9. AIR, DUST AND CLIMATIC FACTORS

9.1 Introduction

This chapter assesses the likely air quality and climate impacts, if any, associated with the proposed residential development at Newcastle South and Ballynakelly, Newcastle, County Dublin.

The proposed development comprises of 406 no dwellings comprising 8 no. one-bed apartments; 20 no. two-bed apartments; 1 no. three-bed apartments; 48 no. two-bed apartments with 48 no. three bed duplex units above; 21 no. two-bed houses; 208 no. three-bed houses; and 52 no. four-bed houses.

In addition, the proposed development provides a childcare facility (approx. 518sqm) with capacity for in the order of 110 no. children to serve the needs of the proposed development. The proposals also include 1 no. retail unit (total gross floor area 67.7sqm) ground floor level within the proposed Ballynakelly apartment block.

The proposed development provides all associated and ancillary infrastructure, landscaping, boundary treatments and development works on a total site of approximately 16 hectares.

9.2 Study Methodology

9.2.1 Standards and Guidelines

9.2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 and Appendix 9.A).

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 NO_2, PM_{10}, $PM_{2.5}$, benzene and CO (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.A).

9.2.1.2 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 9.1 have set ambient air quality limit values for PM_{10} 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)[1] 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[2] apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

Table 9.1 Air Quality Standards Regulations

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 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 (CO)	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

9.2.1.3 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002[3,4]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012[5,6]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP23) took place in Bonn, Germany from the 6th to the 17th of November 2017 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris in 2015 and is an important milestone in terms of international climate change agreements. The Paris Agreement, agreed by over 200 nations, has a stated 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 greenhouse gas 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 on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23rd/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework"[7]. The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

9.2.1.4 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% on 2005 levels), 65 kt for NO_X (49% reduction on 2005 levels), 43 kt for VOCs (25% reduction on 2005 levels), 108 kt for NH_3 (1% reduction on 2005 levels) and 10 kt for $PM_{2.5}$ (18% reduction on 2005 levels).

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD)[8], prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005[9,10]. Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X[11]. Directive (EU) 2016/2284 "*On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC*" was published in December 2016. The Directive will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (85% below 2005 levels), for NO_X (69% reduction), for VOCs (32% reduction), for NH_3 (5% reduction) and for $PM_{2.5}$ (41% reduction).

9.2.2 Local Air Quality Assessment

The air quality assessment has been carried out following procedures described in the publications by the EPA[12-15] and using the methodology outlined in the guidance documents published by the UK DEFRA[16-18]. The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA[19]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "*hot-spots*" identified. An examination of recent EPA and Local Authority data in Ireland[20,21] has indicated that SO_2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential issues in regards to nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ at busy junctions in urban centres[20,21]. Benzene, although previously reported at quite high levels in urban centres, has recently been measured at several city centre locations to be well below the EU limit value[20,21]. Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres[21]. The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5}$, benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations will be predicted for nearby sensitive receptors for the following scenarios:

- The Existing Baseline scenario, for model verification;
- Post Development Year 2020 Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place;
- Post Development Year 2020 Do-Something scenario (DS), which assumes the proposed development in place;
- Post Development Year 2035 Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place; and
- Post Development Year 2035 Do-Something scenario (DS), which assumes the proposed development in place.

The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model[19] (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet[22] (Version 6.1, October 2017), and following guidance issued by the TII[23], UK Highways Agency[19], UK DEFRA[16-18] and the EPA[12-15].

The TII guidance[30] 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 guidance[19], on which the TII guidance was based, 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:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGV flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors that have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200 m of the chosen sensitive receptors inputs to the air dispersion model consist of: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles, annual average traffic speeds and background concentrations. The UK DMRB guidance states that road links at a distance of greater than 200m from a sensitive receptor will not influence pollutant concentrations at the receptor. 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 *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*(23) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any project that causes a change in traffic flows. 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.B Table A1 to Table A3. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

9.2.2.1 Regional Impact Assessment (including Climate)

The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland(23) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges(19). The assessment focused on determining the resulting change in emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) and carbon dioxide (CO_2). 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 development that causes a change in traffic flows. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

9.2.2.2 Conversion of NO_X to NO_2

NO_x (NO + NO_2) 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 NOx emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NO_x to NO_2 in "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*"(23). The TII guidelines recommend the use of DEFRAs NO_x to NO_2 calculator(22) which was originally published in 2009 and is currently on version 6.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NO_x emitted as NO for each local authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

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 NO_2 and NO_x for Ireland. The "*All other Urban UK Traffic*" traffic mix option was used.

9.2.2.3 Ecological Sites

For routes that pass within 2km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an Ecologist(23). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed development and when significant changes in AADT (>5%) occur.

Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Schemes*(24) and *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*(25) 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 areas within 200m of the proposed site and therefore no designated ecological sites require an impact assessment.

9.3 Existing Receiving Environment (Baseline)

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)(26). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Casement Aerodrome, which is located approximately 2 km east of the site. Casement Aerodrome met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.1). For data collated during five representative years (2012-2016), the predominant wind direction is south-westerly. The average wind speed over the period 1981 – 2010 is approximately 5.5 m/s.

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[19]. 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 PM_{10}, NO_2 and benzene. In addition, two of the key pollutants identified in the scoping study (PM_{10} and NO_2) 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[18], 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[18] 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.

In 2011 the UK DEFRA published research[27] on the long term trends in NO_2 and NO_X for roadside monitoring sites in the UK. This study marked a decrease in NO_2 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 NO_2 concentrations which UK DEFRA previously published and monitored concentrations. The impact of this 'gap' is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency (HA) published an Interim advice note (IAN 170/12) in order to correct the DMRB results for future years.

9.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2017"[20], details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment[20]. 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, the region of the proposed development is categorised as Zone A.

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.).

With regard to NO_2, continuous monitoring data from the EPA[20, 21], at suburban Zone A background locations in Rathmines, Ballyfermot, Blanchardstown and Swords show that current levels of NO_2 are below both the annual and 1-hour limit values, with annual average levels ranging from 14 - 26 µg/m^3 in 2017 (see Table 9.2). The Blanchardstown site is located adjacent to the M50 and M3 intersection so has a high contribution due to local traffic. Sufficient data is available for the station in Ballyfermot, the closest monitoring station to the site, to observe long-term trends since 2013[20, 21], with annual average results ranging from 16 – 17 µg/m^3. Based on these results, a conservative estimate of the current background NO_2 concentration in the region of the proposed development is 17 µg/m^3.

Table 9.2 Annual Mean NO_2 Concentrations in Zone A Locations (2013-2017) (µg/m^3)

Year	Ballyfermot	Rathmines	Blanchardstown	Swords
2013	16	19	29	15
2014	16	17	31	14
2015	16	18	25	13
2016	17	20	30	16
2017	17	27	26	14
Average	**16.3**	**18.5**	**28.8**	**14.4**

Continuous PM_{10} monitoring carried out at the suburban background locations of Ballyfermot, Blanchardstown and Tallaght showed annual mean concentrations ranging from 11.8 - 15 µg/m^3 in 2017, with no exceedances of the daily limit value of 50 µg/m^3 (35 exceedances are permitted per year). Sufficient data is available for Tallaght to observe trends over the period 2013 – 2017. Tallaght had an average annual mean PM_{10} concentration of 15 µg/m^3 over the period of 2013 – 2017. PM_{10} results from the urban background location in the Phoenix Park show similarly low levels over the period of 2013 – 2017 with concentrations ranging from 9 – 14 µg/m^3. Based on these results, a conservative estimate of the for PM_{10} the region of the proposed development is 15 µg/m^3.

Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed an average concentration of 8.5 µg/m^3 in 2017. Based on this information, the ratio of $PM_{2.5}$ to PM_{10} is estimated to be in the region of 0.63 – 0.68 with a representative background concentration of 9.45 µg/m^3 estimated for the region of the proposed development.

CO concentrations for the representative urban Zone A monitoring stations are between 2013 and 2017 on average 0.12 mg/m^3 for the 8-hour value. This is significantly below the 10 mg/m^3 limit value. Based on this EPA data, a conservative estimate of the background carbon monoxide concentration in Newcastle in 2018 is 0.14 mg/m^3.

In terms of benzene, monitoring data for the Zone A location of Rathmines is available for the period 2013 – 2017 with an average concentration of 0.95 µg/m^3. Based on this monitoring data a conservative estimate of the current background concentration in Newcastle is 0.95 µg/m^3.

9.4 Characteristics of the Proposed Development

The proposed development comprises of 406 no dwellings comprising 8 no. one-bed apartments; 20 no. two-bed apartments; 1 no. three-bed apartments; 48 no. two-bed apartments with 48 no. three bed duplex units above; 21 no. two-bed houses; 208 no. three-bed houses; and 52 no. four-bed houses.

In addition, the proposed development provides a childcare facility (approx. 518sqm) with capacity for in the order of 110 no. children to serve the needs of the proposed development. The proposals also include 1 no. retail units (total gross floor area 67.7sqm) ground floor level of the mixed-use block.

Further details of the development can be found in Chapter 3. The application site forms part of a larger land holding controlled by the applicant – Cairn Homes Properties Ltd. This proposed application represents Phase 1 of the overall development with an indicative Master Plan for the site and there is an intent of future development of Phase 2 lands. It is envisaged that Phase 2 will consist of approximately 300 no. residential units in addition to the units proposed for phase 1.

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:

A. construction phase, and;

B. operational phase.

During the construction stage the main source of air quality impacts will be as a result of fugitive dust emissions from site activities. Emissions from construction vehicles and machinery have the potential to impact climate. The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows or congestion in the local areas which are associated with the development.

The following describes the primary sources of potential air quality and climate impacts which have been assessed as part of this EIAR.

9.5 Potential Impact of the Proposed Development

9.5.1 Construction Phase

9.5.1.1 Air Quality

It is important to note that the predicted impacts associated with the demolition, earthworks and construction phases of the proposed development are short term and temporary in nature. The Institute of Air Quality Management (IAQM) guidelines[28] for assessing the impact of dust emissions from construction and demolition activities based on the scale & nature of the works and the sensitivity of the area to dust impacts. In terms of the prevailing wind, which is south – westerly, the dominant land use downwind of the site is high sensitivity environments (Residential properties).

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors. Construction activities such as demolition, excavation, earth moving and backfilling may generate quantities of dust, particularly in dry and windy weather conditions. While dust from construction activities tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes from the construction areas.

As shown in Table 9.3 below the risk from dust soiling at the nearest sensitive receptor (a high sensitivity environment, distance < 20 m) is considered high under this guidance. The high sensitivity receptors less than 20 metres of the site boundary are the residential buildings on Burgage Crescent, Orchard Grove and St. Finian's National School. As a result, the sensitivity of the area to dust soiling effects on people and property is **high** according to IAQM guidance[28].

Table 9.3 Sensitivity of the Area to Dust Soiling Effects on People and Property

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

In addition, the IAQM guidelines also outline the assessment criteria for assessing the impact of PM_{10} emissions from construction activities based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected. The current PM_{10} concentration in Zone A locations as reported in Section 9.2.3 above is approximately 15 μg/m^3. As shown in Table 9.4 below the worst-case sensitivity of the area to human health from PM_{10} (high sensitivity, distance <20 m and with receptor numbers between 10 - 100) is considered **low** under this guidance.

Table 9.4 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)			
			<20	<50	<100	<200
High	< 24 μg/m^3	>100	Medium	Low	Low	Low
		10-100	**Low**	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	< 24 μg/m^3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	< 24 μg/m^3	>1	Low	Low	Low	Low

In order to determine the level of dust mitigation required during the proposed demolition and construction phases, the potential dust emission magnitude for each dust generating activity needs to be taken into account, along with the already established sensitivity of the area. These major dust generating activities are divided into four types to reflect their different potential impacts. These are:

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

Demolition

Demolition will primarily involve removal of an area less than 20,000 m^2 of existing buildings (spread across 5 buildings) in order to facilitate construction. Dust emission magnitude from demolition can be classified as small, medium or large and are described below.

- **Large:** Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- **Medium:** Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- **Small:** Total building volume 20,000 m^3, construction material with low potential for dust release, demolition activities <10 m above ground, demolition occurring during wetter months.

The dust emission magnitude for the proposed demolition activities can be classified as small, due to the volume of the 5 no. buildings to be demolished. This results in an overall **low** risk of **temporary** dust soiling impacts (as it is high sensitivity area in terms of dust soiling) and an overall **negligible** risk of **temporary** human health impacts (as it is a low sensitivity area in terms of human health) as a result of the proposed demolition activities as outlined in Table 9.5.

Table 9.5 Risk of Dust Impacts - Demolition

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

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Dust emission magnitude from earthworks can be classified as small, medium and large and are described below.

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;

- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes; and

- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The dust emission magnitude for the proposed earthwork activities can be classified as large as the site is greater than 10,000 m^2. This results in an overall **high** risk of **temporary** dust soiling impacts and an overall **low** risk of **temporary** human health impacts as a result of the proposed earthworks activities as outlined in Table 9.6.

Table 9.6 Risk of Dust Impacts - Earthworks

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

Construction

Dust emission magnitude from construction can be classified as small, medium and large and are described below.

- **Large:** Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;

- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching; and

- **Small:** Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Due to the area of the site, the dust emission magnitude for the proposed construction activities can be classified as large. This results in an overall **high** risk of **temporary** dust soiling impacts and an overall **low** risk of **temporary** human health impacts as a result of the proposed construction activities as outlined in Table 9.7.

Table 9.7 Risk of Dust Impacts - Construction

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

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers geology and duration. Dust emission magnitude from trackout can be classified as small, medium and large and are described below.

- **Large:** > 50 HDV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium:** 10 - 50 HDV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m; and
- **Small:** < 10 HDV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

This results in the dust emission magnitude from trackout activities to be classified as medium, as it has been estimated that there will be 4 trucks/hour on any average day. This results in an overall **medium** risk of **temporary** dust soiling impacts and an overall **low** risk of **temporary** human health impacts as a result of the proposed trackout activities as outlined in Table 9.8.

Table 9.8 Risk of Dust Impacts - Trackout

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

The risk of dust impacts as a result of the proposed development are summarised below in Table 9.9. Overall, in order to ensure that no dust nuisance occurs during the construction activities, a range of dust mitigation measures associated with a **high** risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 9.9 Summary of Dust Risk to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	High Risk	High Risk	Medium Risk
Human Health	Negligible Risk	Low Risk	Low Risk	Low Risk

9.5.1.2 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 CO_2 and N_2O emissions. However, the impact on the climate is considered to be imperceptible in the short and long term.

9.5.1.3 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 short-term and imperceptible with respect to human health.

9.5.2 Operation Phase

9.5.2.1 Local Air Quality and Climate

DBFL have carried out a traffic assessment for the proposed development. It is envisaged that the worst-case change in AADT on any individual road link due to the proposed development work will be 659 vehicles per day. As detailed in the DMRB guidance, a quantitative air quality assessment is required under the following circumstances:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Therefore, using the DMRB screening criteria, no road links can be classed as 'affected' by the proposed development and do not require inclusion in the local air quality and climate assessment.

9.5.2.2 Climate Change

The nature of the development is such that there is no predicted impact on traffic, beneficial or adverse. It is envisaged that there will be no change in AADT due to the Proposed Development. Therefore, using the DMRB screening criteria listed above in Section 9.4.2.1, no road links can be classed as 'affected' by the proposed development and do not require inclusion in the regional climate assessment.

The most likely impact due to climate change on the existing facility is due to flooding, an assessment has been carried out in Chapter 7 of this EIAR to ensure that the site has sufficient capacity in the system for adaption to future increased rainfall due to climate change.

Section 7.3.3 of this EIAR discusses the site flood risk. This section found that historical flood maps show no risk of fluvial, coastal or pluvial flooding on the proposed development site up to the 1% AEP (Annual Exceedance Probability) event. There is the potential of climate change related increased rainfall and flooding in the future. In order to mitigate the potential for pluvial flood a drainage system and attenuation storage design allow for a 10% increase in rainfall intensities, as recommended by the Greater Dublin Strategic Drainage Strategy (GDSDS).

9.5.2.3 Human Health

Due to the nature of the project and scoping out of human health impacts due to operational phase traffic associated with the development, the potential impact on human health is negligible.

9.6 Potential Cumulative Impacts

Should the construction phase of the proposed development coincide with the construction of any other proposed or permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors. The dust mitigation measures outlined in Appendix 9.C should be applied throughout the construction phase of the proposed development, with similar mitigation measures applied for other proposed or permitted developments which will avoid significant cumulative impacts on air quality. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality and climate associated with the construction phase of the proposed development are deemed short-term and not significant.

Permitted developments are included in the traffic impact and therefore the potential for a cumulative impact has already been assessed. Future projects of any future currently unpermitted large scale would need to conduct an EIAR to ensure that no significant impacts on air quality will occur as a result of those developments.

9.7 'Do Nothing' Impact

The Do-Nothing scenario includes retention of the current site without the proposed mixed-use 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).

9.8 Avoidance, Remedial & Mitigation Measures

9.8.1 Construction Phase

9.8.1.1 Air Quality

A dust minimisation plan has been formulated for the construction phase of the project as construction activities are likely to generate some dust emissions. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan, see Appendix 9.C. Provided the dust minimisation measures outlined in the plan are adhered to, the air quality impacts during the construction phase will be not be significant. Activities such as earthworks and the removal of hardstanding should be considered sensitive activities with respect to dust generation. 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;
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions;
- 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 such as rock blasting or earthworks are necessary during dry or windy periods; and
- Before entrance onto public roads, trucks will be adequately inspected to ensure there is no potential for dust emissions and will be cleaned as necessary.

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

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

9.8.1.2 Climate

Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to the short-term and temporary nature of these works, the impact on climate will not be significant.

9.8.2 Operational Phase

9.8.2.1 Air Quality

There are no significant impacts predicted for the operational phase with respect to air quality therefore no site-specific mitigation measures are required during the operational phase of the proposed development.

9.8.2.2 Climate

The impact of the proposed development on climate will be imperceptible. Thus, no site-specific mitigation measures are required.

9.9 Predicted Impact of the Proposed Development

9.9.1 Construction Phase

9.9.1.1 Air Quality

When the dust minimisation measures detailed in the mitigation section of this Chapter (Section 9.7.1.1) are implemented, fugitive emissions of dust from the site will be short-term, localised, insignificant and pose no nuisance at nearby receptors.

9.9.1.2 Climate

Impacts to climate during the construction phase are considered imperceptible and short-term.

9.9.1.3 Human Health

With appropriate dust mitigation measures in place, impacts to human health during the construction phase will be short-term, localised and insignificant at nearby receptors.

9.9.2 Operational Phase

9.9.2.1 Air Quality

The results of the air dispersion modelling study indicate that the impacts of the proposed development on air quality and climate is predicted to be localised, imperceptible with respect to the operational phase for the long and short term.

9.9.2.2 Climate

Impacts to climate during the operational phase are considered imperceptible in the long-term.

9.9.2.3 Human Health

Impacts to human health during the operational phase are localised, imperceptible with respect to the operational phase for the short and long term.

9.10 Monitoring

Monitoring of construction dust deposition at nearby sensitive receptors (residential dwellings) 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/(m^2*day) during the monitoring period between 28 - 32 days.

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

There are no reinstatement requirements with respect to air quality and climate.

9.12 Interactions

Air Quality does not have a significant number of interactions with other chapters. The most significant interactions are between human beings and air quality. An adverse impact due to air quality in either the 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 Newcastle 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 have the potential to be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. However, in this assessment the impact of the interactions between traffic and air quality are not significant.

With the appropriate mitigation measures in place for the can It is predicted that any interactions on flora, fauna, water, geology and soils are neutral.

9.13 Difficulties Encountered in Compiling the Chapter

There were no difficulties encountered while carrying out this assessment.

9.14 References

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APPENDIX 9.A 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 PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 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 $\mu g/m^3$, as an annual average (to be attained everywhere by 2010) and a limit value of 25 $\mu g/m^3$, 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 $\mu g/m^3$ to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 $\mu g/m^3$). Where the AEI is currently greater than 22 $\mu g/m^3$ all appropriate measures should be employed to reduce this level to 18 $\mu g/m^3$ 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 $\mu g/m^3$ 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 NO_2) 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 km^2 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.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations(15). Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise(16) as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NOX, NO2 and PM10, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations(16).

In relation to NO2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO2 mirrors that of NOX showing that the over-prediction is due to NOX calculations rather than the NOX:NO2 conversion. Within most urban situations, the model overestimates annual mean NO2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict PM_{10}. Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable[16].

APPENDIX 9.B Transport Infrastructure Ireland Significance Criteria

Table A1: 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 > 50 µg/m³	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥4 µg/m³	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m³
Medium	Increase / decrease 2 - <4 µg/m³	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m³
Small	Increase / decrease 0.4 - <2 µg/m³	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase / decrease <0.4 µg/m³	Increase / decrease <1 day	Increase / decrease <0.25 µg/m³

Table A2: Air Quality Impact Significance Criteria For Annual Mean NO_2 and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

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/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

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

Table A3: Air Quality Impact Significance Criteria For Changes to Number of Days with PM_{10} Concentration Greater than 50 μg/m³ at a Receptor

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 (≥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

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

APPENDIX 9.C Dust Minimisation 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[28,30,31,32] and the USA[33].

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, 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[30,32]. 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[34]. 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 were 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 developer must monitor the subcontractors' 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 developer 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%[32].

- 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;
- Bowsers 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%[33]. 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.

Demolition:

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

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[32];
- 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 developer. 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.