6. Air Quality and Climate

6.1. Introduction

AWN Consulting Limited were commissioned by Atkins to conduct an assessment into the likely air quality and climate impacts associated with the proposed residential development of c. 17.9ha of lands c. 1.3km north of Blackrock Village Centre and c.3km south of the central core of Dundalk.

6.1.1. Assessment Criteria

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 6.1 and Appendix E).

Air quality significance criteria are assessed based on compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate European Commission Directive 2008/50/EC which has set limit values for the pollutants SO_2, NO_2, PM_{10}, benzene and CO (see Table 6.1) Council Directive 2008/50/EC combines the previous Air Quality Framework Directive (96/62/EC) and its subsequent daughter directives (including 1999/30/EC and 2000/69/EC). Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$.

Table 6.1 - Air Quality Standards Regulations 2011 (based on EU Council Directive 2008/50/EC)

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 NO_2
		Annual limit for protection of human health	40 µg/m^3 NO_2
		Annual critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	0.5 µg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m^3
		Annual & Winter critical level for protection of vegetation	20 µg/m^3
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 PM_{10}
		Annual limit for protection of human health	40 µg/m^3 PM_{10}
$PM_{2.5}$	2008/50/EC	Annual limit for protection of human health	25 µg/m^3 $PM_{2.5}$
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 (CAFE) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

6.1.2. Climate Agreements

The UNFCCC is continuing detailed negotiations in relation to Greenhouse Gases (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 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 has also been made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23/24th of October 2014, agreed the “*2030 Climate and Energy Policy Framework*” (EU, 2014). 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.

6.1.3. 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 Kilo Tonne (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) (2014), 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 (DEHLG, 2007a; 2004). 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 (EEA, 2012). 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).

6.2. Methodology

6.2.1. Local Air Quality Assessment

The air quality assessment was carried out following procedures described in the publications by the EPA (EPA 2002, 2003, 2015, 2017a) and using the methodology outlined in the policy and technical guidance notes, LAQM.PG(16) and LAQM.TG(16), issued by UK Department for Environment, Food and Rural Affairs (UK DEFRA 2001, 2016a, 2016b; UK Department of the Environment, Transport and Roads 1998, UK Highways Agency 2007). The assessment of air quality is carried out using a phased approach as recommended by the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2016a). 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 key pollutants will be carried out at sensitive receptors. These sensitive receptors have the potential to have an impact on the concentration of key pollutants due to the proposed development. An examination of recent EPA and Local Authority data in Ireland (EPA 2018, 2017b), has indicated that SO_2 and 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 problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres (EPA 2018, 2017b). Benzene, although previously reported at quite high levels in urban centres (EPA 2018, 2017b), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2018, 2017b). 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 (EPA 2018, 2017b). 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 were predicted for nearby sensitive receptors for the following five scenarios:

- The Existing scenario (2018), for model verification;
- Opening Year Do-Nothing scenario (DN), which assumes the retention of present Site usage with no development in place (2020);
- Opening Year Do-Something scenario (DS), which assumes the proposed development in place (2020);
- Design Year Do-Nothing scenario (DN), which assumes the retention of present Site usage with no development in place (2025) and
- Design Year of the Do-Something scenario (DS), which assumes the proposed development in place (2025).

The assessment methodology involved air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (UK Highways Agency 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK Department for Environment, Food and Rural Affairs, 2014) (Version 6.1), and following guidance issued by Transport Infrastructure Ireland (TII 2011), UK Highways Agency (UK Highways Agency 2007), UK Department for Environment, Food and Rural Affairs (UK DEFRA 2016a) and the EPA (EPA 2002, 2003, 2015, 2017a).

Transport Infrastructure Ireland guidance 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 Design Manual for Roads and Bridges guidance (UK Highways Agency 2007), on which Transport Infrastructure Ireland 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;
- 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.

Concentrations of key pollutants are calculated at sensitive receptors which 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 Design Manual for Roads and Bridges guidance states that road links at a distance of greater than 200 m 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 Design Manual for Roads and Bridges model uses conservative emission factors, the formulae for which are outlined in the Design Manual for Roads and Bridges 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 predicted 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. Transport Infrastructure Ireland Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011) detail a methodology for determining air quality impact significance criteria for road schemes and can be applied to any development that experiences a change in traffic values. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Transport Infrastructure Ireland significance criteria have been adopted for the proposed development and are detailed in Table 6.2 to Table 6.4. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (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 purpose of this assessment.

Table 6.2 - Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO2 / PM10	No. days with PM10 concentration > 50 µg/m3	Annual Mean PM2.5
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

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

Table 6.3 - Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Moderate	Large
Increase with 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/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 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible
Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

Table 6.4 - Air Quality Impact Significance Criteria

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

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible
Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

6.2.2. 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 (TII 2011) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges (UK Highways Agency 2007). 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 experiences a change in traffic values. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

6.2.3. 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 NO_x emitted as NO_2, 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 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" (TII, 2011). Transport Infrastructure Ireland guidelines recommend the use of the UK Department for Environment, Food and Rural Affairs NO_x to NO_2 calculator (UK DEFRA, 2016) 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 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 NO_2 or PM_{10}. The calculator includes Local Authorities in Northern Ireland and Transport Infrastructure Ireland guidance recommends the use of Craigavon as the choice for local authority when using the calculator. The choice of "*Armagh, Banbridge and Craigavon*" provides the most suitable relationship between NO_2 and NO_x for Ireland. The "All other Non-Urban UK Traffic" traffic mix option was used.

6.2.4. Ecological Sites

For routes which pass within 2 km of a designated area of conservation (either Irish or European designation) Transport Infrastructure Ireland 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.

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev. 2, Transport Infrastructure Ireland, 2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of the Environment, Heritage and Local Government, 2010) provide details regarding the legal protection of designated conservation areas. If the assessment criteria, of a designated area of conservation within 200 m of the proposed development and a significant change in AADT flows, are met an assessment of the potential for impact due to nitrogen deposition should be assessed. The proposed development has the following designated Sites in close proximity to its boundary; Dundalk Bay SAC and SPA. As this Site is adjacent to the proposed development boundary and therefore within 200m, an assessment is required and has been carried out as part of this Air Quality impact assessment.

6.3. Receiving Environment

6.3.1. 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 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 Dublin Airport, which is located approximately 67 km south east of the Site however due to its similar proximity to the east coast it is reasonably representative. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 6.1). 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 5.3 m/s.

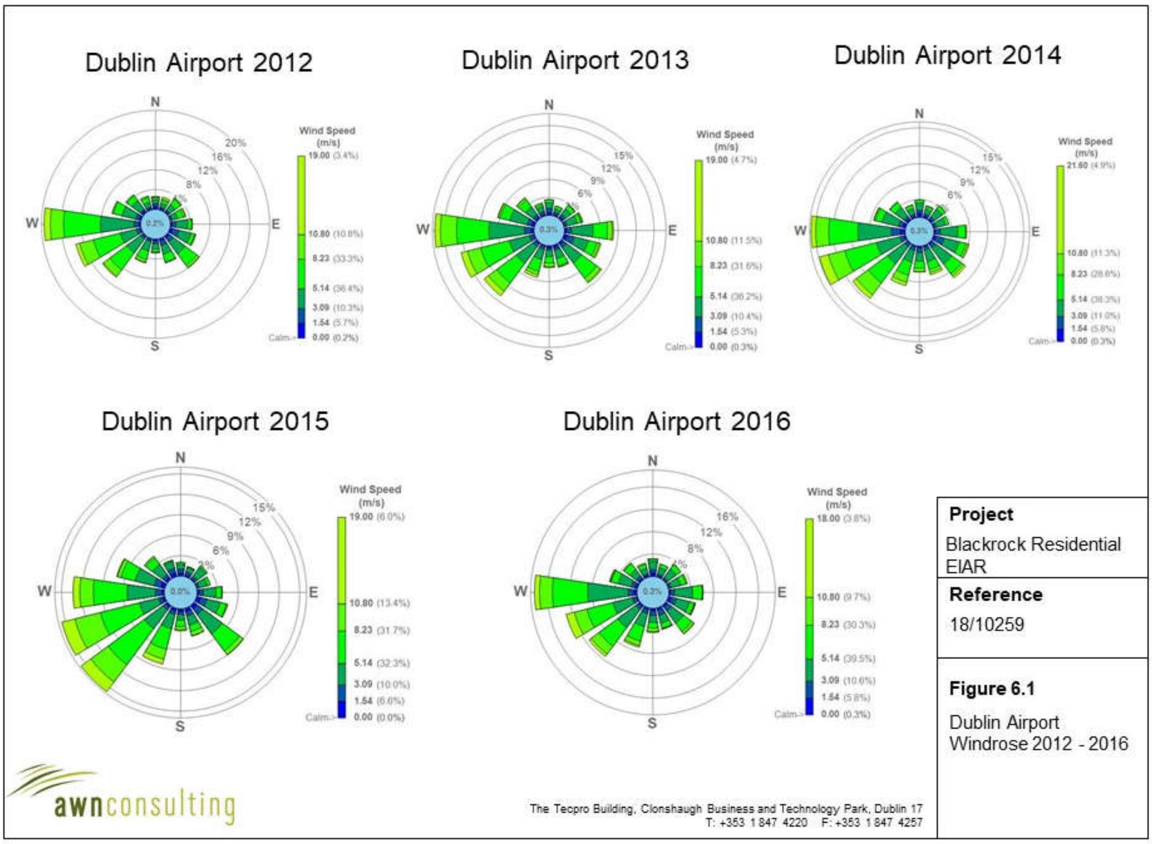

Figure 6.1 - Dublin Airport Windrose 2012-2016

6.3.2. 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 (UK Highways Agency 2007). 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 (UK DETR, 1998), which are the conditions which prevail just prior to opening in the absence of the development (Year 2020). 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.

In 2011 the UK DEFRA published research (UK DEFRA 2011) 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 Design Manual for Roads and Bridges (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.

6.3.3. 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 2016" (EPA 2017b), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 2018). 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 D (EPA 2017b).

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.).

NO_2 monitoring was carried out at two rural Zone D locations in 2016, Emo and Kilkitt and in two urban areas, Enniscorthy and Castlebar (EPA, 2017b). The NO_2 annual average in 2016 for both rural Sites was 3.5 $\mu g/m^3$ with the results for urban stations averaging 8.5 $\mu g/m^3$. Hence long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 $\mu g/m^3$. The average results over the last five years at a range of rural Zone D locations suggest an upper average of no more than 3.5 $\mu g/m^3$ as a background concentration as shown in Table 6.5. Based on the above information an estimate of the background NO_2 concentration in the region of the development is 6 $\mu g/m^3$.

Table 6.5 - Annual Mean NO_2 Concentrations in Zone D Locations (2012-2016) ($\mu g/m^3$)

Year	Enniscorthy (µg/m3)	Kilkitt (µg/m3)	Emo (µg/m3)	Castlebar (µg/m3)
2012	-	4	-	8
2013	-	4	4	11
2014	13	3	3	8
2015	9	2	3	8
2016	10	3	4	9
Average	10.7	3.2	3.5	8.8

CO concentrations for the representative rural Zone D monitoring stations are between 2012 and 2016 on average 0.4 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 region of the proposed development in 2018 is 0.43 mg/m^3.

In terms of benzene, monitoring data for the Zone D location of Shannon Town is available for the period 2011 – 2012 with an average concentration of 0.4 $\mu g/m^3$. More recent data for Zone D locations is not available. Monitoring in the Zone C location of Kilkenny for the period 2014 – 2016 showed an upper average concentration of no more than 0.14 $\mu g/m^3$, which is significantly below the 5 $\mu g/m^3$ limit value. Based on this monitoring data a conservative estimate of the current background concentration in region of the proposed development is 0.2 $\mu g/m^3$.

Long-term PM_{10} monitoring was carried out at the Zone D locations of Castlebar, Claremorris, Enniscorthy and Kilkitt in 2016. The PM_{10} annual averages for these four locations in 2016 ranged from 8.0 to 17.3 $\mu g/m^3$ (EPA, 2017b). The PM_{10} annual average in 2016 for the rural Zone D location of Kilkitt was 12 $\mu g/m^3$ (EPA 2016). Data from 2012 – 2016 for the four Zone D locations showed annual averages ranging from 9 to 19 $\mu g/m^3$ (Table 6.6). Based on these results, a conservative estimate of the background PM_{10} concentration in the region of the proposed development in 2018 is 12 $\mu g/m^3$.

Table 6.6 - Annual Mean PM_{10} Concentrations in Zone D Locations (2012-2016) ($\mu g/m^3$)

Year	Castlebar (µg/m3)	Claremorris (µg/m3)	Enniscorthy (µg/m3)	Kilkitt (µg/m3)
2012	12	10	-	9
2013	15	13	-	11
2014	12	10	22	9
2015	13	10	18	9
2016	10	8	17	12
Average	11	9	19	13

The results of $PM_{2.5}$ monitoring at the Zone D location of Claremorris from 2012 – 2016 (EPA, 2017b) indicated that $PM_{2.5}/PM_{10}$ ratios ranged from 0.5 – 0.6 over that period. Based on this information, a conservative ratio of 0.6 was used to generate a background $PM_{2.5}$ concentration of 7.2 $\mu g/m^3$.

6.4. Potential Impacts in Air Quality & Climate during Construction Phase

The proposed development will involve the construction of a proposed residential development of c. 17.9ha of lands 1.3 km north of Blackrock Village Centre and c. 3 km south of the central core of Dundalk. Further details of the development can be found in Chapter 2. The development has an opening year of 2020 and design year of 2025. 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.

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 area which are associated with the development. The following describes the primary sources of potential air quality impacts which are deemed long term, and which have been assessed in detail as part of this EIAR.

6.4.1. Air Quality

It is likely that construction of the proposed development would take place over a short-term period from the commencement of construction. 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 and PM_{10}/$PM_{2.5}$ emissions (Table 6.7). While construction dust tends to be deposited within 200m of a construction Site, the majority of the deposition occurs within the first 50m. There are a number of sensitive receptors, predominantly residential properties at the northern Site boundary and to the east of the proposed development.

Table 6.7 - Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place (TII 2011)

Source		Potential Distance for Significant Impacts (Distance From Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Impacts
Major	Large construction Sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction Sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction Sites, with limited use of haul roads	25m	10m	10m

6.4.2. Climate

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

6.4.3. Human Health

Best practice mitigation measures are proposed for the construction and operational phases 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.

6.5. Potential Impacts on Air Quality & Climate during Operational Phase

6.5.1. Air Quality

Atkins completed a Traffic and Transportation Generation Report for the development during the operational phase.

The worst-case traffic data used in this assessment has been assessed. It is envisaged that there will be worst case increases in AADT of up to 2,146 vehicles on the Blackrock Road for the opening and design years of 2020 and 2025. Sensitive receptors in the vicinity of the proposed development include the residential receptors and sensitive ecosystems such as the Dundalk Bay SAC and SPA.

Table 6.8 - Traffic Data used in this Assessment

Link Number	Road Name	Base Year	Do-Nothing		Do-Something		Speed (kph)
		2018	**2020**	**2025**	**2020**	**2025**	
1	Blackrock Road	8037 (1.3%)	8319 (1.35%)	8811 (1.43%)	10465 (1.03%)	10957 (1.11%)	60
2	Blackrock Road North	8028 (1.32%)	8310 (1.36%)	8802 (1.45%)	8909 (1.26%)	9402 (1.34%)	60
3	Bóthar na Maol	110 (0%)	114 (0%)	121 (0%)	237 (0%)	244 (0%)	50
4	Blackrock Road North	8652 (3.28%)	8857 (3.35%)	9394 (3.56%)	9826 (2.96%)	10362 (3.16%)	50
5	Finnabair Cres	2342 (3.21%)	2398 (3.28%)	2543 (3.48%)	3587 (2.05%)	3732 (2.22%)	50
6	N52	14758 (8.81%)	15129 (9.01%)	16101 (9.51%)	15689 (8.62%)	16661 (9.13%)	60

Note: Traffic data expressed in AADT, percentage HGV shown in parenthesis

Table 6.9 - Description of Sensitive Receptors (UTM Co-ordinates)

Name	Receptor Type	X	Y
R1	Residential	672440	5984503
R2	Residential	672357	5984751
R3	Residential	672223	5984782

The receptors modelled represent the worst-case locations close to the proposed development and were chosen due to their close proximity (within 200 m) to the proposed development. The worst-case traffic data used in this assessment is shown in Table 6.8, with the percentage of HGV's shown in parenthesis below the AADT. Three sensitive residential receptors in the vicinity of the proposed development have been assessed. Sensitive receptors have been chosen as they have the potential to be adversely impacted by the development, these receptors are shown in Table 6.9.

6.5.2. Modelling Assessment

Transport Infrastructure Ireland "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*" (TII 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. Therefore, in order to assess the impact of the scheme using the 'Do Something' modelling scenario, the 'Do Nothing' modelling scenario must first be assessed.

6.5.3. "Do Nothing" (Existing) Scenario

6.5.3.1. CO and Benzene

The results of the "do nothing" modelling assessment for CO and benzene for opening and design years are shown in Table 6.10 and Table 6.11. Concentrations are well within the limit values at all worst-case receptors. Levels of both pollutants are at maximum 22% and 5% of the respective limit values in 2025.

6.5.3.2. PM_{10}

The results of the "do nothing" modelling assessment for PM_{10} for opening and design years are shown in Table 6.12. Concentrations are well within the annual limit value at all worst-case receptors. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year within the limit, is found to be in compliance at all receptors (Table 6.13). There are up to 4 days of exceedance predicted at any of the three receptors. Annual average PM_{10} concentrations are 50% of the limit value in 2025.

6.5.3.3. $PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ for opening and design years are shown in Table 6.14. The predicted concentrations at all worst-case receptors are well below the $PM_{2.5}$ limit value of 25 µg/m^3. The annual average $PM_{2.5}$ concentration peaks at 53% of the limit value in 2025.

6.5.3.4. NO_2

The results of the "do nothing" assessment of annual average NO_2 concentrations for opening and design years are shown in Table 6.15 for the Highways Agency IAN 170/12 and Table 6.16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The purpose of IAN 170/12 was to account for the conclusions of UK's Department for Environment, Food and Rural Affairs advice on long term trends that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in UK Department for Environment, Food and Rural Affairs technical guidance and observed trends. Hence, the projections calculated via. the IAN 170/12 technique show a slower than previously predicted reduction between the base year and future year predictions. The concentrations are below the limit value at all locations, with levels ranging up to 56% in 2025, using the more conservative IAN prediction.

The hourly limit value for NO_2 is 200 µg/m^3 is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the "do nothing" scenario is not predicted to be exceeded in 2025 (Table 6.17).

6.5.4. "Do Something" (Proposed) Scenario

6.5.4.1. CO and Benzene

The results of the "do something" modelling assessment for CO and benzene for opening and design years are shown in Table 6.10 and Table 6.11. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of both pollutants range from 22% to 5% of the respective limit values in 2025. Future trends indicate similarly low levels of CO and benzene. There are some increases in traffic flows between opening and design years, therefore any reduction in concentrations is due to reduced background concentrations and greater efficiencies predicted in engines.

The impact of the proposed development can be assessed relative to "Do Nothing" levels in 2025 for opening and design years Relative to baseline levels, some imperceptible increases in pollutant levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on CO and benzene concentrations in either opening and design years will be an increase of 0.4% of their respective limit values at Receptor 2. Thus, using the assessment criteria for NO_2 and PM_{10} and applying these criteria to CO and benzene, the impact of the proposed development in terms of CO and benzene is negligible.

6.5.4.2. PM_{10}

The results of the modelled impact of the proposed development for PM_{10} for opening and design years are shown in Table 6.12. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors with levels 51% of the limit value for opening and design years. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year whilst remaining in compliance with the limit value, is found to be in compliance at all receptors. It is predicted that the worst-case receptors will have four exceedances of the 50 µg/m^3 24-hour mean value for either opening and design years (Table 6.13). Future trends with the proposed development in place indicate similarly low levels of PM_{10}.

The impact of the proposed development can be assessed relative to "Do Nothing" levels for opening and design years. Relative to baseline levels, some imperceptible increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed residential development. With regard to impacts at individual receptors, none of the three receptors assessed will experience an increase in concentrations of over 0.32% of the limit value. Thus, the magnitude of the change in air quality is imperceptible based on the criteria outlined in Table 6.2 to Table 6.4.

6.5.4.3. $PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ in the opening and design years are shown in Table 6.14. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors, with levels of 53% of the limit value (see Table 6.1) in 2025. Future trends with the proposed development in place indicate similarly low levels of $PM_{2.5}$.

The impact of the proposed development can be assessed relative to "Do Nothing" levels during opening and design years. Relative to baseline levels, some imperceptible increases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed development. None of the three receptors assessed will experience an increase or decrease in concentrations of over 0.3% of the limit value. Thus, the magnitude of the changes in air is negligible at all receptors based on the criteria outlined in Table 6.2 to Table 6.4.

6.5.4.4. NO_2

The result of the assessment of the impact of the proposed development for NO_2 in the opening and design years are shown in Table 6.15 for the Highways Agency IAN 170/12 and Table 6.16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The annual average concentration is within the limit value (see Table 6.1) at all worst-case receptors using both the UK Department for Environment, Food and Rural Affairs and more conservative IAN technique. Levels of NO_2 are 20% of the annual limit value the opening and design years using the IAN technique, while concentrations are 19% of the annual limit value in opening year and 17% in the design year of 2025 using the UK Department for Environment, Food and Rural Affairs technique in the Do-Something Scenario. Maximum one-hour NO_2 levels with the proposed development in place are not predicted to exceed using either technique. The impact of the proposed development on annual mean NO_2 levels can be assessed relative to "Do Nothing" levels in the opening and design years. Relative to baseline levels, some small increases in pollutant levels are predicted as a result of the proposed residential development. With regard to impacts at individual receptors, none of the three receptors assessed will experience an increase in concentrations of no more than 1.5% of the annual mean limit value for the opening year. Thus, using the assessment criteria outlined in Table 6.2 to Table 6.4, the impact of the proposed development in terms of NO_2 is negligible in the long term.

The hourly limit value for NO_2 is 200 $\mu g/m^3$ is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the "Do something" scenario is not predicted to be exceeded in either 2020 or 2025 (Table 6.17).

Table 6.10 - Maximum 8-hour CO Concentrations (mg/m³)

Receptor	Impact Opening Year (2020)						Design Year (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	2.14	2.18	0.037	0.37	Imperceptible	Negligible Increase	2.15	2.19	0.037	0.37	Imperceptible	Negligible Increase
2	2.12	2.16	0.041	0.41	Imperceptible	Negligible Increase	2.12	2.16	0.040	0.40	Imperceptible	Negligible Increase
3	2.05	2.07	0.022	0.22	Imperceptible	Negligible Increase	2.05	2.07	0.022	0.22	Imperceptible	Negligible Increase

*Do minimum; **Do something

Table 6.11 - Annual Mean Benzene Concentrations (µg/m³)

Receptor	Impact Opening Year (2020)						Design Year (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	0.26	0.27	0.009	0.18	Imperceptible	Negligible Increase	0.26	0.27	0.009	0.17	Imperceptible	Negligible Increase
2	0.26	0.27	0.010	0.19	Imperceptible	Negligible Increase	0.26	0.27	0.010	0.19	Imperceptible	Negligible Increase
3	0.24	0.25	0.005	0.11	Imperceptible	Negligible Increase	0.24	0.25	0.005	0.11	Imperceptible	Negligible Increase

Table 6.12 - Annual Mean PM_{10} Concentrations (µg/m³)

Receptor	Impact Opening Year (2020)						Design Year (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	20.2	20.3	0.12	0.302	Imperceptible	Negligible Increase	20.3	20.4	0.12	0.309	Imperceptible	Negligible Increase
2	20.1	20.3	0.13	0.318	Imperceptible	Negligible Increase	20.2	20.3	0.13	0.325	Imperceptible	Negligible Increase
3	19.9	20.0	0.07	0.171	Imperceptible	Negligible Increase	19.9	20.0	0.07	0.174	Imperceptible	Negligible Increase

Table 6.13 - Number of days with PM_{10} concentration > 50 µg/m^3

Receptor	Impact Opening Year (2020)		Design Year (2025)	
	DM	DS	DM	DS
1	4	4	4	4
2	4	4	4	4
3	3	3	3	3

Table 6.14 - Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	Impact Opening Year (2020)	Design Year (2025)

	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	9.6	9.7	0.06	0.25	Imperceptible	Negligible Increase	9.6	10.1	0.48	1.91	Small	Small Increase
2	9.2	9.2	0.03	0.14	Imperceptible	Negligible Increase	9.2	9.4	0.26	1.03	Imperceptible	Negligible Increase
3	10.0	10.0	0.01	0.05	Imperceptible	Negligible Increase	10.0	10.1	0.10	0.41	Imperceptible	Negligible Increase

Table 6.15 - Annual Mean NO_2 Concentrations (µg/m^3) (using Interim advice note 170/12 V3 Long Term NO_2 Trend Projections)

Receptor	Impact Opening Year (2020)						Design Year (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	7.6	8.2	0.55	1.4	Small	Small Increase	7.5	8.1	0.60	1.5	Small	Small Increase
2	7.3	7.8	0.57	1.4	Small	Small Increase	7.2	7.8	0.61	1.5	Small	Small Increase
3	6.1	6.4	0.30	0.8	Imperceptible	Negligible Increase	6.0	6.3	0.33	0.8	Imperceptible	Negligible Increase

Table 6.16 - Annual Mean NO_2 Concentrations (µg/m^3) (using UK Department for Environment, Food and Rural Affairs Technical Guidance)

Receptor	Impact Opening Year (2020)	Design Year (2025)

	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	6.9	7.4	0.50	1.10	Small	Small Increase	6.2	6.7	0.50	1.3	Small	Small Increase
2	6.5	7.1	0.51	0.63	Small	Small Increase	5.9	6.4	0.50	1.3	Small	Small Increase
3	5.4	5.7	0.27	0.20	Imperceptible	Negligible Increase	4.7	4.9	0.26	0.6	Imperceptible	Negligible Increase

Table 6.17 - Annual 99.8th percentile of daily maximum 1-hour for NO_2 concentrations (µg/m³)

Receptor	IAN 170/12 V3 Long Term NO2 Trend Projections Technique				Defra's Technical Guidance Technique			
	Opening Year (2020)		Design Year (2025)		Opening Year (2020)		Design Year (2025)	
	DM	**DS**	**DM**	**DS**	**DM**	**DS**	**DM**	**DS**
1	69.1	71.3	69.1	85.7	69.1	71.3	69.1	85.7
2	58.5	59.9	58.5	68.6	58.5	59.9	58.5	68.6
3	78	78.4	78	81.4	78	78.4	78	81.4

6.5.5. Regional Air Quality Impacts

The regional impact of the proposed Strategic Housing Development on emissions of NO_x and VOCs has been assessed using the procedures of the National Roads Authority (TII/NRA, 2011) and the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2007). The results (see Table 6.18) indicate that the impact of the proposed development on Ireland's obligations under the Targets set out by "*Directive On the reduction of national emissions of certain atmospheric pollutants and amending Directive 20116/2284*" are negligible. For the assessment year of 2020, the predicted impact of the changes in AADT is to increase NO_x levels by 0.000425% of the NO_x emissions ceiling and decrease VOC levels by 0.0002% of the VOC emissions ceiling to be complied with in 2020. For the assessment year of 2025, the predicted impact of the changes in AADT is to increase NO_x levels by 0.00119% of the NOx emissions ceiling and decrease VOC levels by 0.000248% of the VOC emissions ceiling to be complied with in 2025.

6.5.6. Regional Climate Impacts

The regional impact of the proposed Strategic Housing Development on emissions of CO_2 were also assessed using the Design Manual for Roads and Bridges screening model (see Table 6.18). The results show that the impact of the proposed development in 2020 will be to decrease CO_2 emissions by 0.00039336% of Ireland's EU 2020 Target. In the design year of 2025, the proposed residential development will increase CO_2 emissions by 0.000425% of EU 2020 Target. Thus, the impact of the proposed road development on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the EU 2020 Target (EPA, 2013).

Table 6.18 - Regional Air Quality Assessment

Year	Scenario	VOC	NOX	CO2
		(kg/annum)	(kg/annum)	(tonnes/annum)
2020	Do Nothing	1077	3954	1979
	Do Something	1170	4192	2145
2025	Do Nothing	1141	4172	2107
	Do Something	1246	4500	2297
Increment in 2020		-325.1 kg	93.4 kg	238.5 kg
Increment in 2025		-401.5 kg	104.8 kg	328 kg
Emission Ceiling (kilo Tonnes) 2020		46.5[Note 1]	**46.5**	**56.1**
Emission Ceiling (kilo Tonnes) 2025		42.2 [Note 1]	**42.2**	**27.5**
Impact in 2020 (%)		0.000200%	0.000425%	0.000393%
Impact in 2025 (%)		0.000248%	0.001193%	0.000449%

Note 1 Targets under the "*Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*"

Note 2 20-20-20 Climate and Energy Package

6.5.7. Ecosystems

The EU Habitats Directive (92/43/EEC) provides the EU legislative framework of protecting rare and endangered species of flora and fauna, and habitats. This legislation requires the establishment and conservation of a network of Sites of particular conservation value that are to be termed 'European Sites'.

There are three principal types of European Site, a Special Area of Conservation (SAC), a Special Protection Area (SPA) and Sites of Community Importance. The candidate forms of each of these are also included and are afforded the same legislative protection as defined under SI 473/2011. These Sites form part of "Natura 2000" a network of protected areas throughout the European Union. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) are heritage Sites that are designated for the protection of flora, fauna, habitats and geological Sites under Irish domestic legislation being the Wildlife (Amendment) Act 2000. These Sites do not form part of the Natura 2000 network however.

The TII/NRA guidelines state that as the potential impact of a development is limited to a local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated Site lies within 200m of the road centre line. There are a number of designated areas of conservation within 2km of the proposed development. The Dundalk Bay SAC and SPA is located adjacent to the Blackrock and therefore inside the 200m assessment zone.

The impact of NO_x (i.e. NO and NO_2) emissions resulting from the proposed road at the Dundalk Bay SAC and SPA was assessed. Dispersion modelling and prediction was carried out at typical traffic speeds at the closest location of the road to the SAC/SPA. Ambient NO_x concentrations predicted for the opening and design years at Dundalk Bay SAC and SPA. The road contribution to dry deposition along the transect is also given and was calculated using the methodology of the TII/NRA (TII/NRA, 2011).

The impact at 2m has been calculated as a worst-case location within the Dundalk Bay SAC and SPA. The predicted annual average NO_x level in the Dundalk Bay SAC and SPA is within the limit value of 30µg/m^3 for the “do nothing” scenario in 2020 and 2025, with NOx concentrations reaching at most 16% of this limit in 2020 and 2025. Levels with the proposed development in place are similar reaching 20% of the limit value for the “do something” scenario in 2020 or 2025.

The predicted annual average NO_x levels at the Dundalk Bay SAC and SPA is within the limit value of 30µg/m^3 for the “do something” scenario in both the opening and design years. The impact of the proposed scheme leads to an increase in NO_x concentrations of at most 1 µg/m^3 at Dundalk Bay SAC and SPA. The TII/NRA guidelines state in Appendix E that where the scheme is expected to cause an increase of more than 2µg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_x should be assessed by the project ecologist.

The road contribution to the NO_2 dry deposition rate at 2 m is also calculated. The maximum decrease in the NO_2 dry deposition rate is 0.055 Kg(N)/ha/yr in 2020 and 2025. This is a negligible impact within the Dundalk Bay SAC and SPA for NO_2 dry deposition due to the development.

6.5.8. Human Health

A review of construction and operational phase traffic has been undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated in the sections above, the impact due to the development will be not significant. Reviewing this with respect to baseline background concentrations of air pollution and with all National and EU ambient air quality limit values it is predicted that the impact of the proposed development will not result in a significant impact on human health.

6.6. Cumulative Impacts

Due to the small volume of additional traffic predicted to be generated due to the proposed development, the most significant cumulative impact is the potential of construction phases overlapping with other developments in the area. Should the construction phases of the proposed development and other permitted developments coincide, it is predicted that once appropriate mitigations are put in place during construction, impacts will not be significant. The cumulative impact of any permitted developments and proposed development are predicted to cause insignificant impacts during the operational phase with respect to local air quality for the long and short term.

6.7. Mitigation Measures

6.7.1. Air Quality

The greatest potential impact on air quality during the construction phase is from construction dust emissions, PM_{10}/$PM_{2.5}$ emissions and the potential for nuisance dust. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Due to the sensitivity of the current residential receptors to the Site additional mitigation measures recommended in the Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction (2014) for sensitive receptors have been included. Provided the dust minimisation measures outlined in the Dust Plan (see Appendix E) and

Outline Construction Environmental Management Plan are adhered to, the air quality impacts during the construction phase should be not be significant.

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.
- 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.
- Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- 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. This will ensure that dust nuisance will not be an issue.

6.8. Residual Impacts

When the dust minimisation measures detailed in the mitigation section of this Chapter are implemented, residual fugitive emissions of dust from the Site will be insignificant and pose no nuisance at nearby receptors. Therefore, the overall impact of the construction phase is considered short-term, negative and not significant.

In relation to air quality during operational phase of the proposed development, compliance will be maintained with all relevant ambient air quality standards and guideline values and thus the impact of the development is not significant in the long term.

The results of the air dispersion modelling study indicate that the residual impacts of the proposed development on air quality and climate are predicted to be imperceptible for most parameters with respect to the operational phase local air quality assessment for the long and short term with a negligible impact with regard to all pollutants at all receptors in the long term.

Due to the nature and scale of the development, the impact of the proposed development on climate and Ireland’s obligations under the EU 20-20-20 climate objectives is not significant in the long term.

6.9. Monitoring Requirements

The Site is within close proximity of a number of sensitive receptors, therefore it is recommended that dust monitoring (Bergerhoff Method) should be conducted during the construction phase as this will ensure the efficiency of the dust mitigation measures and will also highlight when more measures may need to be implemented.

Dust emissions resulting from Site activities can potentially have a substantial temporary impact on local air quality. Dust emissions from this particular Site would mainly be associated with earth excavation, loading/unloading of material and HGV traffic entering and leaving the Site. Dust emissions often vary from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. Emissions from any single Site can be expected to have a definable beginning and an end, and also to vary substantially due to varying Site activity. Meteorological conditions affect the level of dust emissions and subsequent deposition downwind of the source.

Dust monitoring should be conducted 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 requirement for the operational phase of the proposed development.