12.0 AIR QUALITY & CLIMATE

12.1 INTRODUCTION AND METHODOLOGY

AWN Consulting Limited were commissioned by Tom Philips and Associates and their client IRES Residential Properties Limited to conduct an assessment into the likely air quality and climate impacts associated with the proposed development at lands known as “RB Central” at Rockbrook, Carmanhall Road, Sandyford Business District, Sandyford, Dublin 18.

The development will consist of 2 no. residential blocks ranging in in height from 5-14 storeys comprising a total of 428 no. apartments (including all balconies, terraces and roof gardens) arranged around two courtyards; communal and public open spaces including boulevards; 4 no. ground floor retail units; resident community uses and crèche with outdoor play area. The development will also include revisions to the existing basement levels including car and bicycle parking provision with new vehicular access from Carmanhall Road; apartment storage areas; waste storage areas; ESB substations and switch room and plant/service areas. The development will also include all piped infrastructure and ducting; green roofs; changes in level; internal roads and pathways; pedestrian access points; services provision; landscaping and boundary treatments and all associated site development and excavation works above and below ground.

This chapter was completed by Dr. Avril Challoner. A Senior Air Quality Consultant at AWN Consulting who holds a First-Class Honours Degree in Environmental Engineering from National University of Ireland, Galway (2009), as well as a PhD in Air Quality from the Trinity College Dublin (2012). She is a full member of both the Institute of Air Quality Management and Institution of Environmental Sciences. Avril has been active in the field of air quality and climate for 9 years, both in research and consultancy.

12.1.1 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 12.1 and Appendix 12.1).

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 12.1) 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 12.1- 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/m³ NO_2
		Annual limit for protection of human health	40 µg/m³ NO_2
		Critical limit for protection of vegetation	30 µg/m³ NO + NO_2
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m³
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m³
		Critical limit for the protection of vegetation	20 µg/m³
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/m³ PM_{10}
		Annual limit for protection of human health	40 µg/m³ PM_{10}
$PM_{2.5}$	2008/50/EC	Annual limit for protection of human health	25 µg/m³ $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	5 µg/m³
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m³ (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

12.1.2 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 (COP24) took place in Katowice, Poland from the 4th to the 14th December 2018 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.

12.1.3 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 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).

12.2 METHODOLOGY

12.2.1 Local Air Quality Assessment

The air quality assessment was carried out following procedures described in the publications by the EPA (EPA 2002, 2003, 2015, 2017) 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, 2019, 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, 2019). Benzene, although previously reported at quite high levels in urban centres (EPA 2018, 2019), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2019, 2018). 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, 2019). 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 (2021);
- Opening Year Do-Something scenario (DS), which assumes the proposed development in place (2021);
- Design Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place (2031) and
- Design Year of the Do-Something scenario (DS), which assumes the proposed development in place (2031).

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, 2017) (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, 2017).

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 11.2 to Table 11.4. 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 12.2- Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 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

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

Table 12.3: 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/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial

Well Below Objective/Limit Value With Scheme (<30 μg/m^3 of NO_2 or PM_{10}) (<18.75 μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

Table 12.3: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

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 12.4: 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)*

12.2.2 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.

12.2.3 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 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" (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, 2017) 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 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.

12.2.4 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 no designated sites within a 2 km radius, therefore no assessment with respect to sensitive ecological receptors is required.

12.3 RECEIVING ENVIRONMENT

12.3.1 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 16 km north of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see 12.1). For data collated during five representative years (2013-2017), the predominant wind direction is south-westerly. The average wind speed over the period 1981 – 2010 is approximately 5.3 m/s.

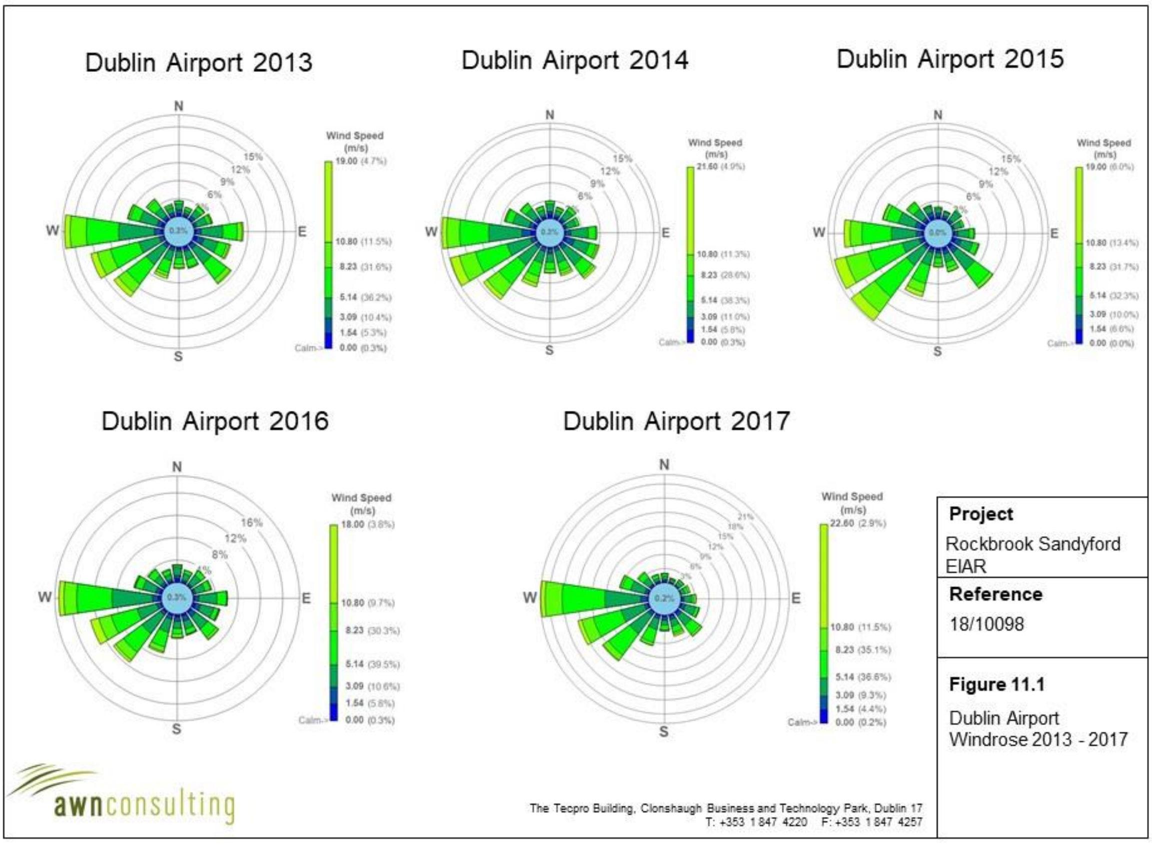

Figure 12.1: Dublin Airport Meteorological Station 2013-2017

12.3.2 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 2021). 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 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.

12.3.3 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" (EPA 2018), 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 2019). 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 (EPA 2018, 2019), at suburban Zone A background locations in Rathmines, St Anne's Park, Dun Laoghaire, Swords and Ballyfermot show that current levels of NO_2 are below both the annual and 1-hour limit values, with annual average levels ranging from 14 - 17 µg/m^3 in 2017 (see Table 11.5). Sufficient data is available for the station in Dun Laoghaire to observe long-term trends since 2013 (EPA 2018, 2019), with annual average results ranging from 15 – 19 µg/m^3. Based on these results, an estimate of the current background NO_2 concentration in the region of the proposed development is 19 µg/m^3.

Table 12.5: Annual Mean NO_2 Concentrations in Zone A Locations (2012-2017) (µg/m^3)

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year					
			2012	2013	2014	2015	2016	2017
Rathmines	Urban Background	Annual Mean NO_2 (µg/m^3)	21	19	17	18	20	17
		99.8th%ile 1-hr NO_2 (µg/m^3)	96	92	105	105	88	Note 1
Ballyfermot	Suburban Background	Annual Mean NO_2 (µg/m^3)	-	16	16	16	17	16
		99.8th%ile 1-hr NO_2 (µg/m^3)	-	82	93	127	90	Note 1
Dun Laoghaire	Suburban Background	Annual Mean NO_2 (µg/m^3)	18	16	15	16	19	17
		99.8th%ile 1-hr NO_2 (µg/m^3)	107	92	86	91	105	Note 1
Swords	Suburban Background	Annual Mean NO_2 (µg/m^3)	15	15	14	13	16	14
		99.8th%ile 1-hr NO_2 (µg/m^3)	99	87	137	93	96	Note 1
St. Anne's Park	Suburban Background	Annual Mean NO_2 (µg/m^3)	-	12	14	14	-	-
		99.8th%ile 1-hr NO_2 (µg/m^3)	-	63	63	67	-	

Note 1 – 2017 99.8th%ile 1-hr NO_2 Data is not yet published

Continuous PM_{10} monitoring carried out at the suburban background locations of Ballyfermot, Dun Laoghaire and Tallaght showed annual mean concentrations ranging from 11.8 – 12.0 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 Dun Laoghaire to observe trends over the period 2012 – 2017. Dun Laoghaire had an average annual mean PM_{10} concentration of 14 µg/m^3 over the period of 2012 – 2017. PM_{10} results from the urban background location in the Phoenix Park show similarly low levels over the period of 2012 – 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 14 µg/m^3.

Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed an average concentration of 10 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 – 0.70 with a representative background concentration of 9.8 µg/m^3 estimated for the region of the proposed development.

CO concentrations for the representative urban Zone A monitoring stations are between 2012 and 2017 on average 0.3 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 Sandyford is 0.3 mg/m^3.

In terms of benzene, monitoring data for the Zone A location of Rathmines is available for the period 2012 – 2017 with an average concentration of 0.95 µg/m^3. Based on this monitoring data a conservative estimate of the current background concentration at the Sandyford is 0.95 µg/m^3.

12.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

Further details of the development can be found in Chapter 3. The development has an opening year of 2021 and design year of 2031. 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.

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.

During the operational phase of the development there will be different sources of potential air quality impacts. 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.

12.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

12.5.1 Construction Phase

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 12.6). 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 commercial properties but also some residential in close proximity to the site boundary.

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.

Table 12.6: Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place (TII 2011)

Source		Potential Distance for Significant Effects (Distance From Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large construction sites, with high use of haul 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

12.5.2 Operational Phase

Air Quality

CST Group completed a Traffic Assessment for the development during the operational phase. As there is the potential for a number of emissions to the atmosphere during the operational phase of the development the traffic impact will be reviewed and assessed against the guidance discussed in Section 12.2.1 of this Chapter. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene, PM_{10} and $PM_{2.5}$.

Climate

CST Group completed a Traffic Assessment for the development during the operational phase. As there is the potential for a number of emissions of GHG's to the atmosphere during the operational phase of the development the traffic impact will be reviewed and assessed against the guidance discussed in Section 12.2.1 of this Chapter. Road traffic and space heating of buildings may give rise to CO_2 and N_2O emissions. There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development.

12.6 AMELIORATIVE, REMEDIAL OR REDUCTIVE MEASURES

In order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and operational phases associated with the proposed development.

12.6.1 Construction Phase

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 Plan (see Appendix 12.3) and construction 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.

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.

12.6.2 Operational Phase

No additional mitigation measures are required as the operational phase of the proposed development as it is predicted to have an imperceptible impact on ambient air quality and climate.

There are a number of potential flooding impacts due to increased rainfall as a result of climate change. A site-specific Flood Risk Assessment has been carried out by Punch Consulting; this assessment ensures the design of defence mechanisms with respect to flooding can account for a rise of 50mm at the 1:1000 year. Any potential impacts as result of climate change have been assessed and mitigated during the design process and it is predicted that flooding will have an imperceptible impact.

12.7 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

12.7.1 Construction Phase

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and $PM_{10}/PM_{2.5}$ emissions (Table 12.6). 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 small number of high sensitivity receptors, predominantly residential properties in proximity to the site boundary. Due to the nature of the area sensitive residential receptors are greater than 200m from construction areas. Any impacts can be easily mitigated and with mitigation measures in place it is predicted that potential impacts are short term and negligible.

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. However, due to the scale of the project it is predicted that the construction phase GHG impacts will be negligible and short-term.

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.

11.7.2 Operational Phase

Local Air Quality

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 with respect to the operational phase local air quality assessment for the long and short term.

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 road links impacted by the proposed development. The worst-case traffic data used in this assessment is shown in Table 12.7, with the percentage of HGV's shown in parenthesis below the AADT. The proposed development is in a mainly commercial area, with some residential receptors. The closest residential receptors which have the potential to be impacted by increased AADT are located on the Beacon South Quarter development. Two sensitive 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 12.8. The road assessed has been chosen as it will have the most significant operational traffic impact due to the proposed development.

Table 12.7: Traffic Data used in this Assessment

Link Number	Road Name	Base Year	Do-Nothing		Do-Something		Speed (kph)
		2018	***2021***	***2021***	***2031***	***2031***	
1	Carmanhall Road	6800 (1.2%)	7700 (1.2%)	8600 (1.2%)	10700 (1.2%)	11600 (1.2%)	50

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

Table 12.8: Description of Sensitive Receptors (UTM Co-ordinates)

Name	Receptor Type	X	Y
R1	Residential	685719	5906839
R2	Commercial	686007	5906687

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 causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. 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.

"Do Nothing" Scenario

CO and Benzene

The results of the "do nothing" modelling assessment for CO and benzene in the opening and design years are shown in Table 12.9 and Table 12.10. Concentrations are well within the limit values at all worst-case receptors. Levels of both pollutants are at maximum 17% and 20% of the respective limit values in 2021 and 2031.

PM_{10}

The results of the "do nothing" modelling assessment for PM_{10} in the opening and design years are shown in Table 12.11. 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 12.12). There will be no days of exceedance predicted at any of the receptors. Annual average PM_{10} concentrations are 35% of the limit value in 2021 and 2031.

$PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ in the opening and design years are shown in Table 12.13. 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 37% of the limit value in 2021 and 2031.

NO_2

The results of the "do nothing" assessment of annual average NO_2 concentrations in the opening and design years are shown in Table 12.14 for the Highways Agency IAN 170/12 and Table 11.15 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 45% of the limit value in 2021 and 43% in 2031, 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 1-hour limit value is not predicted to be exceeded for the "do nothing" scenario in either 2021 or 2031 (Table 12.16).

“Do Something” Scenario

CO and Benzene

The results of the modelled impact of the scheme for CO and benzene in the opening and design years are shown in Table 12.9 and Table 12.10 respectively. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of both pollutants range from 17% to 20% of the respective limit values in 2021 and 2031. Future trends indicate similarly low levels of CO and benzene. There are some increases in traffic flows between 2020 and 2025, but these are mitigated 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 2021 and 2031. 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 2021 and 2031 will be an increase of 0.6% of their respective limit values. 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 in the long-term**.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} in the opening and design years are shown in Table 12.11. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors with levels 36% of the limit value in 2021. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year whist 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 no exceedances of the 50 µg/m^3 24-hour mean value in 2021 and 2031 (Table 12.12). Future trends with the proposed development in place indicate similarly low levels of PM_{10}. Annual average PM_{10} concentrations are also 36% of the limit in 2031.

The impact of the proposed development can be assessed relative to “Do Nothing” levels in 2021 and 2031. Relative to baseline levels, some imperceptible increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed development. With regard to impacts at individual receptors, neither of the receptors assessed will experience an increase in concentrations of over 0.45% of the limit value in 2021 and 2031. Thus, the magnitude of the changes in air quality are imperceptible at all receptors based on the criteria outlined in Table 12.2 to Table 12.4. Therefore, the impact of the proposed development in terms of PM_{10} is **negligible in the long-term**.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ in the opening and design years are shown in Table 12.13. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors, with levels of 37% of the limit value in 2021. Future trends with the proposed development in place indicate similarly low levels of $PM_{2.5}$. Annual average $PM_{2.5}$ concentrations are 37% of the limit in 2031

The impact of the proposed development can be assessed relative to "Do Nothing" levels in 2021 and 2031. Relative to baseline levels, imperceptible increases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed development. Neither of the receptors assessed will experience an increase or decrease in concentrations of over 0.46% of the limit value in 2021 and 2031. Thus, the magnitude of the changes in air quality is negligible at both receptors based on the criteria outlined in Table 12.2 and Table 12.3. Therefore, the impact of the proposed development in terms of $PM_{2.5}$ is **negligible in the long-term**.

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 12.14 for the Highways Agency IAN 170/12 and Table 12.15 using the UK Department for Environment, Food and Rural Affairs technique, respectively. The annual average concentration is within the limit value 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 47% and 45% of the annual limit value in 2021 and 2031 using the IAN technique, while concentrations are 41% and 35% of the annual limit value in 2021 and 2031 using the UK Department for Environment, Food and Rural Affairs technique. The impact of the proposed development on annual mean NO_2 levels can be assessed relative to "Do Nothing" levels in 2021 and 2031. Relative to baseline levels, some small increases in pollutant levels are predicted as a result of the proposed development. With regard to impacts at individual receptors, neither of the receptors assessed will experience an increase in concentrations of over 2.4% of the limit value in 2021. Thus, using the assessment criteria outlined in Table 12.2 and Table 12.3, the impact of the proposed development in terms of NO_2 is **negligible** at both of the receptors assessed **in the long-term**.

The hourly limit value for NO_2 is 200 $\mu g/m^3$ is expressed as a 99.8^{th} percentile (i.e. it must not be exceeded more than 18 times per year). The 1-hour limit value is not predicted to be exceeded for the "Do Something" scenario in either 2021 and 2031 (Table 12.16).

Table 12.9: Maximum 8-hour CO Concentrations (mg/m³)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	1.64	1.69	0.054	Imperceptible	Negligible Increase	1.65	1.71	0.054	Imperceptible	Negligible Increase
2	1.66	1.72	0.061	Imperceptible	Negligible Increase	1.67	1.73	0.060	Imperceptible	Negligible Increase

Table 12.10 Annual Mean Benzene Concentrations (μg/m³)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	0.98	1.00	0.013	Imperceptible	Negligible Increase	0.99	1.00	0.013	Imperceptible	Negligible Increase
2	0.99	1.00	0.014	Imperceptible	Negligible Increase	0.99	1.00	0.014	Imperceptible	Negligible Increase

Table 12.11: Annual Mean PM_{10} Concentrations (μg/m³)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	14.1	14.2	0.16	Imperceptible	Negligible Increase	14.1	14.3	0.16	Imperceptible	Negligible Increase
2	14.1	14.3	0.18	Imperceptible	Negligible Increase	14.2	14.4	0.18	Imperceptible	Negligible Increase

Table 12.12: Number of days with PM_{10} concentration > 50 µg/m³

Receptor	Opening Year (2021)		Design Year (2031)	
	DM	DS	DM	DS
1	0	0	0	0
2	0	0	0	0

Table 12.13: $PM_{2.5}$ Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	9.2	9.3	0.10	Imperceptible	Negligible Increase	9.2	9.3	0.11	Imperceptible	Negligible Increase
2	9.2	9.3	0.11	Imperceptible	Negligible Increase	9.2	9.3	0.12	Imperceptible	Negligible Increase

Table 12.14: Annual Mean NO_2 Concentrations (µg/m³) (using Interim advice note 170/12 V3 Long Term NO_2 Trend Projections)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	17.8	18.6	0.76	Small	Small Increase	16.9	17.7	0.85	Small	Small Increase
2	18.0	18.9	0.85	Small	Small Increase	17.1	18.1	0.94	Small	Small Increase

Table 12.15: Annual Mean NO_2 Concentrations (µg/m³) (using UK Department for Environment, Food and Rural Affairs Technical Guidance)

Receptor	Impact Opening Year (2021)					Impact Design Year (2031)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	15.6	16.2	0.66	Small	Small Increase	13.1	13.7	0.66	Small	Small Increase
2	15.8	16.5	0.74	Small	Small Increase	13.3	14.0	0.73	Small	Small Increase

Table 12.16: 99.8th percentile of daily maximum 1-hour for NO_2 concentrations (µg/m³)

Receptor	1 Hour 99.8th%ile NO_2 Concentrations (µg/m³)							
	IAN 170/12 V3 Long Term NO2 Trend Projections Technique				Defra's Technical Guidance Technique			
	Opening Year (2021)		Design Year (2031)		Opening Year (2021)		Design Year (2031)	
	DM	DS	DM	DS	DM	DS	DM	DS
1	62.3	65	59.1	62.1	62.3	65	59.1	62.1
2	63.2	66.1	60.0	63.3	63.2	66.1	60	63.3

Table 12.17 Regional Air Quality & Climate Assessment

Year	Scenario	VOC (kg/annum)	NO_X (kg/annum)	CO_2 (tonnes/annum)
2021	Do Nothing	155	403	262
	Do Something	215	555	363
2031	Do Nothing	172	448	293
	Do Something	232	599	394
Increment in 2020		60 kg	152.2 kg	100.8 Tonnes
Increment in 2035		59.6 kg	151.4 kg	100.8 Tonnes
Emission Ceiling (kilo Tonnes) 2020		57	66	37,942,682
Emission Ceiling (kilo Tonnes) 2035		51	40	37,942,682
Impact in 2020 (%)		0.0001057%	0.00023%	0.0002657256%
Impact in 2035 (%)		0.0001158%	0.000376%	0.0002656025%

Note 1 Targets under Directive EU 2016/2284 "On the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC" adjusted for Article 4(1) and Annex II

New reduction commitments

Note 2 20-20-20 Climate and Energy Package adjusted for commission Decision (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020

12.7.3 Operational Phase – Regional Air Quality Impacts

The regional impact of the proposed development on emissions of NO_X and VOCs has been assessed using the procedures of Transport Infrastructure Ireland (TII, 2011) and the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2016). The results (see Table 12.17) show that the likely impact of the proposed development on Ireland's obligations under the Targets set out by Directive EU 2016/2284 "*On the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*" are imperceptible and long-term. For the post development year, the predicted impact of the changes in AADT is to increase NO_x levels by 0.000376% of the NO_x emissions ceiling and increase VOC levels by 0.0001158% of the VOC emissions ceiling.

Therefore, the likely overall magnitude of the changes on air quality in the operational stage is ***imperceptible***, ***long-term*** and ***not significant***.

12.7.4 Operational Phase – Climate Impacts

The impact of the proposed development on emissions of CO_2 impacting climate were also assessed using the Design Manual for Roads and Bridges screening model (see Table 12.17). The results show that the impact of the proposed development in the post development year will be to increase CO_2 emissions by 0.0002657% of Ireland's EU 2020 Target. Thus, the impact of the proposed development on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the EU 2020 Target.

Therefore, the likely overall magnitude of the changes on climate in the operational stage is ***imperceptible***, ***long-term*** and ***not significant***.

12.7.5 Human Health Impacts

Air dispersion modelling of operational traffic emissions was 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 by the modelling results, emissions as a result of the proposed development are compliant with all National and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health.

12.8 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/(m2*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.

12.9 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered while carrying out this assessment.

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