated or off-site projects, are classed as indirect effects. Cumulative effects are often indirect, arising from the accumulation of different effects that are individually minor.

Cumulative air quality impacts have the potential to arise locally when construction activities associated with the Proposed Development take place at the same time as other developments in a specific location.

A review of other off-site developments was completed as part of this assessment. Chapter 2 of this EIAR details the existing, proposed and granted planning permissions on record in the area, a review of these planning permissions has been completed as part of this assessment.

The cumulative effects on the air quality and climate of the current Proposed Development and other permitted or existing developments have been considered, through the generation of air pollutants and GHG emissions. The potential impacts on air quality and climate are assessed in Section 8.5 and it is considered that there are no other potential significant cumulative impacts associated with the Proposed Development and considered offsite permitted developments.

In terms of dust, no significant impacts are predicted; good construction practice, which incorporates the implementation of the identified mitigation measures, will be employed at the Proposed Development site. Due to the implementation of good construction practices at the Site of the Proposed Development and these offsite permitted developments, it is not anticipated that significant cumulative impacts will occur.

Assessment of road traffic emission impacts on air quality involved traffic data which is inclusive of traffic associated with other existing and permitted developments on the road networks surrounding the site. Therefore, cumulative impacts have been assessed in this regard and the impact on ambient air quality has been determined as not being significant.

It is considered that there are no other potential significant cumulative impacts associated with the Proposed Development and considered offsite permitted developments.

8.5.4 "Do Nothing" Impact

A do-nothing scenario would result in the site remaining undeveloped. If the Proposed Development were not to proceed there would be no effects on the air quality in the area or the macro and microclimate.

8.6 Avoidance, Remedial and Mitigation Measures

8.6.1 Air Quality

8.6.1.1 Construction Phase

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager;
- Display the head or regional office contact information; and
- Develop and implement a Dust Management Plan (DMP), the final dust management plan will form part of the overall construction management plan which will formally be prepared and submitted to DLRCC post grant of planning permission.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- Make the complaints log available to the local authority when asked;
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book; and
- Hold regular liaison meetings with other high risk construction sites within 250m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary;
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the DLRCC when asked; and
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and Maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean using wet methods;
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles;
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable; and
- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved haul roads.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Ensure effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
- Avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- Bag and remove any biological debris or damp down such material before demolition;

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- Only remove the cover in small areas during work and not all at once.

Measures Specific to Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- Record all inspections of haul routes and any subsequent action in a site log book;
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; and
- Access gates to be located at least 10 m from receptors where possible.

8.6.1.2 Operational Phase

It has been determined that the operational phase air quality impact is negligible and therefore, no site-specific mitigation measures are proposed.

8.6.2 Climate

As climatic impacts associated with the construction and operational phases of the Proposed Development are negligible, no mitigation measures are proposed. Best practice measures will be implemented to minimise exhaust emissions from construction and operational vehicles and machinery by avoidance of engines running unnecessarily, as idle engines will not be permitted for excessive periods.

8.6.3 "Worst Case" Scenario

A worst-case scenario has been applied in Step 2A (defining the potential dust emission magnitude) of the construction dust impact assessment and the highest risk category has been applied when selecting the mitigation measures that are general for the Proposed Development (i.e., the site is medium risk for demolition and construction, but a high risk for earthworks and trackout, therefore, the high-risk site mitigation measures apply).

It is expected that adequate mitigation measures, as outlined in Section 8.6.1, will assist in preventing nuisance dust from resulting in any significant effects. However, even with the most rigorous DMP in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, and if, for example, dust emissions occur under adverse weather conditions, or there is an interruption to the water supply used for dust suppression, the local community may experience occasional, short-term dust annoyance. The likely scale of this would not be considered sufficient to change the conclusion that with mitigation the effects will be 'not significant'.

8.7 Residual Impacts

The IAQM recommends that significance is only assigned to effect after considering the construction activity mitigation. The risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3 (Section 8.6.1 of this chapter) and the final step is to determine whether there are significant effects arising from the construction phase of the Proposed Development. The proposed mitigation measures will reduce the effects to be not significant.

The traffic generated by the Proposed Development has been assessed for its impact on air quality and it has been determined to have an overall not significant impact in terms of local air quality with the implementation of the proposed mitigation measures. Furthermore, it is considered that the effects of the Proposed Development on climate is considered to be not significant. Therefore, no significant adverse residual effects are anticipated from the proposed scheme in the context of air quality and climate.

8.8 Monitoring

The monitoring of construction dust during the construction phase of the Proposed Development is recommended to ensure that impacts are not experienced beyond the site boundary. Monitoring of dust can be carried out by using the Bergerhoff Method. This involves placing Bergerhoff Dust Deposit Gauges at a strategic locations along the site boundaries for a period of 30 +/- 2 days. The selection of sampling point locations should be carried out in consideration of the requirements of *VDI 2119* with respect to the location of the samplers relative to buildings and other obstructions, height above ground, and sample collection and analysis procedures. After the exposure period is complete, the Gauges should be removed from the Site; the dust deposits in each Gauge will then be determined gravimetrically and expressed as a dust deposition rate in $mg/m^2/day$ in accordance with the relevant standard.

Due to the negligible impact on air quality and climate from the operational phase of the Proposed Development, no specific monitoring is recommended except for monitoring via the Bergerhoff Method..

8.9 Interactions

Interactions between Air Quality and Climate and other aspects of this EIAR have been considered in this section of the chapter.

8.9.1 Population and Human Health

Interactions between Air Quality and Population and Human Health have been considered as the Proposed Development has the potential to cause health issues as a result of impacts on air quality from dust nuisances and potential traffic derived pollutants. However, the mitigation measures employed at the Proposed Development will ensure that all impacts are compliant with ambient air quality standards and human health will not be affected. Furthermore, traffic-related pollutants have been assessed and determined as having an overall insignificant impact, therefore air quality impacts from the Proposed Development are not expected to have a significant impact on population and human health.

8.9.2 Biodiversity

Interactions between Air Quality and Biodiversity have been considered as the construction phase has the potential to interact with flora and fauna in adjacent habitats and designated sites due to dust emissions arising from the construction works. However, the mitigation measures employed at the Proposed Development will ensure that the impacts to flora and fauna are not significant.

8.9.3 Traffic

There can be a significant interaction between air quality, climate and traffic. This is due to traffic-related pollutants that may arise. In the current assessment, traffic derived pollutants which may affect Air Quality and Climate have been deemed not significant. Therefore, the impact of the interaction between air quality and climate is not significant.

8.10 Difficulties Encountered When Compiling

No difficulties have been encountered while compiling this chapter.

8.11 References

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