Chapter 7.0

Air Quality and Climate

7.0 Introduction

The dominant source of air pollutant emissions resulting from the proposed development will be from road traffic. Thus, the air quality impact resulting from additional road traffic emissions as a result of the development is the primary focus of this chapter.

The impact of a development on climate can refer to local scale impacts on the microclimate such as the impact of the project on local wind flow, temperature, rainfall or solar radiation. Climate impacts can be on a regional or global scale through an increase in pollutant emissions. This chapter assesses the microclimate and macroclimate impacts of the proposed development.

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7.1 Methodology

7.1.1 Air Quality

The air quality assessment has been carried out following procedures described in the publications by the National Roads Authority (now Transport Infrastructure Ireland) [1] and EPA [2,3] and using the methodology outlined in the guidance documents published by the UK DEFRA [4-5].

Ambient Air Quality Standards

In response to the adverse health effects of pollutants in air, the European Union has developed an extensive body of legislation which establishes health-based standards and objectives for several pollutants. These standards and objectives apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times.

Limit values or target values for the following pollutants are set by the EU Directive 2008/50/EC: sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and oxides of nitrogen (NOx), particulate matter (PM_{10} and $PM_{2.5}$), lead (Pb), benzene, carbon monoxide (CO) and ozone (O_3). This has been transposed into Irish Legislation as the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). The air quality standards for NO_2, PM_{10} and $PM_{2.5}$, which are the focus of this assessment, are provided in Table 7.1.

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 7.1 have set ambient air quality limit values for these pollutants.

With regard to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines in Ireland regarding the maximum dust deposition levels that may be generated during the construction phase of a development.

The German TA-Luft standard for dust deposition (non-hazardous dust) has been used in Ireland and sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value has also been implemented with regard to dust impacts from construction sites.

Table 7.1 Air Quality Standards Regulations 2011

Pollutant	***Limit***	***Averaging Period***	***Legal Nature***	***Permitted Exceedances Each Year***
Nitrogen dioxide (NO_2)	200 µg/m^3	1 hour	Limit value entered into force 1/1/2010	18
	40 µg/m^3	1 year	Limit value entered into force 1/1/2010[a]	n/a
Particles <10 µm (PM_{10})	50 µg/m^3	24 hours	Limit value entered into force 1/1/2005[b]	35
	40 µg/m^3	1 year	Limit value entered into force 1/1/2005[b]	n/a
Fine particles <2.5 µm ($PM_{2.5}$)	25 µg/m^3 [c]	1 year	Target value entered into force 1/1/2010	n/a
			Limit value enters into force 1/1/2015	

a Under Directive 2008/50/EC an EU member State can apply for an extension of up to five years (i.e. maximum up to 2015) in a specific zone. Request is subject to assessment by the Commission.

b Under Directive 2008/50/EC an EU Member State was able to apply for an extension until three years after the date of entry into force of Directive 2008/50/EC (i.e. May 2011) in a specific zone. Request was subject to assessment by the Commission.

c Standard introduced by Directive 2008/50/EC.

Air Quality Assessment

The most recent annual EPA air quality monitoring reports and data [6-7] show that CO concentrations in Ireland are expected to stay low for the foreseeable future, and that benzene concentrations have been low and stable for the last number of years and are anticipated to stay low in the medium term. However, the monitoring data indicates that while NO_2 concentrations are low in rural areas, higher levels in urban areas continue to pose a threat to compliance with the limit value. Furthermore, PM_{10} and $PM_{2.5}$ also have the potential to exceed the limit values in urban areas. The impact of the proposed development on NO_2, PM_{10} and $PM_{2.5}$ is therefore the focus of this assessment.

Cumulative effects have been assessed, as recommended by the EPA [2,3] and using the methodology of the NRA / TII [1]. The assessment focused firstly on identifying the existing baseline levels of NO_2, PM_{10} and $PM_{2.5}$ in the region of the proposed development, both currently (by analysis of existing EPA monitoring data), and for the opening and design years of the development (through modelling).

Ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the opening year (2029) were then predicted at worst-case sensitive receptors close to the development for both the “do nothing” and “do something” scenarios. The impact of the development on air quality at the sensitive receptors was determined through a comparison of the predicted “do something” ambient concentrations with the relevant air quality limit values / target values.

In addition, the significance of the impact on air quality was assessed through comparison of the predicted “do nothing” and “do something” pollutant concentrations in 2029.

Air Dispersion Modelling

The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model [8] and following guidance issued by the UK DEFRA [4,5], the NRA (TII) [1] and the EPA [2,3].

The inputs to the air dispersion model consist of information on road layouts, receptor locations, annual average daily traffic movements (AADT), annual average traffic speeds and background concentrations. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data. This worst-case concentration was then added to the existing background concentration to give the worst-case predicted ambient concentration and compared with the relevant ambient air quality standard.

Impact Assessment Methodology

The impact of the development on local air quality was assessed in terms of the relative additional contribution of the development to pollutant levels. Guidance on determining air quality impact of road schemes published by the NRA (TII) [1] was used for this assessment. The NRA / TII significance criteria have been adopted as detailed in Tables 7.2 - 7.4. The significance criteria are based on PM_{10}, $PM_{2.5}$ and NO_2 only as these pollutants are most likely to exceed the limit values.

7.1.2 Climate

The potential impact of the proposed development on microclimate was considered in relation to the existing local weather conditions and the size and nature of the development.

The regional impact of the proposed development at a national / international level during operation was assessed using the approach detailed by the NRA (TII) [1]. This provides a method for the prediction of the impact of emissions of pollutants from road schemes on a regional scale using the regional impact assessment mode of the UK DMRB Screening Model [8]. The assessment focused on determining the increase in annual emissions of carbon dioxide during operation of the proposed development. Inputs to the DMRB model consist of information such as road lengths, annual average daily traffic movements (AADT), road link type and annual average traffic speeds. Using this input data, the model predicts the total carbon emissions resulting from operation of the facility in a specified year. The total carbon emissions were converted to CO_2 emissions using the molar ratio of carbon dioxide to carbon.

With regard to average traffic speeds, road traffic on regional roads close to the development were modelled at speeds of 60 - 70 kph and on local roads at 30 - 50 kph. Traffic on the Northern Ring Road was modelled at 70 kph and traffic on roads within the development was modelled at 20 kph.

Table 7.2 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

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

Table 7.3 Air Quality Impact Descriptors for Changes to Annual Mean NO_2 / PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration[a]**		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 μg/m³ of NO_2 or PM_{10}) (≥25 μg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-<40 μg/m³ of NO_2 or PM_{10}) (22.5-<25 μg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-<36 μg/m³ of NO_2 or PM_{10}) (18.75-<22.5 μg/m³ of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 μg/m³ of NO_2 or PM_{10}) (<18.75 μg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 μg/m³ of NO_2 or PM_{10}) (≥25 μg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36-<40 μg/m³ of NO_2 or PM_{10}) (22.5-<25 μg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30-<36 μg/m³ of NO_2 or PM_{10}) (18.75-<22.5 μg/m³ of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 μg/m³ of NO_2 or PM_{10}) (<18.75 μg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

a Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible.

Table 7.4 Quality Impact Descriptors for Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[a]		
	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

a Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible.

7.2 Receiving Environment (Baseline Scenario)

7.2.1 Air Quality

Trends In Air Quality

Local air quality is influenced by the type and extent of local emission sources and on the dispersion of emissions from those sources. The dispersion of pollutant emissions is in turn influenced by regional and local meteorological conditions.

Pollutant concentrations generally fall significantly with distance from major road sources [8] and as a result, in areas where the dominant source is road traffic, population exposure is generally determined by the location of sensitive receptors relative to the major roads sources in the area.

Baseline Air Monitoring

A short-term air quality monitoring study was conducted in the region of the proposed development in order to determine the effect of local road traffic sources.

NO_2 was monitored, using nitrogen dioxide passive diffusion tubes, over a three-week period at four locations near the proposed development (see Figure 7.1, AM1-AM4). The locations were chosen in order to measure NO_2 exposure at busy roadside locations in the region of the proposed development.

Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following sampling, the tubes were analysed using UV spectrophotometry, at a UKAS accredited laboratory (ESG, UK).

The NO_2 monitoring results are presented in Table 7.5. Average concentrations over the three-week survey period ranged from 6.4 - 21 µg/m^3 and were below the annual average limit value of 40 µg/m^3. The highest concentration was measured to the west of the site at the junction of the R614 Ballyhooly Road and Lower Dublin Hill. The ambient NO_2 concentration at this location was equivalent to 53% of the limit value. Average concentrations at the remaining three locations reaches at most 22% of the limit value.

Figure 7.1 Baseline Air Monitoring - Approximate Location of NO_2 Diffusion Tubes

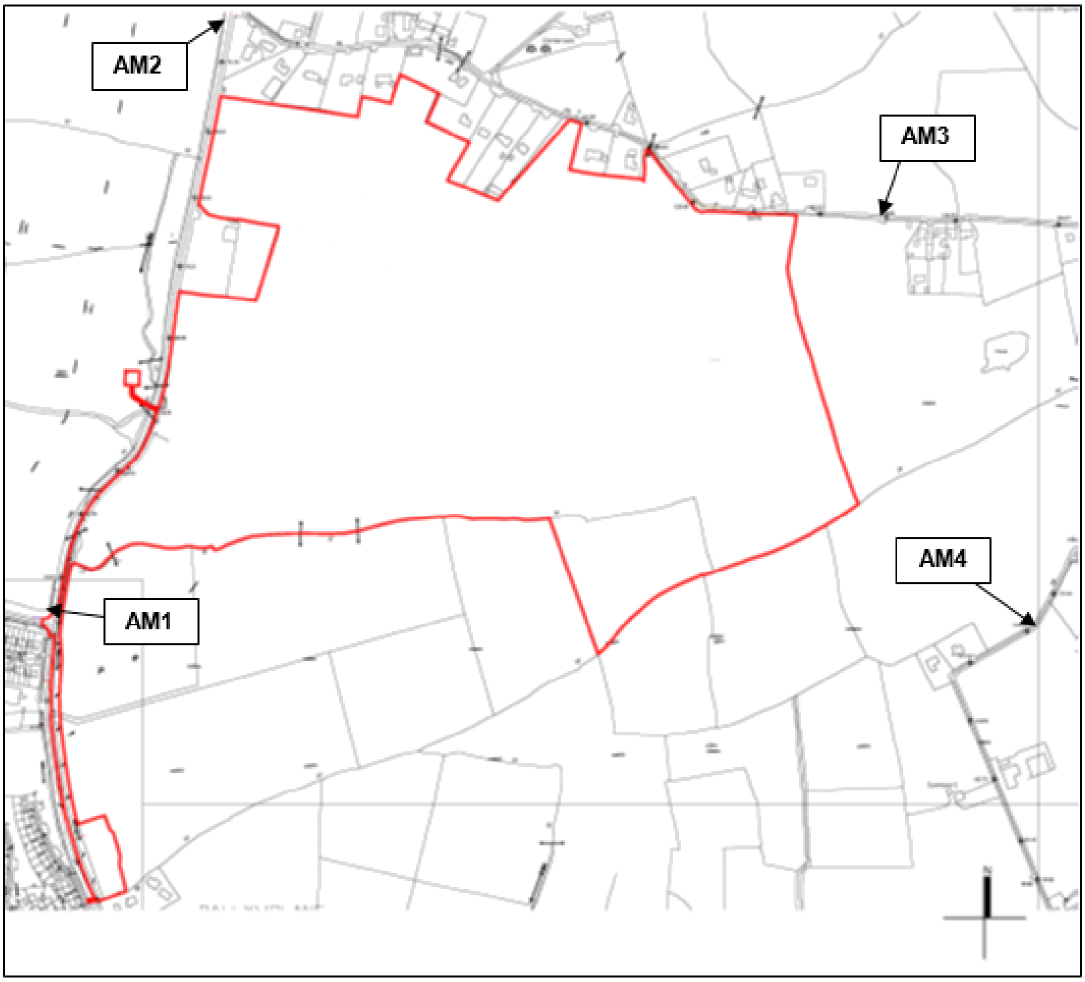


Table 7.5 NO_2 Baseline Air Monitoring Results

Monitoring Location	***Sampling Period***	***NO_2 Concentration***
AM1 - Southwest of Site	17/07/17 - 10/08/17	21 µg/m^3
AM2 - Northwest of Site	17/07/17 - 10/08/17	8.7 µg/m^3
AM3 - North of Site	17/07/17 - 10/08/17	7.4 µg/m^3
AM4 - Southeast of Site	17/07/17 - 10/08/17	6.4 µg/m^3
Annual Average Limit Value		*40 µg/m^3*

EPA Air Monitoring Data

Member States are required under EU air quality legislation to designate zones for the assessment and management of air quality. In Ireland, four air quality zones have been defined and are set out in the in the Air Quality Standards Regulations 2011 (S.I. No. 108 of 2011). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 21 towns and cities with a population of greater than 15,000. The remainder of the country is defined as Zone D. The zones are subject to review and were last changed on 1 January 2013 to take account of population counts from the 2011 census.

The EPA National Ambient Air Quality Programme coordinates and conducts ambient air monitoring throughout the state in order to assess compliance with the ambient air quality limit or target values. The number and location of monitoring sites is determined based on population size and on a comparison of individual pollutant levels measured over the previous five years with their upper and lower assessment levels. The site of the proposed development is located within Zone B (Cork) and the results of recent monitoring at locations in Cork as provided by the EPA [6-7] are discussed below.

The trend in NO_2 concentrations measured in Cork City Centre over the past number of years shows that levels approached the limit value of 40 µg/m^3 over the period 2008 - 2010 peaking at 34 µg/m^3. However, levels decreased to 23 µg/m^3 from 2010 to 2013 which was consistent with a general downward trend in concentrations throughout the country. More recently, there is a downward trend in the annual average concentration at a new city centre location over the period 2014-2018). The most recent reported annual average NO_2 concentration (at South Link Road) was 25 µg/m^3, or 63% of the annual limit value.

Data from the PM_{10} monitoring programme at two locations in Cork show a general downward trend in annual average concentrations over the period 2009-2018, with city centre traffic-influenced concentrations most recently measured at 17 µg/m^3, while those at a suburban background location were 11 µg/m^3. Annual average levels are consistently below the annual limit value of 40 µg/m^3.

Recent $PM_{2.5}$ monitoring in Cork City Centre also shows a general downward trend in average concentrations, with levels at Heatherton Park reducing from a peak of 18 µg/m^3 in 2010 to 11 µg/m^3 in 2018.

The Cork air monitoring data has been used to define worst-case background concentrations for the dispersion modelling impact assessment conducted for the proposed development. These are detailed in Table 7.6. The expected variation in NO_2, PM_{10} and $PM_{2.5}$ background concentrations between 2019 and the opening year (2029) was calculated based on predicted reduction factors provided by the NRA (TII) [1].

Table 7.6 Background Concentrations Used for Dispersion Modelling

Pollutant	***2019***	***2029***
NO_2	20.0 µg/m^3	23.8 µg/m^3
PM_{10}	15.0 µg/m^3	14.9 µg/m^3
$PM_{2.5}$	9.0 µg/m^3	8.9 µg/m^3

7.2.2 Climate

Local Meteorological Conditions

The nearest synoptic weather station operated by Met Éireann with long-term data available (for over 30 years) is located at Cork Airport, approximately 8 km south west of the site. The World Meteorological Organization (WMO) recommends that climate averages are computed over a 30-year period of consecutive records. This period is considered to be sufficiently long enough to smooth out year to year variations in meteorological parameters. The meteorological data listed below was obtained from Met Éireann and is based on 30-year records for Cork airport over the period 1981-2010.

The annual mean temperature is 9.9°C, with a mean daily maximum of 12.9°C and a mean daily minimum of 6.9°C. The mean relative humidity at 09:00 is 87% and at 15:00 is 77%. The mean daily sunshine duration ranges from 2.0 hours in winter to 5.5 hours in summer, with an annual average of 3.9 hours. The annual mean rainfall is 1228 mm with average monthly totals ranging from 76.5 mm (April) to 138 mm (October). On average, 152 days are recorded per year with rainfall greater than 1.0 mm. The annual mean wind speed is 10.5 m/s.

Policy & Legislative Measures

<u>EU Climate and Energy Package</u>

In 2007, EU leaders endorsed the 20-20-20 targets which are: (i) a 20% reduction of GHG emissions compared with 1990, (ii) a 20% share of renewables in EU energy consumption, and (iii) a 20% improvement in energy efficiency compared to projections. The EU climate and energy package was adopted in 2009 in order to implement these targets. The package comprises four pieces of binding and complementary legislation as follows:

- i) Revision and strengthening of the EU Emissions Trading System (EU-ETS);
- ii) An Effort Sharing Decision for emissions from sectors not covered by the EU-ETS;
- iii) Binding national targets for renewable energy; and
- iv) A legal framework to promote the development and safe use of carbon capture and storage (CCS).

Revision of the EU-ETS involves a single EU-wide cap on emission allowances from 2013 onwards, the progressive replacement of free allocation of allowances by auctioning and an expansion of the system to new sectors and gases. The key legislation in the context of greenhouse gas emissions targets for Ireland is the EU Effort Sharing Decision.

<u>EU Effort Sharing Decision</u>

The EU Effort Sharing Decision (ESD) (Decision 406/2009/EC) sets 2020 targets for sectors outside the Emissions Trading Scheme (known as non-ETS sector emissions) and also annual binding limits for the period 2013-2020. Ireland's 2020 target is to reduce non-ETS sector emissions (e.g. agriculture, transport, residential, commercial, non-energy intensive industry and waste) by 20% based on 2005 emission levels [9].

Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act 2015 sets out the requirement for National Mitigation Plans to address greenhouse gas mitigation and National Climate Change Adaptation Frameworks to address adaptation to the impacts of climate change.

In particular, the Act provides for:

- The making of five-yearly National Mitigation Plans to specify the policy measures to reduce greenhouse gas emissions;
- The development of a National Adaptation Framework to specify the national strategy for the application of adaptation measures in different sectors and by local authorities to reduce the vulnerability of the State to the negative effects of climate change; and
- Establishment of the Climate Change Advisory Council to advise ministers and the government on climate change matters.

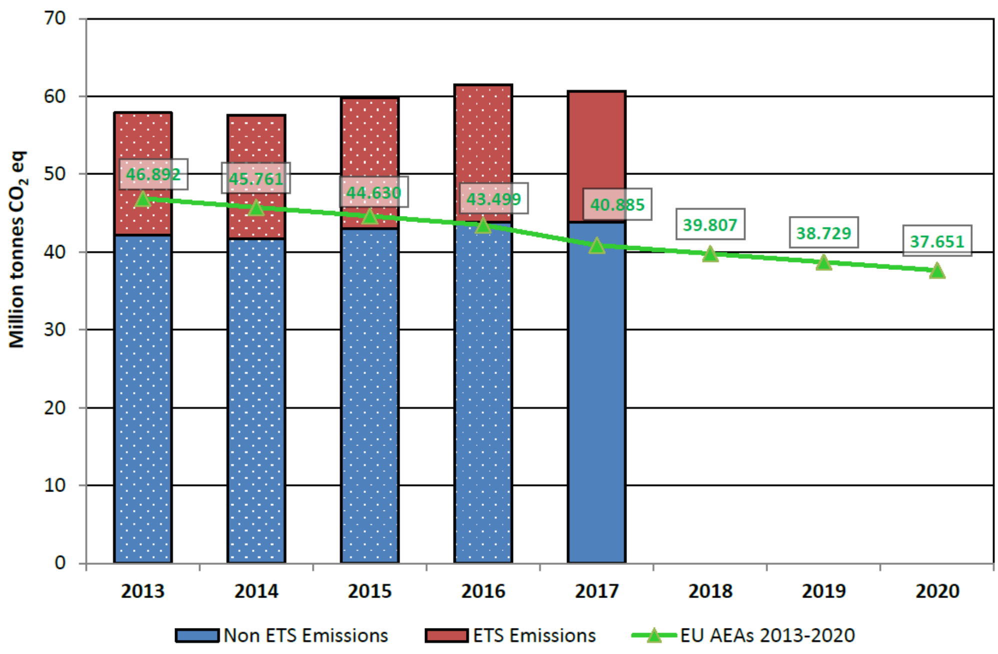
Ireland's first statutory National Mitigation Plan was published in July 2017 [10]. The document incorporates sectoral mitigation measures to reduce greenhouse gas emission for key sectors, such as agriculture, transport, energy and the built environment. Chapter 5 of the document relating to *Decarbonising Transport*, identifies the current measures in place and potential additional measures to contain the level of emissions associated with the transport sector. The National Mitigation Plan also sets out an ambition that all new cars and vans sold in Ireland from 2030 will be zero emission capable.

Ireland's Greenhouse Gas Emissions

The EPA is responsible for compiling greenhouse gas emission inventories for Ireland and for reporting the data to the relevant European and international institutions. The most recent report on Ireland's greenhouse gas emissions (April 2019) [8] provides provisional estimates of greenhouse gas emissions for the period 1990 - 2017. For 2017, the total national greenhouse gas emissions are estimated to be 60.74 million tonnes carbon dioxide equivalent (Mt CO_2 eq). This is 0.9% lower (0.53 Mt CO_2 eq) than emissions in 2016. The report states that ETS sector emissions decreased by 4.7% (0.84 Mt CO_2 eq) and non-ETS emissions increased by 0.7% (0.31 Mt CO_2 eq) in 2017. Agriculture (46%) and transport (27%) are the largest contributors to non-ETS emissions representing 73% of the total.

Ireland's non-ETS sector emissions in 2017 (i.e. the national total emissions less emissions covered by the EU's emissions trading scheme for stationary and aviation operators) are 43.83 Mt CO_2 eq. This value is 2.94 Mt CO_2 eq more than the annual limit for 2017, which indicates that Ireland will not be in compliance with its 2017 Effort Sharing Decision annual limit. Ireland's ESD targets (or annual emission allowances, AEAs) for the period 2013-2020 are shown in Figure 7.2.

Figure 7.2 Ireland's ESD Targets 2013-2020



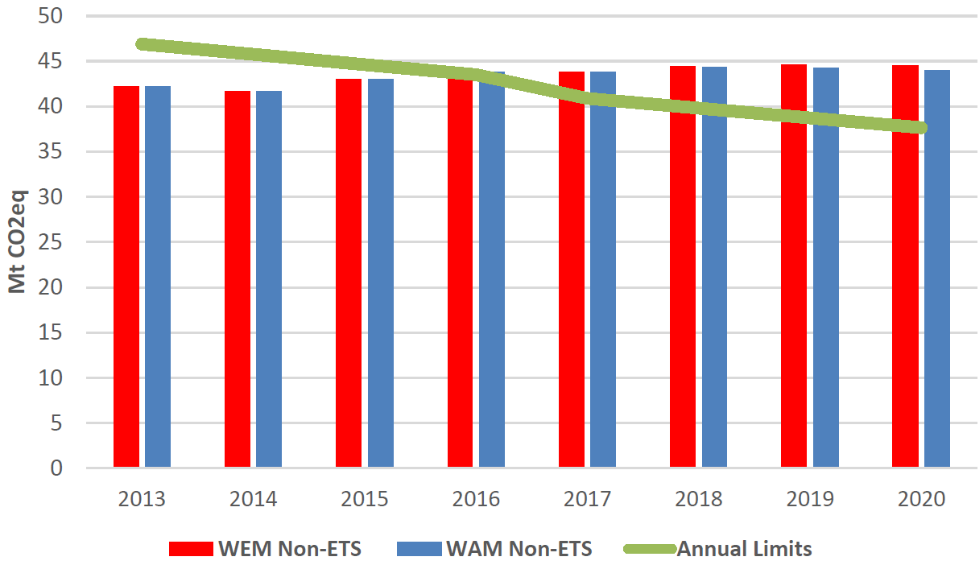
Source: Environmental Protection Agency [9]

The EPA publishes an annual report on greenhouse gas emission projections, the most recent of which details projections from 2018-2040 [11]. This report projects greenhouse gas emissions up to 2040 for two scenarios as follows:

- *With Existing Measures:* Assumes no additional policies and measures beyond those already in place by the end of 2017 are implemented; and
- *With Additional Measures:* Assumes implementation of the With Existing Measures scenario in addition to, based on current progress, further implementation of in the National Renewable Energy Action Plan (NREAP) [12] and the National Energy Efficiency Action Plan (NEEAP) [13] and more recently Ireland's National Development Plan 2018-2027 [14].

Figure 7.3 shows historic (2013-2017) and projected emission levels (2018-2020) for non-ETS sector emissions under the With Existing Measures and With Additional Measures scenarios. In addition, it shows the annual compliance/non-compliance in relation to the annual emission limits. Ireland's non-ETS emissions are projected to be 5% and 6% below 2005 levels in 2020 under the With Existing Measures and With Additional Measures scenarios, respectively. The target for Ireland is a 20% reduction.

Figure 7.3 With Measures and With Additional Measures greenhouse gas emission projections and comparison with the linear reduction pathway required between 2013 and 2020



Source: Environmental Protection Agency [11]

7.3 Potential Impact of the Proposed Development

7.3.1 Air Quality

The dominant source of air pollutant emissions resulting from the proposed development will be from road traffic. The air quality impact resulting from additional road traffic emissions as a result of the development has been modelled with the results presented below.

Locations Used For Modelling Assessment

Two receptors were modelled near the development; (1) at the R614 Ballyhooly Road / Dublin Hill link road junction; and (2) at the Ballyvolane Road / R614 Ballyhooly Road junction. Results are reported assuming average daily speeds of 30 km/hr and a worst-case rush hour speed of 10 km/hr. The discussion below is based on the higher average speed for all pollutants. The effect of reducing speeds to 10 km/hr is discussed separately.

Modelling Assessment Results – Do Nothing Scenario

NO_2

The results of the "do nothing" assessment for NO_2 in the opening year are shown in Table 7.7. The predicted concentrations are below the annual limit value of 40 µg/m^3. "Do nothing" annual average concentrations of NO_2 reach at most 83% of the annual limit value in 2029.

The DMRB screening assessment tool predicts annual average NO_2 concentrations only and cannot predict hourly mean NO_2 concentrations. However, the NRA / TII guidelines [1] state that the hourly mean standard is unlikely to be exceeded at roadside locations unless the annual mean is above 60 µg/m^3. The hourly mean NO_2 concentrations for the “do nothing” scenario are therefore expected to be well below the limit value of 200 µg/m^3.

<u>PM_{10}</u>

The results of the "do nothing" modelling assessment for PM_{10} in the opening year are shown in Table 7.7. Annual average PM_{10} concentrations reach 41% of the limit value of 40 µg/m^3 in 2029. There is one predicted exceedance of the 24-hour limit value of 50 µg/m^3 at the worst-case assessment locations.

<u>$PM_{2.5}$</u>

The results of the "do nothing" modelling assessment for $PM_{2.5}$ in the opening year are shown in Table 7.7. Annual average $PM_{2.5}$ concentrations reach at most 35% of the limit value of 25 µg/m^3 in 2024 and 36% of the limit in 2034.

Modelling Assessment Results – Do Something Scenario

<u>NO_2</u>

Predicted ambient NO_2 concentrations with the development in place (“do something”) are shown in Table 7.7. The predicted annual average NO_2 concentration (including background) with the development in place is equivalent to at most 84% of the annual limit value in 2029.

The results show an increase in pollutant concentrations of just over 0.3 µg/m^3. Based on the definitions set out in Table 7.2 and 7.3, the magnitude of change in NO_2 concentrations is imperceptible and the impact of the proposed development is imperceptible.

Since the annual average NO_2 concentrations are well below 60 µg/m^3, the hourly mean NO_2 concentrations are similarly expected to be well below the limit value of 200 µg/m^3.

<u>PM_{10}</u>

The modelled “do something” concentrations are equivalent to 41 - 42% of the annual average limit value in 2029. A comparison of the predicted “do nothing” and “do something” concentrations shows the predicted impact of the proposed development is below 0.4 µg/m^3 and is therefore defined as imperceptible (see Table 7.2). Based on the definitions set out in Table 7.3 the impact of the proposed development on ambient concentrations is negligible.

<u>$PM_{2.5}$</u>

The modelled “do something” concentrations are also equivalent to at most 43% of the annual average limit value in 2029. A comparison of the predicted “do nothing” and “do something” concentrations shows the predicted impact of the proposed development is below 0.25 µg/m^3 and is therefore defined as imperceptible (see Table 7.2). The impact of the proposed development on ambient $PM_{2.5}$ concentrations is therefore defined as negligible (see Table 7.3).

Variation in Traffic Speed (Worst-Case Scenario)

An assessment of the effect of changing the traffic speed (for the entire assessment year) from the higher speeds of 30 km/hr to a worst-case congestion speed of 10 km/hr has also been carried out for all pollutants (see Table 7.8). The results indicate that pollutant levels are increased at the worst-case traffic speed but are still below the air quality limit values.

Summary of Modelling Assessment

In summary, the proposed development will lead to an insignificant increase in pollutant levels. Using the assessment criteria outlined in Tables 7.2 - 7.4, the impact of the development in terms of NO_2, PM_{10} and $PM_{2.5}$ is negligible.

Table 7.7 Results of Dispersion Modelling Impact Assessment at Typical Road Traffic Speeds

Scenarios	***Assessment Locations[a]***	***Nitrogen Dioxide (µg/m³)***	***PM_{10} (µg/m³)***		***$PM_{2.5}$ (µg/m³)***
		Annual average	***Annual average***	***No. Days >50***	***Annual average***
2029	Location 1	33.1	16.8	1	7.9
Do Nothing	Location 2	33.1	16.8	1	7.9
2029	Location 1	33.5	16.8	1	7.9
Do Something	Location 2	33.5	16.8	1	7.9
Air Quality Limit Values[b]		*40*	*40*	*35*	*25*

a See Section 7.2 for details of locations used for the assessment.
b See Table 7.1.

Table 7.8 Results of Dispersion Modelling Impact Assessment at Worst-Case Road Traffic Speeds

Scenarios	***Assessment Locations[a]***	***Nitrogen Dioxide (µg/m³)***	***PM_{10} (µg/m³)***		***$PM_{2.5}$ (µg/m³)***
		Annual average	***Annual average***	***No. Days >50***	***Annual average***
2029	Location 1	37.9	18.0	1	9.1
Do Nothing	Location 2	37.9	18.0	1	9.1
2029	Location 1	38.4	18.1	1	9.2
Do Something	Location 2	38.4	18.1	1	9.2
Air Quality Limit Values[b]		*40*	*40*	*35*	*25*

a See Section 7.2 for details of locations used for the assessment.
b See Table 7.1.

7.3.2 Climate

Construction of the proposed development will lead to changes in the existing local terrain, which may slightly alter wind flow patterns and localised temperatures. However, these changes are unlikely to impact on local meteorological conditions. Thus, due to the size and the nature of the proposed development the impact on microclimate during construction and operation will be negligible.

With regard to macroclimate, the dominant source of CO_2 emissions resulting from the proposed development during operation will be from road traffic. During the construction phase, there will be additional CO_2 emissions resulting from the construction activities and the embodied CO_2 in the construction materials.

The results of modelling the regional impact assessment of the proposed development in the opening and design years are presented in Table 7.9. The results show that CO_2 emissions resulting from road traffic will be equal to 8.61 kt CO_2 eq in 2029 with the proposed development in place. The increase in CO_2 emissions resulting from the development in the opening year is 0.26 kt CO_2 eq.

The impact of the increased road traffic CO_2 emissions in 2029 is equivalent to at most 0.001% of Ireland's ESD target for non-ETS emissions in 2020 and thus the impact on macroclimate will be negligible.

Table 7.9 Dispersion Model Results - Regional Impact Assessment

Year	***Model Scenario***	***Model Results***
2029	Do Nothing	8.36 kt CO_2 eq
	Do Something	8.61 kt CO_2 eq
	Increase in Emissions	0.26 kt CO_2 eq
	Ireland's EU ESD Target for 2020	37,651 kt CO_2 eq
	Impact Relative to 2020 Target	0.001%

7.4 Mitigation

7.4.1 Air Quality

Construction Phase

Construction traffic will be the dominant source of emissions during construction. The air quality assessment has determined that the impact of development traffic on the pollutants NO_2, PM_{10} and $PM_{2.5}$ will be negligible. As is the case for developments of this type, the volume of construction traffic will be considerably less than development traffic during the operational phase of the development. Therefore, in addition to the size and nature of the construction activities, exhaust emissions from construction traffic during the construction phase will have a negligible impact on local air quality.

With regard to construction dust, once dust emissions are managed through the implementation of a satisfactory dust management plan (see Appendix 7.1) then the effect on PM_{10} and $PM_{2.5}$ concentrations (i.e. fine particulates) will be slight. Details of the dust management plan will be agreed with the planning authority.

The dust management plan will detail a set of mitigation measures to be put in place during the construction phase. The impact of dust emissions is dependent on the mitigation measures adopted. The requirement for mitigation measures will depend on meteorological conditions, the specific construction activities (i.e. relating to earthworks, construction and site vehicles) and the potential for dust nuisance as a result of those activities. Typical mitigation measures which will be required when there is the potential for dust nuisance are detailed below. An on-site record of all air quality / dust complaints should be maintained. The cause of any complaints should be identified and the measures taken to reduce emissions should be recorded.

The site should be designed such that machinery and dust causing activities are as far from nearby sensitive locations as possible. A barrier should be erected around the site to screen dusty activities. Material handling systems and site stockpiling of materials should be designed and laid out to minimise exposure to wind. Water misting or sprays should be used as required if particularly dusty activities are necessary during dry or windy periods. Water suppression should be used during dry and/or windy conditions to minimise dust emissions.

Site roads should be regularly cleaned and maintained. Hard surface roads should be swept to remove mud and aggregate materials from their surface. Site roads that have the potential to give rise to dust emissions should be watered as required during dry and/or windy conditions.

Vehicles delivering material with the potential for dust emissions should be enclosed or covered to restrict the escape of dust. Vehicles exiting the site should make use of a wheel wash facility prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site should be regularly inspected for cleanliness, and cleaned as necessary using water-assisted dust sweepers.

The dust management plan and control measures in place should be reviewed at regular intervals during the construction phase to ensure the effectiveness of the control measures and to improve these measures where needed.

Operation Phase

Mitigation measures in relation to traffic-derived pollutants are managed at a strategic level by EU legislation on vehicle emissions and fuel quality. The results of the dispersion modelling assessment show that there are no requirements for local management of air quality during the operation phase of the development.

7.4.2 Climate

Construction Phase

The embodied CO_2 in construction can be reduced at project specification / procurement through leaner design, designing out waste, reusing materials, and selecting materials with lower embodied carbon over the project life-cycle [15].

Operation Phase

The policy and legislative measures in place in Ireland with regard to reducing national greenhouse gas emissions are discussed in Section 7.2.2. These measures will lead to a reduction in CO_2 emissions from road traffic.

7.5 Residual Impacts

The results of the air quality and climate impact assessment show that the predicted impact of the proposed development will be negligible. Thus there will be no residual impacts on air quality and climate resulting from the development.

7.6 Monitoring

Monitoring during the operational phase is not required. It is recommended that dust monitoring be conducted during construction to assess nuisance dust levels.

7.7 Interactions

The generation of traffic during the construction and operation stages of the development leads to increased vehicle emissions and thereby interacts with air quality and climate. Furthermore, the effects of increased pollution and CO_2 emissions interact with population and human health. The results of this assessment show that these impacts will be negligible.

7.8 References

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