

Chapter 9:

Air Quality and Climate

9.0 AIR QUALITY AND CLIMATE

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts associated with the proposed residential development at Golf Lane, Carrickmines, Dublin 18. The proposed development will involve construction of residential apartment blocks with associated resident support facilities and amenities, along with a childcare facility, local shop, and gym. Two basement levels will be provided to accommodate bicycle and car parking, bin stores, and other plant and ancillary spaces. The total gross site area comprises 2.56 hectares.

This chapter was completed by Ciara Nolan, an environmental consultant in the air quality section of AWN Consulting Ltd. She holds an MSc. (First Class) in Environmental Science from University College Dublin and has also completed a BSc. in Energy Systems Engineering. She is an Associate Member of both the Institute of Air Quality Management and the Institution of Environmental Science. She has been active in the field of air quality for 4 years, with a primary focus on consultancy.

9.2 STUDY METHODOLOGY

This chapter has been prepared having regard to the following guidelines:

- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports – Draft (EPA, 2017)
- Advice Note on Preparing Environmental Impact Statements – Draft (EPA, 2015)
- Advice Notes On Current Practice (In The Preparation Of Environmental Impact Statements) (EPA, 2003)
- Guidelines On Information To Be Contained in Environmental Impact Statements (EPA, 2002)
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, 2013)
- Guidance on the Assessment of Dust from Demolition and Construction Version 1.1 (Institute of Air Quality Management (IAQM), 2014)
- UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality (UK Highways Agency, 2019a)
- UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate (UK Highways Agency, 2019b)

9.2.1 Criteria for Rating of Impacts

Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 and Appendix 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants. The limit values for NO₂, PM₁₀, PM_{2.5}, benzene and CO are relevant to this assessment as these are traffic related pollutants (see Table 9.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 9.1).

Pollutant	Regulation ^{Note 1}	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m ³
		Annual limit for protection of human health	40 µg/m ³
		Critical level for protection of vegetation	30 µg/m ³ NO + NO ₂
Particulate Matter (as PM ₁₀)	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m ³
		Annual limit for protection of human health	40 µg/m ³
Particulate Matter (as PM _{2.5})	2008/50/EC	Annual limit for protection of human health	25 µg/m ³
Benzene	2008/50/EC	Annual limit for protection of human health	5 µg/m ³
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m ³ (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 9.1: Air Quality Standards Regulations

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM₁₀) and less than 2.5 microns (PM_{2.5}) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM₁₀ and PM_{2.5}.

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

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m²*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government (DEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m²*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

Climate Agreements

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

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

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland 'to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'.

The Act makes provision for, *inter alia*, a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

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

The Dun Laoghaire - Rathdown County Council Climate Change Action Plan 2019 – 2024 published in 2019 (Dun Laoghaire - Rathdown County Council and Codema, 2019) outlines a number of goals and plans to prepare for and adapt to climate change. There are five key action areas within the plan: Energy and Buildings, Transport, Flood Resilience, Nature-based Solutions and Resource Management. Some of the measures promoted within the Action Plan under the 5 key areas involve building retrofits, energy master-planning, better integration of transport and land use planning, increasing public bike facilities, developing public transport routes, development of flood resilient designs, promotion of the use of green infrastructure and waste prevention initiatives. The implementation of these measures will enable the Dun Laoghaire - Rathdown County Council area 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 Action Plan and incorporate climate friendly designs and measures where possible.

9.2.2 Assessment of Construction Phase

The current assessment focuses on identifying the existing baseline levels of PM₁₀ and PM_{2.5} in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the impact of the construction phase of the development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the proposed development.

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

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

The construction stage traffic will not change AADT numbers by 1,000 or more nor will the number of HGV change by 200 or more. Therefore, the above scoping criteria is not met and the construction stage traffic has been scoped out from any further assessment as there is no potential for significant impacts to air quality.

9.2.3 Assessment of Operational Phase

Air Quality Assessment

The air quality assessment has been carried out following procedures described in the publications by the EPA (2015; 2017) and using the methodology outlined in the guidance documents published by the UK Highways Agency (2019a) and UK Department of Environment Food and Rural Affairs (DEFRA) (2016; 2018). Transport Infrastructure Ireland (TII) reference the use of the UK Highways Agency and DEFRA guidance and methodology in their document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011). This approach is considered best practice in the absence of Irish guidance and can be applied to any development that causes a change in traffic.

In 2019 the UK Highways Agency DMRB air quality guidance was revised with *LA 105 Air Quality* replacing a number of key pieces of guidance (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). This revised document outlines a number of changes for air quality assessments in relation to road schemes, but can be applied to any development that causes a change in traffic. Previously the DMRB air quality spreadsheet was used for the majority of assessments in Ireland with detailed modelling only required if this screening tool indicated compliance issues with the EU air quality standards. Guidance from Transport Infrastructure Ireland (TII, 2011) recommends the use of the UK Highways Agency DMRB spreadsheet tool for assessing the air quality impacts from road schemes. However, the DMRB spreadsheet tool was last revised in 2007 and accounts for modelled years up to 2025. Vehicle emission standards up to Euro V are included but since 2017, Euro 6d standards are applicable for the new fleet. In addition, the model does not account for electric or hybrid vehicle use. Therefore, this is a somewhat outdated assessment tool. The *LA 105* guidance document states that the DMRB spreadsheet tool may still be used for simple air quality assessments where there is unlikely to be a breach of the air quality standards. Due to its use of a “dirtier” fleet, vehicle emissions would be considered to be higher than more modern models and therefore any results will be conservative in nature and will provide a worst-case assessment.

The 2019 UK Highways Agency DMRB air quality revised guidance *LA 105 Air Quality* states that modelling should be conducted for NO₂ for the base, opening and design years for both the do minimum (do nothing) and do something scenarios. Modelling of PM₁₀ is only required for the base year to demonstrate that the air quality limit values in relation to PM₁₀ are not breached. Where the air quality modelling indicates exceedances of the PM₁₀ air quality limits in the base year then PM₁₀ should be included in the air quality model in the do minimum and do something scenarios. Modelling of PM_{2.5} is not required as there are currently no issues with compliance with regard to this pollutant. The modelling of PM₁₀ can be used to show that the project does not impact on the PM_{2.5} limit value as if compliance with the PM₁₀ limit is achieved then compliance with the PM_{2.5} limit will also be achieved. Historically modelling of carbon monoxide (CO) and benzene (Bz) was required however, this is no longer needed as concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (EPA, 2019b). The key pollutant reviewed in this assessment is NO₂. Concentrations of PM₁₀ have been modelled for the base year to indicate that there are no potential compliance issues. Modelling of operational NO₂ concentrations has been conducted for the do nothing and do something scenarios for the opening year (2023) and design year (2038).

The TII guidance (2011) states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK DMRB scoping criteria outlined in Section 9.2.2 has been used in the current assessment to determine the road links required for inclusion in the modelling assessment. Sensitive receptors within 200m of impacted road links are included within the modelling assessment. Pollutant concentrations are calculated at these sensitive receptor locations to determine the impact of the proposed development in terms of air quality. The guidance states a proportionate number of representative receptors which are located in areas which will experience the highest concentrations or greatest improvements as a result of the proposed development are to be included in the modelling (UK Highways Agency, 2019a). The TII guidance (2011) defines 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. A total of three high sensitivity residential receptors (R1 – R3) were included in the modelling assessment and are detailed in Figure 9.1.

The following model inputs are required to complete the assessment using the DMRB spreadsheet tool: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles (%HGV), annual average traffic speeds and background concentrations. Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The DMRB model uses conservative emission factors, the formulae for which are outlined in the DMRB Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the proposed development with these ambient air quality standards.

The TII document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) details a methodology for determining air quality impact significance criteria for road schemes which can be applied to any project that causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. The TII significance criteria have been adopted for the proposed development and are detailed in Appendix 9.2 Table A9.2.1 to Table A9.2.3. The significance criteria are based on NO₂ and PM₁₀ as these pollutants are most likely to exceed the annual mean limit values (40 µg/m³).

Conversion of NO_x to NO₂

NO_x (NO + NO₂) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGV's the proportion of NO_x emitted as NO₂, rather than NO is increasing. With the correct conditions (presence of sunlight and O₃) emissions in the form of NO, have the potential to be converted to NO₂.

Transport Infrastructure Ireland states the recommended method for the conversion of NO_x to NO₂ in "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" (2011). The TII guidelines recommend the use of DEFRA's NO_x to NO₂ calculator (2020) which was originally published in 2009 and is currently on version 8.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O₃ and proportion of NO_x emitted as NO for each local authority across the UK. O₃ is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO₂ or PM₁₀.

The calculator includes Local Authorities in Northern Ireland and the TII guidance recommends the use of 'Armagh, Banbridge and Craigavon' as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO₂ and NO_x for Ireland. The "All Other-Urban UK Traffic" traffic mix option was used.

Update to NO₂ Projections using DMRB

In 2011 the UK DEFRA published research (Highways England, 2013) on the long term trends in NO₂ and NO_x for roadside monitoring sites in the UK. This study marked a decrease in NO₂ concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO₂ concentrations which UK DEFRA previously published and monitored concentrations. The impact of this ‘gap’ is that the DMRB screening model can under-predict NO₂ concentrations for predicted future years. Subsequently, the UK Highways Agency published an Interim advice note (IAN 170/12) in order to correct the DMRB results for future years. This methodology has been used in the current assessment to predict future concentrations of NO₂ as a result of the proposed development.

Traffic Data Used in Modelling Assessment

Traffic flow information was obtained from DBFL Consulting Engineers on 05/05/2020 for the purposes of this assessment. Data for the Do Nothing and Do Something scenarios for the base year 2017, opening year 2023 and design year 2038 were provided. The traffic data is detailed in Table 9.2 with the %HGV shown in parenthesis beside the AADT. Only road links that met the DMRB scoping criteria outlined in Section 9.2.3 and that were within 200m of receptors were included in the modelling assessment. Background concentrations have been included as per Section 9.3.3 of this chapter based on available EPA background monitoring data (EPA, 2020b).

This traffic data has also been used in the operational stage climate impact assessment.

Road Name	Speed (kph)	Base Year 2017	Opening Year 2023		Design Year 2038	
			Do Nothing	Do Something	Do Nothing	Do Something
Golf Lane (A)	50	510 (0%)	1,037 (0%)	2,420 (0.4%)	550 (0%)	1,934 (0.5%)
Glenamuck Road (B)	50	12,940 (4.2%)	17,148 (3.8%)	19,425 (3.4%)	3,265 (1.5%)	3,292 (1.6%)
Glenamuck Road (D)	50	17,397 (3.8%)	22,033 (3.6%)	23,140 (3.4%)	25,065 (4.2%)	26,071 (4.1%)
Glenamuck Road (G)	50	20,110 (3.6%)	24,528 (3.5%)	25,634 (3.4%)	26,972 (4.3%)	27,979 (4.2%)

Table 9.2: Traffic Data Used in Modelling Assessment



Figure 9.1: Approximate Location of Receptors used in Local Air Quality Modelling Assessment

Air Quality Impact on Ecological Sites

For routes that pass within 2 km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an ecologist (TII, 2011). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed scheme and when significant changes in AADT (>5%) occur. Only sites that are sensitive to nitrogen deposition should be included in the assessment. In addition, the UK Highways Agency (2019) states that a detailed assessment does not need to be conducted for areas that have been designated for geological features or watercourses.

Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (2009) and *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities* (DEHLG, 2010) provide details regarding the legal protection of designated conservation areas.

If both of the following assessment criteria are met, an assessment of the potential for impact due to nitrogen deposition should be conducted:

- A designated area of conservation is located within 200 m of the proposed development; and
- A significant change in AADT flows (>5%) will occur.

There are no designated sites within 200m of any of the road links impacted by the proposed development. Therefore, a detailed NO_x assessment is not required.

Climate Assessment

Ireland has annual GHG targets which are set at an EU level and need to be complied with in order to reduce the impact of climate change. Impacts to climate as a result of GHG emissions are assessed against the targets set out by the EU under *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013*. Which has set a target of a 30% reduction in non-ETS sector emissions by 2030 relative to 2005 levels.

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established by reference to EPA data on annual GHG emissions (see Section 9.3.4). Thereafter the impact of the proposed development on climate is determined. Emissions from road traffic associated with the proposed development have the potential to emit carbon dioxide (CO₂) which will impact climate.

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

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

There are a small number of road links that will experience an increase of 10% or more in the AADT. These road links have been included in the detailed climate assessment (see Table 9.2). The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland (2011) and the methodology provided in Annex D in the UK Design Manual for Roads and Bridges (UK Highways Agency, 2007). The assessment focused on determining the resulting change in emissions of carbon dioxide (CO₂). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes and can be applied to any project that causes a change in traffic. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds (see Table 9.2).

The EU guidance (2013) also states indirect GHG emissions as a result of a development must be considered, this includes emissions associated with energy usage. The Building Lifecycle Report and Sustainability & Energy Statement prepared in relation to this assessment have been reviewed and used to inform the operational phase climate assessment. These reports outline a number of measures in relation to energy usage from the proposed development primarily in relation to heat and electricity. A number of measures have been incorporated into the overall design of the development to reduce the impact to climate where possible.

9.3 EXISTING RECEIVING ENVIRONMENT

9.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted.

In relation to PM₁₀, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than PM_{2.5}) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles (PM_{2.5} - PM₁₀) will actually increase at higher wind speeds. Thus, measured levels of PM₁₀ will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 20 km north of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.2). For data collated during five representative years (2015 – 2019), the predominant wind direction is westerly to south-westerly with a mean wind speed of 5.3 m/s over the period 2005 – 2019 (Met Eireann, 2020).

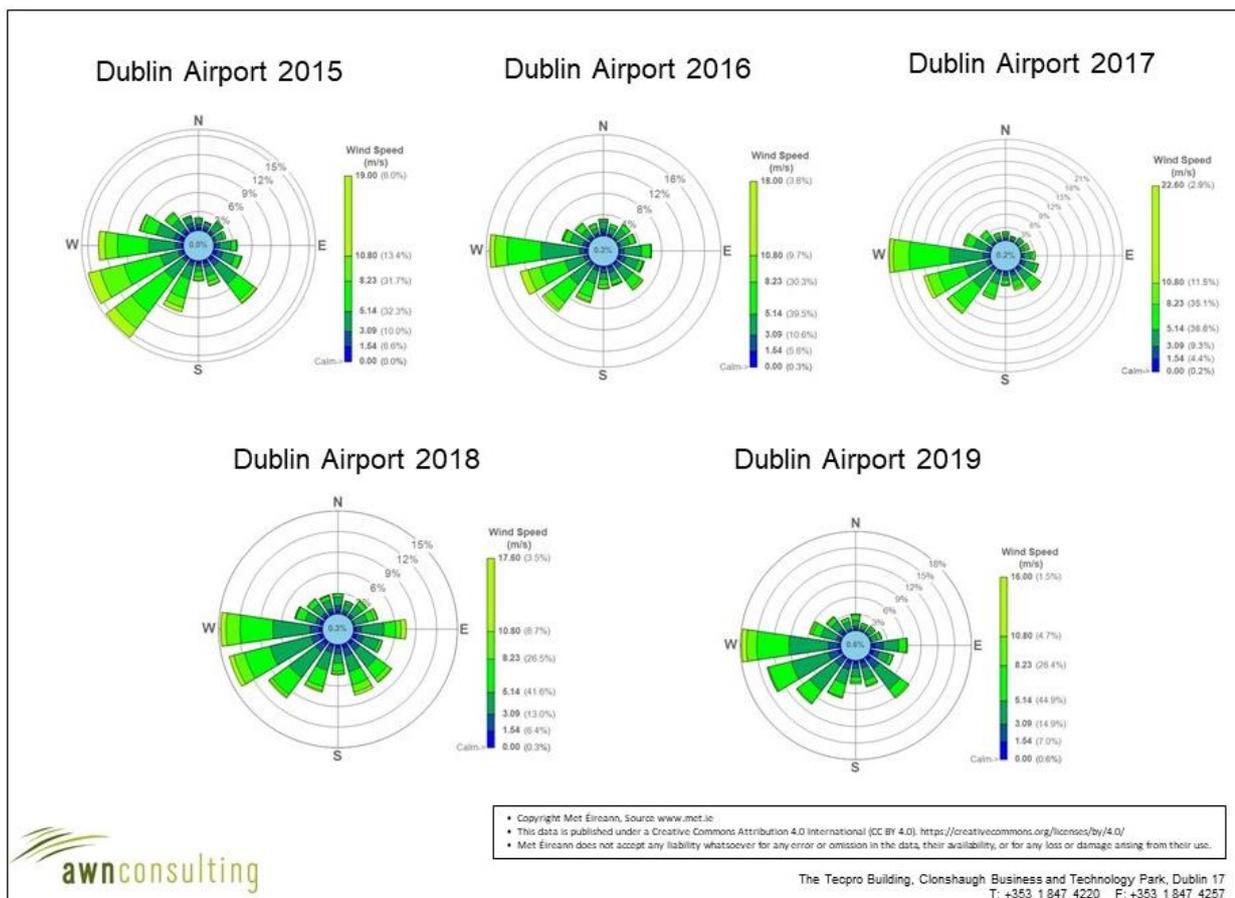


Figure 9.2: Dublin Airport Windrose 2015 – 2019

9.3.2 Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources (WHO, 2006). Thus, residential exposure is determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In assessing baseline air quality, two tools are generally used: ambient air monitoring and air dispersion modelling. In order to adequately characterise the current baseline environment through monitoring, comprehensive measurements would be required at a number of key receptors for PM₁₀, NO₂ and benzene. In addition, two of the key pollutants identified in the scoping study (PM₁₀ and NO₂) have limit values which require assessment over time periods varying from one hour to one year. Thus, continuous monitoring over at least a one-year period at a number of locations would be necessary in order to fully determine compliance for these

pollutants. Although this study would provide information on current air quality it would not be able to provide predictive information on baseline conditions (UK DETR, 1998), which are the conditions which prevail just prior to opening in the absence of the development. Hence the impacts of the development were fully assessed by air dispersion modelling (UK DETR, 1998) which is the most practical tool for this purpose. The baseline environment has also been assessed using modelling, since the use of the same predictive technique for both the 'do-nothing' and 'do-something' scenario will minimise errors and allow an accurate determination of the relative impact of the development.

9.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA. The most recent annual report on air quality in Ireland is “*Air Quality In Ireland 2019*” (EPA, 2020b). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2020b).

As part of the implementation of the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), as amended, four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2020b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development site is within Zone A (EPA, 2020c). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

Long-term NO₂ monitoring was carried out at the Zone A urban background locations of Rathmines, Dún Laoghaire, Swords and Ballyfermot for the period 2015 - 2019 (EPA, 2020b). Long term average concentrations are significantly below the annual average limit of 40 µg/m³, average results range from 13 – 22 µg/m³ for the suburban background locations. The NO₂ annual average for this five year period suggests an upper average limit of no more than 19 µg/m³ (Table 9.3) for the urban background locations. Based on the above information, a conservative estimate of the current background NO₂ concentration for the region of the proposed development is 19 µg/m³.

Station	Averaging Period ^{Note 1}	Year				
		2015	2016	2017	2018	2019
Rathmines	Annual Mean NO ₂ (µg/m ³)	18	20	17	20	22
	Max 1-hr NO ₂ (µg/m ³)	106	102	116	138	183
Dun Laoghaire	Annual Mean NO ₂ (µg/m ³)	16	19	17	19	15
	Max 1-hr NO ₂ (µg/m ³)	103	142	153	135	104
Swords	Annual Mean NO ₂ (µg/m ³)	13	16	14	16	15
	Max 1-hr NO ₂ (µg/m ³)	170	206	107	112	108
Ballyfermot	Annual Mean NO ₂ (µg/m ³)	16	17	17	17	20
	Max 1-hr NO ₂ (µg/m ³)	142	127	148	217	124

Note 1 Annual average limit value - 40 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

1-hour limit value - 200 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.3: Trends In Zone A Air Quality - Nitrogen Dioxide (NO₂)

Continuous PM₁₀ monitoring was carried out at five Zone A locations from 2015 - 2019, Ballyfermot, Rathmines, Dún Laoghaire, Tallaght and Phoenix Park. These showed an upper average limit of no more than 16 µg/m³ (Table 9.4). Levels range from 9 - 16 µg/m³ over the five year period with at most 9 exceedances (in Rathmines)

of the 24-hour limit value of 50 µg/m³ in 2019 (35 exceedances are permitted per year) (EPA,2020b). Based on the EPA data, a conservative estimate of the current background PM₁₀ concentration in the region of the proposed development is 16 µg/m³.

Station	Averaging Period ^{Note 1}	Year				
		2015	2016	2017	2018	2019
Ballyfermot	Annual Mean PM ₁₀ (µg/m ³)	12	11	12	16	14
	24-hr Mean > 50 µg/m ³ (days)	3	0	1	0	7
Dún Laoghaire	Annual Mean PM ₁₀ (µg/m ³)	13	13	12	13	12
	24-hr Mean > 50 µg/m ³ (days)	3	0	2	0	2
Tallaght	Annual Mean PM ₁₀ (µg/m ³)	14	14	12	15	12
	24-hr Mean > 50 µg/m ³ (days)	4	0	2	1	3
Rathmines	Annual Mean PM ₁₀ (µg/m ³)	15	15	13	15	15
	24-hr Mean > 50 µg/m ³ (days)	5	3	5	2	9
Phoenix Park	Annual Mean PM ₁₀ (µg/m ³)	12	11	9	11	11
	24-hr Mean > 50 µg/m ³ (days)	2	0	1	0	2

Note1 Annual average limit value - 40 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Daily limit value - 50 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.4: Trends In Zone A Air Quality - PM₁₀

Average PM_{2.5} levels in Rathmines over the period 2015 - 2019 ranged from 8 - 10 µg/m³, with a PM_{2.5}/PM₁₀ ratio ranging from 0.53 – 0.68 (EPA, 2020b). Based on this information, a conservative ratio of 0.7 was used to generate an existing PM_{2.5} concentration in the region of the development of 11.2 µg/m³.

In terms of benzene, the annual mean concentration in the Zone A monitoring location of Rathmines for 2019 was 0.3 µg/m³. This is well below the limit value of 5 µg/m³. Between 2015 - 2019 annual mean concentrations at the Zone A site ranged from 0.3 – 1.0 µg/m³. Based on this EPA data a conservative estimate of the current background benzene concentration in the region of the proposed development is 1.0 µg/m³.

With regard to CO, annual averages at the Zone A, locations of Winetavern Street and Coleraine Street over the 2015 – 2019 period are low, peaking at 0.5 mg/m³ which is well below the limit value of 10 mg/m³ (EPA, 2020b). Based on this EPA data, a conservative estimate of the current background CO concentration in the region of the proposed development is 0.5 mg/m³.

Background concentrations for the Opening Year 2023 and Design Year of 2038 have been calculated for the local air quality assessment. These have used current estimated background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

9.3.4 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details provisional emissions up to 2019 (EPA, 2020d). The data published in 2020 states that Ireland will exceed its 2019 annual limit set under the EU’s Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.98 Mt. For 2019, total national greenhouse gas emissions are estimated to be 59.90 million tonnes carbon dioxide equivalent (Mt CO₂eq) with 45.71 MtCO₂eq of emissions associated with

the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2019 at 35.3% of the total, with the transport sector accounting for 20.3% of emissions of CO₂.

GHG emissions for 2019 are estimated to be 4.5% lower than those recorded in 2018. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for four years in a row. Emissions from 2016 – 2019 exceeded the annual EU targets by 0.29 MtCO₂eq, 2.94 MtCO₂eq, 5.57 MtCO₂eq and 6.98 MtCO₂eq respectively. Agriculture is consistently the largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2019 GHG Emissions Projections Report for 2018 – 2040 (EPA 2019b) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018. Implementation of these are classed as a “*With Additional Measures scenario*” for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 – 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 10 Mt CO₂eq under the “*With Existing Measures*” scenario and 9 Mt CO₂eq under the “*With Additional Measures*” scenario (EPA, 2019b).

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development comprises a residential development of 482 no. units (all apartments), along with ancillary residential amenities, and provision of a childcare facility, gym, and local shop. The proposed residential units comprise 31 no. studio units, 183 no. 1-bedroom units, 229 no. 2-bedroom units, and 39 no. 3-bedroom units (including 2 no. duplex type units).

The proposed development is set out in 7 no. blocks which comprise the following:

- Block A1 comprises 62. no. apartments within a part four, part six storey building, including 10 no. studio units, 7 no. 1-bedroom units, 41 no. 2 bedroom units, and 4 no. 3-bedroom units. An ESB substation is provided at ground floor level.
- Block A2 comprises 85 no. apartments within a part four, part eight storey building, including 25 no. 1-bedroom units, 45 no. 2-bedroom units, and 15 no. 3-bedroom units.
- Block A3 comprises 79 no. apartments within a part four, part twelve storey building, including 21 no. studio units, 19 no. 1-bedroom units, 28 no. 2-bedroom units, and 11 no. 3-bedroom units.
- Block B0 comprises 150 no. apartments and resident's amenities within a part four, part eighteen, part twenty-one and part twenty-two storey building. The apartments include 76 no. 1-bedroom units, 68 no. 2-bedroom units, and 6 no. 3-bedroom units (including 2 no. duplex type units). An ESB substation, resident's concierge area and amenity space (171 sq.m sq.m) are provided at ground floor level. A further resident's amenity / event space is provided at the twentieth and twenty-first floor levels (83 sq.m).
- Block B1 comprises 8 no. apartments and is four storeys in height, directly abutting Block B. The apartments include 4 no. 1-bedroom units, and 4 no. 2-bedroom units.
- Block C comprises 42 no. apartments and a local shop within a part five, part seven storey building. The apartments include 30 no. 1-bedroom units, 9 no. 2-bedroom units, and 3 no. 3-bedroom units. A local shop (154 sq.m) and an ESB substation are provided at ground floor level.
- Block D comprises 56 no. apartments, a commercial gym, resident's concierge area, resident's lounge, and a childcare facility in a part four, part seven storey building. The apartments include 22 no. 1-bedroom units, and 34 no. 2-bedroom units. The resident's concierge area (99 sq.m), commercial gym

(340 sq.m), and childcare facility (300 sq.m) units are located at ground floor level. The resident's lounge (292 sq.m) is located at first floor level.

Two basement levels are proposed, providing car parking spaces (299 no.), bin stores, plant rooms, bicycle parking (1,000 no. spaces), and circulation areas. A further 240 no. bicycle parking spaces and 4 no. car parking spaces are provided at ground level. The proposed development includes landscaping, boundary treatments, public, private and communal open space (including roof terraces), two cycle / pedestrian crossings over the stream at the western side of the site, along with a new pedestrian and cycle crossing of Glenamuck Road South at the west of the site, cycle and pedestrian facilities, play facilities, and lighting. The proposed buildings include the provision of private open space in the form of balconies and winter gardens to all elevations of the proposed buildings. The development also includes vehicular, pedestrian, and cycle accesses, drop off areas, boundary treatments, services, and all associated ancillary and site development works.

A full description of the development can be found in Chapter 2.

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

- Construction phase, and;
- Operational phase.

9.4.1 Construction Phase

The key elements of construction of the proposed development with potential for air quality and climate impacts are:

- Potential fugitive dust emissions from general site preparation and construction activities;
- Potential fugitive dust emissions from trucks associated with construction;
- Engine emissions from construction vehicles and machinery.

The construction phase impacts will be short-term in duration.

9.4.2 Operational Phase

The key elements of operation of the proposed development with potential for air quality and climate impacts are:

- A change in traffic flows on road links nearby the proposed development.

The potential sources of air and climatic emissions during the operational phase of the proposed development are deemed long-term.

9.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

9.5.1 Construction Stage

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. The proposed development can be considered moderate in scale and therefore there is the potential for significant dust soiling 50 m from the source (TII, 2011) (Table 9.5). While construction dust tends to be deposited within 200 m of a construction site, the majority of the deposition occurs within the first 50 m. There are a number of high sensitivity receptors (residential properties) to the direct south and west of the site boundary. In the absence of mitigation there is the potential for significant, negative, short-term impacts to nearby sensitive receptors as a result of dust emissions from the proposed development.

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	Description	Soiling	PM ₁₀	Vegetation Effects
Major	Large construction sites with high use of haul routes	100m	25m	25m
Moderate	Moderate sized construction sites with moderate use of haul routes	50m	15m	15m
Minor	Minor construction sites with limited use of haul routes	25m	10m	10m

Source: Appendix 8: Assessment of Construction Impacts taken from “Guidelines for the treatment of Air Quality During the Planning & Construction of National Road Schemes” (TII, 2011)

Table 9.5: Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. The construction stage traffic has been reviewed and a detailed air quality assessment has been scoped out as none of the road links impacted by the proposed development satisfy the DMRB assessment criteria in Section 9.2.2 and referenced below.

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

The construction stage traffic has the potential for a negative, imperceptible and short-term impact on air quality.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO₂ and N₂O emissions. The Institute of Air Quality Management document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on climate. Therefore, the potential impact on climate is considered to be imperceptible and short-term.

Human Health

Dust emissions from the construction phase of the proposed development have the potential to impact human health through the release of PM₁₀ and PM_{2.5} emissions. As per Table 9.5 significant PM₁₀ emissions can occur within 15m of the site for a development of this scale. There are a number of high sensitivity (residential) receptors to the direct south and west of the site however, only one property is within 15m of the site. Therefore, in the absence of mitigation there is the potential for slight, negative, short-term impacts to human health as a result of the proposed development.

9.5.2 Operational Phase

Air Quality

The potential impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. The impact of NO₂ emissions for the opening and design years was predicted at the nearest sensitive receptors to the development. This assessment allows the significance of the development, with respect to both relative and absolute impacts, to be determined.

Transport Infrastructure Ireland's document *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (2011) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any development that causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Results are compared against the 'Do-Nothing' scenario, which assumes that the proposed development is not in place in future years, in order to determine the degree of impact.

The results of the assessment of the impact of the proposed development on NO₂ in the opening year 2023 are shown in Table 9.6 and for design year 2038 are shown in Table 9.7. The annual average concentration is in compliance with the limit value at all worst-case receptors in 2023 and 2038. Concentrations of NO₂ are at most 54% of the annual limit value in 2023 and at most 48% in 2038. There are some increases in traffic volumes between 2023 and 2038, therefore any reductions in concentrations is due to decreased background values. In addition, the hourly limit value for NO₂ is 200 µg/m³ and is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The maximum 1-hour NO₂ concentration is not predicted to be exceeded in any modelled year (Table 9.8).

The impact of the proposed development on annual mean NO₂ concentrations can be assessed relative to "Do Nothing (DN)" levels. Relative to baseline levels, there are predicted to be some imperceptible increases in NO₂ concentrations at receptors R1 – R3. Concentrations will increase by at most 0.9% of the relevant limit value in 2023 and 2038 at receptor R1. Using the assessment criteria outlined in Appendix 9.2, Table A9.2.1 and Table A9.2.2 the impact of the proposed development in terms of NO₂ is considered negligible. Therefore, the overall impact of NO₂ concentrations as a result of the proposed scheme is long-term, negative and imperceptible.

Concentrations of PM₁₀ were modelled for the baseline year of 2017. The modelling showed that concentrations were in compliance with the annual limit value of 40 µg/m³ at all receptors assessed, therefore, further modelling for the opening and design years was not required. Concentrations reached at most 0.58 µg/m³. When a background concentration of 16 µg/m³ is included the overall impact is 41% of the annual limit value at the worst case receptor.

The impact of the proposed development on ambient air quality in the operational stage is considered long-term, localised, negative and imperceptible and therefore, no mitigation is required.

Receptor	Opening Year 2023				
	DN	DS	DS-DN	Magnitude	Description
R1	18.4	18.7	0.34	Imperceptible	Negligible Increase
R2	21.4	21.5	0.05	Imperceptible	Negligible Increase
R3	19.9	20.0	0.01	Imperceptible	Negligible Increase

Table 9.6: Predicted Annual Mean NO₂ Concentrations – Opening Year 2023 (µg/m³)

Receptor	Design Year 2038				
	DN	DS	DS-DN	Magnitude	Description
R1	17.3	17.7	0.37	Imperceptible	Negligible Increase
R2	17.4	17.4	0.01	Imperceptible	Negligible Increase
R3	19.1	19.1	0.01	Imperceptible	Negligible Increase

Table 9.7: Predicted Annual Mean NO₂ Concentrations – Design Year 2038 (µg/m³)

Receptor	Opening Year 2023		Design Year 2038	
	DN	DS	DN	DS
R1	64.4	65.6	60.6	61.9
R2	75.0	75.2	60.7	60.8
R3	69.8	69.9	66.9	67.0

Table 9.8: Predicted 99.8th percentile of Daily Maximum 1-hour NO₂ Concentrations (µg/m³)

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development. The predicted concentrations of CO₂ for the future years of 2023 and 2038 are detailed in Table 9.9. These are significantly less than the 2020 and 2030 targets set out under EU legislation. It is predicted that in 2023 the proposed development will increase CO₂ emissions by 0.00021% of the EU 2020 target. In 2038 CO₂ emissions will increase by 0.00020% of the 2030 target. Therefore, the climate impact of the proposed development is considered negative, long-term and imperceptible.

Year	Scenario	CO ₂
		(tonnes/annum)
2023	Do Nothing	1,461
	Do Something	1,539
2038	Do Nothing	1,641
	Do Something	1,708
Increment in 2023		78.0 Tonnes
Increment in 2038		66.9 Tonnes
Emission Ceiling (kilo Tonnes) 2020		37,943 ^{Note 1}
Emission Ceiling (kilo Tonnes) 2030		32,860 ^{Note 2}
Impact in 2023 (%)		0.00021 %
Impact in 2038 (%)		0.00020 %

Note 1 Target under *European Commission Decision 2017/1471 of 10th August 2017 and amending decision 2013/162/EU to revise Member States' annual emissions allocations for the period from 2017 to 2020*

Note 2 Target under *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013*

Table 9.9: Climate Impact Assessment

Human Health

Traffic related air emissions have the potential to impact air quality which can affect human health. However, air dispersion modelling of traffic emissions has shown that levels of all pollutants are below the ambient air

quality standards set for the protection of human health. It can be determined that the impact to human health during the operational stage is long-term, negative and imperceptible and therefore, no mitigation is required.

9.6 DO NOTHING IMPACT

The Do Nothing scenario includes retention of the current site without the proposed development in place. In this scenario, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc).

9.7 MITIGATION MEASURES

There is the potential for a number of impacts to air quality and climate during the construction and operational phases of the proposed development. Construction dust emissions are considered the primary source of air quality impacts associated with the proposed development. To avoid any potential significant impacts the following mitigation measures have been proposed.

9.7.1 Demolition & Construction Phase

Air Quality

AIRCONST1: The proactive control of fugitive dust will ensure the prevention of significant emissions. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 9.3. These measures have been incorporated into the overall Construction Environmental Management Plan (CEMP) prepared in respect of the proposed development.

In summary the measures which will be implemented will include:

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

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

Climate

AIRCONST2: Demolition and construction stage traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO₂ and N₂O emissions. However, due to short-term nature of these works, the impact on climate will not be significant.

Nevertheless, some site-specific mitigation measures will be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular, the prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

9.7.2 Operational Stage

The impact of the operational traffic associated with proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no additional site specific mitigation measures are required.

AIR OPER 1: Impacts to climate can occur as a result of electricity usage for heating and lighting from the proposed development. However, the proposed development has been designed to reduce the impact to climate as much as possible during the operational phase. The Building Lifecycle Report and Sustainability & Energy Statement prepared by JAK Consulting Engineers in support of this planning application outline the measures to be implemented to reduce impacts to climate. Firstly, the proposed development is located in close proximity to a number of good transport and cycling routes including Luas and bus routes which will promote more sustainable modes of transport and reduce GHG emissions. The residential units will comply with the Part L (2019) building regulations and will be Nearly Zero Energy Buildings (NZEB) compliant. The key design elements outlined in the Sustainability & Energy Statement include:

- High performance triple glass in the windows.
- High levels of insulation.
- A+ Low energy LED lighting throughout the development.
- High levels of air-tightness of the dwellings.
- High efficiency heat pump for each unit serving heating, hot water and ventilation requirements.

In addition, natural lighting will be utilised as much as possible with artificial lighting to include LEDs to reduce energy demand and thus GHG emissions from electricity supply. Natural ventilation will be used in the basement areas where possible to avoid the need for mechanical systems and reduce the building's energy demand. Bicycle parking facilities will be provided to promote the use of more sustainable transport modes. Electric vehicle charging infrastructure will be incorporated into the design to allow for E-car charging points to be installed as required. Full descriptions of the measures proposed and their benefits are outlined within the Sustainability & Energy Statement and the Building Lifecycle Report submitted with this application.

9.8 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

9.8.1 Construction Stage

Air Quality

Once the dust minimisation measures outlined in Section 9.7 and Appendix 9.3 are implemented, the impact of the proposed development in terms of dust soiling will be short-term and imperceptible at nearby receptors.

Climate

According to the IAQM guidance (2014) site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore the predicted impact is short-term and imperceptible.

Human Health

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the impact of construction of the proposed development is likely to be negative, short-term and imperceptible with respect to human health.

9.8.2 Operational Stage

Air Quality

Air dispersion modelling of operational traffic emissions associated with the proposed development was carried out using the UK DMRB model. The modelling assessment determined that the change in emissions of NO₂ at nearby sensitive receptors as a result of the proposed development will be imperceptible. Therefore, the operational phase impact to air quality is long-term, localised, negative and imperceptible.

Climate

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. As a result of this there is the potential for flooding related impacts on site in future years. A detailed flood risk assessment has been undertaken as part of this planning application and adequate attenuation and drainage have been provided for to account for increased rainfall in future years. Therefore, the impact will be imperceptible.

Modelling of operational phase CO₂ emissions as a result of the traffic associated with the proposed development was carried out to determine the impact to climate. It was found that emissions of CO₂ will increase by an imperceptible amount as a result of the proposed development and are significantly below the EU 2020 and 2030 GHG targets. The operational phase impact to climate is long-term, negative and imperceptible. In addition, the proposed development has been designed to reduce the impact to climate where possible during operation.

Human Health

As the air dispersion modelling has shown that emissions of air pollutants are significantly below the ambient air quality standards which are based on the protection of human health, impacts to human health are long-term, negative and imperceptible.

9.9 CUMULATIVE IMPACTS

According to the IAQM guidance (2014) should the construction phase of the proposed development coincide with the construction of any other permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors. A review of recent planning permissions for the area was conducted and it was found that there were a number of relevant sites for which cumulative impacts may occur should their construction phase and that of the proposed development overlap. These include the development of Quadrant 3 at The Park, Carrickmines (planning ref. D18A/0257) and the Glenamuck District Roads Scheme (planning ref. PL06D.303945).

Both permitted developments (D18A/0257 and PL06D.303945) are of moderate scale. The EIAR for the Glenamuck District Road Scheme prepared by DBFL Consulting Engineers (2019) determined that there was the potential for dust soiling impacts up to 50m from the site, however there will be a high level of dust control implemented through the construction phase and therefore no significant dust emissions will occur. In addition, the EIAR for The Park Carrickmines prepared by John Span & Associates (2018) also determined dust emissions from the construction phase will not be significant and a high level of dust control measures will be implemented throughout the construction phase. The dust mitigation measures outlined in Appendix 9.3 will be applied throughout the construction phase of the proposed development which will further avoid significant cumulative impacts on air quality. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality associated with the construction phase of the proposed development are deemed short-term, negative and imperceptible.

According to the IAQM guidance (2014) site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore, cumulative impacts are not predicted.

Cumulative impacts have been incorporated into the traffic data supplied for the operational stage air and climate modelling assessments where such information was available. The results of the modelling assessment (section 9.5.2) show that there is a long-term, negative and imperceptible impact to air quality and climate during the operational stage.

9.10 MONITORING

9.10.1 Construction Stage

Monitoring of construction dust deposition at nearby sensitive receptors during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m²*day) during the monitoring period between 28 - 32 days.

9.10.2 Operational Stage

There is no monitoring recommended for the operational phase of the development as impacts to air quality and climate are predicted to be imperceptible.

9.11 REINSTATEMENT

Not applicable to air quality and climate.

9.12 INTERACTIONS

Air quality does not have a significant number of interactions with other topics. The most significant interactions are between population and human health and air quality. An adverse impact due to air quality in either the demolition, construction or operational phase has the potential to cause health and dust nuisance issues. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is long term and neutral with respect to human beings.

Interactions between air quality and traffic can be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The impacts of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible.

With the appropriate mitigation measures to prevent fugitive dust emissions, it is predicted that there will be no significant interactions between air quality and land and soils. No other significant interactions with air quality have been identified.

9.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered when compiling this assessment.

9.14 REFERENCES

BRE (2003) Controlling Particles, Vapours & Noise Pollution From Construction Sites

DEHLG (2004) Quarries and Ancillary Activities, Guidelines for Planning Authorities
Department of the Environment, Heritage and Local Government (2010) Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities

Dun Laoghaire – Rathdown County Council & Codema (2019) Dun Laoghaire - Rathdown County Council Climate Change Action Plan 2019 -2024

European Commission (2013) *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment*

Environmental Protection Agency (2015) Advice Notes for Preparing Environmental Impact Statements – Draft

Environmental Protection Agency (2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports - Draft

Environmental Protection Agency (2019) GHG Emissions Projections Report - Ireland's Greenhouse Gas Emissions Projections 2018 - 2040

Environmental Protection Agency (2020a) Ireland's Transboundary Gas Emissions 1990 –2030

Environmental Protection Agency (2020b) Air Quality Monitoring Report 2019 (& previous annual reports)

Environmental Protection Agency (2020c) EPA website Available at:
<http://www.epa.ie/whatwedo/monitoring/air/>

Environmental Protection Agency (2020d) Ireland's Final Greenhouse Gas Emissions 1990 – 2018

German VDI (2002) Technical Guidelines on Air Quality Control – TA Luft

Government of Ireland (2015) Climate Action and Low Carbon Development Act

Government of Ireland (2019) Climate Action Plan 2019

Government of Ireland (2020) Draft General Scheme of the Climate Action (Amendment) Bill 2019

Government of Ireland (2020b) Climate Action and Low Carbon Development (Amendment) Bill 2020

Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction Version 1.1

Met Éireann (2020) Met Eireann website: <https://www.met.ie/>

The Scottish Office (1996) Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings

Transport Infrastructure Ireland (2009) Guidelines for Assessment of Ecological Impacts of National Roads Schemes (Rev. 2, Transport Infrastructure Ireland, 2009)

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

UK DEFRA (2016) Part IV of the Environment Act 1995: Local Air Quality Management, LAQM. PG(16)

UK DEFRA (2020) NO_x to NO₂ Conversion Spreadsheet (Version 8.1)

UK DEFRA (2018) Part IV of the Environment Act 1995: Local Air Quality Management, LAQM.TG(16)

UK Department of the Environment, Transport and Roads (1998) Preparation of Environmental Statements for Planning Projects That Require Environmental Assessment - A Good Practice Guide, Appendix 8 - Air & Climate

UK Highways Agency (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 - HA207/07 (Document & Calculation Spreadsheet)

UK Highways Agency (2019a) UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality

UK Highways Agency (2019b) UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate

UK Office of Deputy Prime Minister (2002) Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance

USEPA (1997) Fugitive Dust Technical Information Document for the Best Available Control Measures

World Health Organisation (2006) Air Quality Guidelines - Global Update 2005 (and previous Air Quality Guideline Reports 1999 & 2000)

APPENDIX 9.1 - AMBIENT AIR QUALITY STANDARDS

AMBIENT AIR QUALITY STANDARDS

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM₁₀, 40% for the hourly and annual limit value for NO₂ and 26% for hourly SO₂ limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to PM_{2.5}. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for PM_{2.5} are included in Directive 2008/50/EC. The approach for PM_{2.5} was to establish a target value of 25 µg/m³, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m³, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to PM_{2.5} between 2010 and 2020. This exposure reduction target will range from 0% (for PM_{2.5} concentrations of less than 8.5 µg/m³ to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m³). Where the AEI is currently greater than 22 µg/m³ all appropriate measures should be employed to reduce this level to 18 µg/m³ by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m³ was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as “a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC”. These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_x (NO and NO₂) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_x such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_x limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation
- As a guideline, a monitoring station should be indicative of approximately 1000 km² of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

APPENDIX 9.2 – TRANSPORT INFRASTRUCTURE IRELAND SIGNIFICANCE CRITERIA

TRANSPORT INFRASTRUCTURE IRELAND SIGNIFICANCE CRITERIA

Magnitude of Change	Annual Mean NO ₂ / PM ₁₀	No. days with PM ₁₀ concentration > 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 A9.2.1 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration ^{Note 1}		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m ³ of NO ₂ or PM ₁₀) (≥25 µg/m ³ of PM _{2.5})	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m ³ of NO ₂ or PM ₁₀) (22.5 - <25 µg/m ³ of PM _{2.5})	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m ³ of NO ₂ or PM ₁₀) (18.75 - <22.5 µg/m ³ of PM _{2.5})	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m ³ of NO ₂ or PM ₁₀) (<18.75 µg/m ³ of PM _{2.5})	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m ³ of NO ₂ or PM ₁₀) (≥25 µg/m ³ of PM _{2.5})	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m ³ of NO ₂ or PM ₁₀) (22.5 - <25 µg/m ³ of PM _{2.5})	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m ³ of NO ₂ or PM ₁₀) (18.75 - <22.5 µg/m ³ of PM _{2.5})	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 µg/m ³ of NO ₂ or PM ₁₀) (<18.75 µg/m ³ of PM _{2.5})	Negligible	Negligible	Slight Beneficial

^{Note 1} Well Below Standard = <75% of limit value.

Table A9.2.2 Air Quality Impact Significance Criteria For Annual Mean NO₂ and PM₁₀ and PM_{2.5} Concentrations at a Receptor

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	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

Table A9.2.3 Air Quality Impact Significance Criteria For Changes to Number of Days with PM₁₀ Concentration Greater than 50 µg/m³ at a Receptor

APPENDIX 9.3 – DUST MANAGEMENT PLAN

DUST MANAGEMENT PLAN

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK (IAQM (2014), BRE (2003), The Scottish Office (1996), UK ODPM (2002)) and the USA (USEPA, 1997). The following measures have been incorporated into the Outline Construction & Demolition Management Plan (OC&DMP) prepared for the site.

Site Management

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 9.1 for the windrose for Dublin Airport). As the prevailing wind is predominantly south-westerly to south-easterly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (IAQM, 2014; UK ODPM, 2002). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
- At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK ODPM, 2002).

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible;
- Bowers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing / Earth Moving

Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions.

- Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK ODPM, 2002).
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

Summary of Dust Mitigation Measures

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;

- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.