Chapter 07
Air Quality

Contents

7. Air Quality

7.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) has considered the potential air quality impacts associated with the Construction and Operational Phases of the Ringsend to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme).

During the Construction Phase, the potential air quality impacts associated with the development of the Proposed Scheme have been assessed. This included construction activities such as utility diversions, road carriageway / cycleway / footway resurfacing and kerb road realignments. Construction traffic on construction access routes are also assessed as part of the study area for this phase of the works.

During the Operational Phase, the potential air quality impacts associated with altered traffic flows along the Proposed Scheme, reallocated traffic lanes and displaced traffic flows have been assessed.

The assessment has been carried out according to best practice and guidelines relating to air quality.

The aim of the Proposed Scheme when in operation is to provide enhanced walking, cycling and bus infrastructure on this key access corridor in the Dublin region, which will enable and deliver efficient, safe, and integrated sustainable transport movement along the corridor. The objectives of the Proposed Scheme are described in Chapter 1 (Introduction). The Proposed Scheme which is described in Chapter 4 (Proposed Scheme Description) has been designed to meet these objectives.

The design of the Proposed Scheme has evolved through comprehensive design iteration, with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme undertaken throughout the option selection and design development process have been incorporated, where appropriate.

7.2 Methodology

The assessment has been undertaken with reference to the most applicable guidance documents relating to air quality, which are set out in the following sections of this Chapter.

An overview of the methodology undertaken for the air quality impact assessment is outlined below:

- A detailed baseline air monitoring study has been undertaken in order to characterise the existing ambient environment in areas along the Proposed Scheme. This has been undertaken through a review of available published ambient air monitoring data and site-specific ambient air monitoring at sensitive locations along the Proposed Scheme;
- A review of the most applicable standards and guidelines has been reviewed in order to define the air quality significance criteria for the Construction and Operational Phases of the Proposed Scheme;
- Predictive calculations and impact assessments relating to the likely Construction Phase air quality impacts have been undertaken at the nearest sensitive locations to the construction work areas associated with the Proposed Scheme;
- Predictive calculations have been performed to assess the potential air quality impacts associated with traffic alterations associated with the operation of the Proposed Scheme at the most sensitive locations; and
- A schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential air quality impacts associated with the Proposed Scheme.

7.2.1 Study Area

The study area for this assessment covers the length of the Proposed Scheme, approximately 4.3 kilometres (km) (2 x 1.6km along the River Liffey Quays and 1.1km of cycle route through Ringsend and Irishtown to Sean Moore Road), between Ringsend to the City Centre, and the area either side of the Proposed Scheme up to a maximum distance of 350 metres (m) during the Construction Phase, and 200m during the Operational Phase. For the Construction Phase assessment, the focus is on air quality sensitive receptors adjacent to the proposed works (e.g. utility diversions, road widening works, road excavation works (where required), road reconfiguration and resurfacing works) that are susceptible to air quality impacts but also those receptors along construction access routes or routes along which traffic is redistributed within the study area (please see Chapter 5 (Construction) for more information on construction access routes). The extent of the overall study area is typically up to a maximum of 350m from a specific area of construction work, as per the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (hereafter referred to as the IAQM Guidance) (IAQM 2014), with the key impacted study areas focused up to a maximum of 100m depending on the air emission sources in question and the local area under consideration. For the Operational Phase, assessment of the dust impacts from maintenance of the Proposed Scheme route has been scoped out on the basis that these activities have low potential for dust release and are likely to have a negligible impact on air quality sensitive receptors.

For the Construction Phase and Operational Phase traffic assessment, the focus is on air quality sensitive receptors which bound the Proposed Scheme and those along diverted traffic routes within the study area. Highly sensitive air quality receptors during the Construction Phase include residential properties, hospitals, schools and residential care homes, whilst commercial and workplace properties are generally viewed as being of medium sensitivity (IAQM 2014). Sensitive receptor locations include residential housing, schools, hospitals, places of worship, sports centres and shopping areas (i.e. locations where members of the public are likely to be regularly present) (Transport Infrastructure Ireland (TII 2011)). Designated areas of conservation (either Irish or European designation) are also considered sensitive air quality receptors (TII 2011). Potential impacts to air quality relate to alterations to traffic patterns (e.g. introduction of a new bus lane or due to redistributed traffic), with particular attention focused on those areas where the Proposed Scheme will be encroaching closer to air quality receptors, specifically where bus or traffic lanes are moving closer to air quality receptors.

For the Construction Phase and Operational Phase traffic assessment, the focus is on air quality receptors within an overall study area of 200m from the Proposed Scheme, as per the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (hereafter referred to as the TII Air Quality Guidelines) (TII 2011) or diverted routes within the key impacted study areas focused within 50m to 100m. The range of air quality sensitive receptors for the two geographical sections are discussed in Table 7.1. The locations of sensitive receptors are provided initially in Table 7.19, and also in Figure 7.3 to Figure 7.8 in Volume 3 of this EIAR.

Table 7.1: Description of Air Quality Receptors within the Study Area

Proposed Scheme Section	Description of Study Area
Talbot Memorial Bridge on Custom House Quay to Tom Clarke East Link Bridge on North Wall Quay	Between Talbot Memorial Bridge on Custom House Quay to Tom Clarke East Link Bridge on North Wall Quay, the key air quality high sensitivity receptors are residential apartments at Excise Walk and Dublin Landings. However, the area is predominantly medium sensitivity receptors such as commercial office properties including IFSC House, the Convention Centre, Central Bank of Ireland, amenity space within and adjoining the CHQ building and hotel properties including Jury's Inn Hotel, Hilton Garden Inn, The Mayson and The Spencer, all located within 5m to 10m of the road edge. Between Talbot Memorial Bridge on City Quay to Tom Clarke East Link Bridge on Sir John Rogerson's Quay, the air quality sensitive areas are predominantly of medium sensitivity as the area has a range of commercial office buildings located within 5m to 10m of the City Quay and Sir John Rogerson's Quay existing road edge. High sensitivity residential dwellings are located at Peterson's Court and Lombard Court, which bound the south of City Quay at distances of 10m to 15m from the road edge, Hanover Riverside Apartments, Longboat Quay North Apartments and Butlers Court, which bound the south of Sir John Rogerson's Quay at a distance of 5m from the road edge.
Tom Clarke East Link Bridge (South) and Sean Moore Road	Between the Tom Clarke East Link Bridge (South) and Sean Moore Road, the key air quality sensitive areas are predominantly high sensitivity residential dwellings which bound the south of York Road and Pigeon House Road, including Portview Apartments, Thorncastle Court, Pembroke Cottages and Poolbeg Quay apartments, which are located at distances of 5m to 15m from the edge of these local roads. Educational receptors include Ringsend College along York Road at a distance of 5m from the road edge. Ringsend and Irishtown Community Centre is located within 100m of the Proposed Scheme. Other sensitive residential receptors include those along the cycle route from Cambridge Park, Kerlogue Road and Bremen Road, located within 5m to 10m of these local roads. Recreational amenity receptors in the area include St Patrick's Rowing Club and Irishtown Stadium.

7.2.2 Relevant Guidelines, Policy and Legislation

The following Environmental Protection Agency (EPA) guideline was considered and consulted in the preparation of this Chapter:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022).

The statutory ambient air quality limit values in Ireland are outlined in S.I. No. 180/2011 - Air Quality Standards Regulations 2011 (hereafter referred to as the Air Quality Regulations), which incorporates the ambient air quality limits set out in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (hereafter referred to as the CAFE Directive), for a range of air pollutants. The statutory ambient air quality guidelines are discussed in greater detail in Section 7.2.2.1.

In addition to the specific statutory air quality standards, the assessment has made reference to national guidelines, where available, in addition to international standards and guidelines relating to the assessment of ambient air quality impacts from road schemes. These are summarised below:

- IAQM Guidance (IAQM 2014);
- A Guide to The Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020)
- TII Air Quality Guidelines (TII 2011);
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (hereafter referred to as the TII Ecological Guidelines) (TII 2009);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission 2013);
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report (European Commission 2017);
- United Kingdom (UK) Department of Environment Food and Rural Affairs (DEFRA) Part IV of the Environment Act 1995: Local Air Quality Management Policy Guidance (PG22) (hereafter referred to as LAQM (PG22)) (DEFRA 2022a);
- Part IV of the Environment Act 1995: Local Air Quality Management Technical Guidance (TG22) (hereafter referred to as LAQM (TG22)) (DEFRA 2022b);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) – LA 105 Air Quality (hereafter referred to as LA 105 Air Quality) (UKHA 2019);
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2005 (hereafter referred to as the WHO Air Quality Guidelines) (WHO 2006); and
- WHO Global Air Quality Guidelines: Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide (WHO 2021).

The guidance 'PE-ENV-01107: Air Quality Assessment of Proposed National Roads – Standard' was issued by TII in December 2022. Section 1.9 of PE-ENV-01107 states that:

'where projects requiring approval under Section 51, Section 177AE or Part 8 have, at the date of publication of this SD, commenced planning and design, and in particular, where technical advisor contracts have been executed, this SD should be:

- *treated as advice and guidance;*
- *employed to the greatest extent reasonably practicable; and*
- *applied in a proportionate manner, having regard to the characteristics and location of the project/maintenance works and the type and characteristics of potential impacts.'*

At the date of publication of PE-ENV-01107, this EIAR was being finalised. It is therefore considered appropriate to retain the methodology outlined in the 2011 TII Air Quality Guidelines (TII 2011) and LA 105 Air Quality (UKHA 2019), particularly to preserve comparability of air quality impacts from the cumulative assessment of this scheme with 11 other Core Bus Corridor Schemes and the standalone assessments of other schemes already submitted for planning permission.

7.2.2.1 Ambient Air Quality Standards / Limit Values

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. The applicable legal standards in Ireland are outlined in the Air Quality Regulations, which incorporate the CAFE Directive. The Air Quality Regulations set limit values for the pollutants nitrogen dioxide (NO_2) and nitrogen oxides (NO_X), particulate matter (PM) with an aerodynamic diameter of less than 10 microns (PM_{10}), PM with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$), lead (Pb), sulphur dioxide (SO_2), benzene and carbon monoxide (CO) (see Table 7.2).

Table 7.2: Air Quality Regulations (based on the CAFE Directive)

Pollutant	Regulation*	Limit Type	Value**
NO_2	S.I. 739 of 2022	Hourly limit for protection of human health - not to be exceeded more than 18 times / year	200µg/m^3 NO_2
		Annual limit for protection of human health	40µg/m^3 NO_2
Nitrogen Oxides (NO + NO_2)		Critical limit for the protection of vegetation and natural ecosystems	30µg/m^3 NO + NO_2
Lead	S.I. 739 of 2022	Annual limit for protection of human health	0.5µg/m^3
SO_2	S.I. 739 of 2022	Hourly limit for protection of human health - not to be exceeded more than 24 times / year	350µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times / year	125µg/m^3
		Critical limit for the protection of vegetation and natural ecosystems (calendar year and winter)	20µg/m^3
PM (as PM_{10})	S.I. 739 of 2022	24-hour limit for protection of human health - not to be exceeded more than 35 times / year	50µg/m^3
		Annual limit for protection of human health	40µg/m^3
PM (as $PM_{2.5}$)	S.I. 739 of 2022	Annual limit for protection of human health	25µg/m^3
Benzene	S.I. 739 of 2022	Annual limit for protection of human health	5µg/m^3
CO	S.I. 739 of 2022	8-hour limit (on a rolling basis) for protection of human health	10mg/m^3

* CAFE Directive replaces the previous Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management and daughter directives, Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air and Directive 2000/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air.
** µg/m^3 (micrograms per cubic metre); mg/m^3 (milligrams per cubic metre).

The WHO Air Quality Guidelines (WHO 2021) values relating to NO_2, PM_{10} and $PM_{2.5}$ are shown in Table 7.3. The WHO Air Quality Guidelines values are more stringent than the European Union (EU) statutory limit values for NO_2, PM_{10} and $PM_{2.5}$. However, the WHO NO_2 one-hour guideline value is an absolute value while the EU standards allow this limit to be exceeded for 18 hours / annum without breaching the statutory limit value.

In May 2020, as part of the joint WHO / United Nations Environment Program (UNEP) / World Bank *BreatheLife* campaign, the four Dublin local authorities signed a commitment to achieve the WHO 2016 Air Quality Guidelines (WHO 2006) by a target date of 2030.

The appropriate compliance limit values for the assessment of air quality impacts of the Proposed Scheme are those outlined in the Air Quality Regulations, which incorporates the CAFE Directive.

Table 7.3: WHO Air Quality Guidelines (WHO 2021)

Pollutant	Regulation	Limit Type	Value
NO_2	WHO Air Quality Guidelines	Hourly limit for protection of human health	25µg/m^3 NO_2
		Annual limit for protection of human health	10µg/m^3 NO_2
PM (as PM_{10})		24-hour limit for protection of human health	45µg/m^3 PM_{10}
		Annual limit for protection of human health	15µg/m^3 PM_{10}
PM (as $PM_{2.5}$)		24-hour limit for protection of human health	15µg/m^3 $PM_{2.5}$
		Annual limit for protection of human health	5µg/m^3 $PM_{2.5}$

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the Construction Phase of a development in Ireland. Dublin City Council (DCC) has published a guidance document titled, Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition (DCC 2018). However, this guidance does not specify a guideline value.

The Verein Deutscher Ingenieure (VDI) German Technical Instructions on Air Quality Control – TA Luft standard for dust deposition (VDI 2002) (non-hazardous dust) sets a maximum permissible emission level for dust deposition of 350mg/(m^2*day) (milligrams, per metre squared, per day) averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health and Local Government (DEHLG) Quarries and Ancillary Activities, Guidelines for Planning Authorities (DEHLG 2004) apply the Bergerhoff limit of 350mg/(m^2*day) measured over monitoring periods of between 28 to 32 days which are then averaged over a one-year period to the site boundary of quarries. This guidance value is applied to potential dust impacts from the construction of the Proposed Scheme.

7.2.2.2 National Air Emission Targets

Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (hereafter referred to as the National Emissions Reduction Directive) was published in December 2016. The National Emissions Reduction Directive applied the limits set out in Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (hereafter referred to as the National Emission Ceiling Directive) until 2020 and established new national emission reduction commitments which are applicable from 2020 and 2030 for SO_2, NO_X, non-methane volatile organic compounds (NMVOC), ammonia (NH_3), $PM_{2.5}$ and methane (CH_4). In relation to Ireland, the 2020 to 2029 emission targets are 25.6kt (kilotonnes) for SO_2 (65% on 2005 levels), 66.8kt for NO_X (49% reduction on 2005 levels), 56.3kt for NMVOCs (25% reduction on 2005 levels), 112.1kt for NH_3 (1% reduction on 2005 levels) and 15.6kt for $PM_{2.5}$ (18% reduction on 2005 levels), as shown in Table 7.4. In relation to 2030, Ireland's emission targets are 85% below 2005 levels for SO_2, 69% reduction for NO_x, 32% reduction for VOCs, 5% reduction for NH_3 and 41% reduction for $PM_{2.5}$, also shown in Table 7.4.

Table 7.4: National Air Emission Targets (Ireland's Air Pollutant Emissions 2020 to 2030)

Pollutant	2020 to 2029 Reduction Commitments (kilotonnes) (and % Reduction Compared to 2005 Levels)	2030 Reduction Commitments (kilotonnes) (and % Reduction Compared to 2005 Levels)
SO_2	25.6	11.0
	-65%	-85%
NO_X	66.8	40.6
	-49%	-69%
NMVOC	56.3	51.1
	-25%	-32%
NH_3	112.1	107.5
	-1%	-5%
$PM_{2.5}$	15.6	11.2
	-18%	-41%

7.2.2.3 Regional Policy

In 2009, the Dublin Regional Air Quality Management Plan 2009-2012 (DCC 2009) was published, and a range of strategies defined to improve air quality in the Dublin Region. The strategies included an improvement in co-ordination to build on the good work to date, to mainstream air quality management into all major policy areas, strengthen the decision-making by improving sharing of information on air quality, introduce measures related to local authority activities that will reduce air emissions and identify and prioritise the main potential threats to air quality.

In relation to specific policies, Policy 6 states that the local authorities shall:

> *'support and encourage the rapid implementation of Quality Bus Corridors and other bus priority measures along the routes identified in the Dublin Transportation Initiative strategy within their functional areas.'*

The Dublin Regional Air Quality Management Plan for Improvements in Levels of Nitrogen Dioxide in Ambient Air Quality (DCC 2011) was a companion document to the Dublin Regional Air Quality Management Plan 2009 - 2012. The document reviewed the measured levels of NO_2 in Dublin City. The document defined the current strategic planning approach as the promotion of *'consolidated urban development based on enhanced public transport*' and outlines a range of measures and policies which will help to improve ambient levels of NO_2.

As a result of an exceedance of the annual mean NO_2 ambient air quality limit value at the St John's Road West monitoring station in 2019 (EPA 2020a), a Dublin Region Air Quality Plan by Dublin Local Authorities in conjunction with the EPA was legally required by the end of 2021 (DCC, Fingal County Council, South Dublin County Council, Dún Laoghaire-Rathdown County Council 2021). The Air Quality Action Plan was subject to public consultation, which gave interested members of the public the opportunity to share their views and input to the plan, which is now complete and was issued to the Minister for the Environment and the EU Commission at the end of 2021. The plan sets out 14 broad measures and a number of associated actions to address the exceedance of the nitrogen dioxide annual limit value. This location of exceedance is outside the study area of the Proposed Scheme.

7.2.3 Data Collection and Collation

The baseline ambient air quality environment has been characterised through a desk study of publicly available data sources and in-situ baseline ambient monitoring surveys.

7.2.3.1 Desk Study

A desk-based air quality assessment was carried out following guidelines described in the publication by TII (TII 2011). TII states that wherever possible use should be made of existing certified air quality data such as that undertaken by the EPA. Air quality monitoring programmes have been undertaken in recent years by the EPA and Local Authorities in the Dublin region. The most recent annual report at the time of assessment, Air Quality in Ireland 2019 (EPA 2020a), details the range and scope of monitoring undertaken throughout Ireland. The Urban Environmental Indicators: Nitrogen dioxide levels in Dublin report (EPA 2020b) assessed spatial variations in ambient air quality in Dublin using diffusion tube sampling and detailed air dispersion modelling. The study found that there were potential exceedances of the ambient air quality limit values for NO_2 close to busy City Centre road junctions, near the Dublin Port Tunnel entrance and exit and along the M50 Motorway. The baseline air quality data collected through the desk study is detailed in Section 7.3.2.1.

A review of potentially sensitive ecological areas has also been conducted using the National Parks and Wildlife Services (NPWS) online mapping services. This review is discussed in Section 7.2.4.2.

7.2.3.2 Site-Specific Baseline Surveys

A site-specific baseline monitoring study was undertaken at monthly intervals from November 2019 to June 2020 as part of the air quality assessment for NO_2 using diffusion tube monitoring at six locations, as detailed in Section 7.3.2.2 and as shown in Figure 7.1 in Volume 3 of this EIAR. Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following a month of sampling, the tubes were analysed using ultraviolet (UV) spectrophotometry, at a United Kingdom Accreditation Service (UKAS) accredited laboratory (SOCOTEC Laboratories in Burton-on-Trent, UK).

The TII Air Quality Guidelines (TII 2011) note that NO_2 diffusion tube monitoring provides a simple, cost-effective means of monitoring at a number of locations across an area and can provide useful information on spatial distributions. The baseline study overlapped in time with traffic surveys being conducted as part of the Traffic Impact Assessment (TIA). Details of the baseline data collected is discussed in Section 7.3.2.

7.2.4 Appraisal Method for the Assessment of Impacts

7.2.4.1 Air Quality Impact Assessment from Traffic Emissions

The air quality assessment has been carried out following procedures described in the EPA Guidelines (EPA 2022) and using the methodology outlined in LA 105 Air Quality (UKHA 2019), LAQM (PG22) (DEFRA 2022a) and LAQM (TG22) (DEFRA 2022b). The general approach outlined in the LA 105 Air Quality, LAQM (PG22) and LAQM (TG22) guidance documents and the methodology outlined within has been recommended for use in assessing Irish road schemes by the TII Air Quality Guidelines (TII 2011) as discussed in Section 7.2.4.1.1 below.

The potential changes in regional air emissions due to the Construction Phase and Operational Phase traffic impacts of the Proposed Scheme have been assessed using the National Transport Authority (NTA) Environmental Appraisal Tool (NTA 2015), which is based on the Environmental Evaluation Model (hereafter referred to as ENEVAL). The data also takes into account the modal shift from private car to bus (walking or cycling).

A validation study of ENEVAL was undertaken by Jacobs Systra in 2016 (Jacobs Systra 2016) which involved running the module on all the Regional Modelling System (RMS) base models to produce a national emission figure for CO_2 (carbon dioxide) production against the national figure provided by the Department of Transport, Tourism and Sport (DTTAS) of 12 megatonnes. The resultant figure was 8.1 megatonnes for ENEVAL. The DTTAS figure included non-transport related fuel (agricultural and industrial use), and in addition, the ENEVAL modelled year was 2012, whilst the DTTAS figures were based on 2015 which would be expected to have higher flows. Therefore, ENEVAL is deemed to be valid for the purposes of calculating regional emissions.

7.2.4.1.1 Local Air Quality Screening Assessment

In 2019, the UKHA DMRB air quality guidance was revised with the publication of LA 105 Air Quality (UKHA 2019) replacing a number of historical guidance documents (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). The revised document outlines a number of changes of approach when assessing the air quality impact of road schemes.

LA 105 Air Quality states that modelling should be conducted for NO_2 for the base, construction and opening years for both the Do Minimum and Do Something scenarios (please see Chapter 6 (Traffic & Transport) for the definition of these terms). Modelling of PM_{10} is only required for the base year to demonstrate that the air quality limit values in relation to PM_{10} are not breached. Where the air quality modelling indicates exceedances of the PM_{10} air quality limits in the base year then PM_{10} should be included in the air quality model in the Do-Minimum and Do-Something scenarios. LA 105 Air Quality guidance states that modelling of $PM_{2.5}$ is not required, as modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value. However, as outlined in Section 7.2.2.1, the four Dublin local authorities have signed up for the *BreatheLife* campaign (https://breathelife2030.org/) to work towards achieving the goal of compliance with the WHO Air Quality Guidelines (WHO 2006) by 2030. Modelling of PM_{10} and $PM_{2.5}$ was undertaken to consider the impact of the Proposed Scheme on these concentrations.

Historically, modelling of CO, lead and benzene was required by the UK HA Design Manual for Roads and Bridges document & calculation spreadsheet (UKHA 2007) and TII Air Quality Guidelines (TII 2011). However, guidance has now been updated by LA 105 Air Quality. As concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (see Section 7.3.2.1) CO, lead and benzene have been scoped out of detailed assessment (EPA 2020a).

LA 105 Air Quality states that the following scoping criteria shall be used to determine whether the air quality impacts of a project can be scoped out or require an assessment based on the changes between the Do Something traffic (with the Proposed Scheme) compared to the Do Minimum traffic (without the Proposed Scheme):

- Annual Average Daily Traffic (AADT) changes by 1,000 or more;
- Heavy Duty Vehicle (HDV) (includes goods vehicles, buses and other heavy vehicles) AADT changes by 200 or more;
- A change in speed band; and
- A change in carriageway alignment by 5m or greater.

The above scoping criteria have been used in the current assessment to determine the road links required for inclusion in the modelling assessment. Sensitive receptors within 200m of impacted road links were included within the modelling assessment as detailed in LA 105 Air Quality.

7.2.4.1.2 Atmospheric Dispersion Modelling System (ADMS)-Roads Dispersion Model

The TII Air Quality Guidelines (TII 2011) state 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.).

Guidance from LA 105 Air Quality states that a detailed assessment must be conducted where the sensitivity of the environment is medium or above when combined with a high-risk project, due to a risk of exceeding air quality thresholds.

Considering the scale of the Proposed Scheme, its risk should be considered high as it has the potential to have an impact on ambient air quality over a large geographical area.

Guidance from LA 105 Air Quality states that a medium sensitivity environment includes areas that have annual mean NO_2 concentrations of 36µg/m^3 or above combined with sensitive receptors within 50m of the impacted roads. NO_2 concentrations (Section 7.3.2.1 and Section 7.3.2.2) were found to be generally below 36µg/m^3 along the suburban areas along the Proposed Scheme. Towards the City Centre, ambient NO_2 concentrations were measured in excess of 36µg/m^3. The LA 105 Air Quality guidance states that a detailed assessment should consider a representative number of receptors and all receptors, with the likelihood of exceeding the air quality limit values.

Vehicle-derived air emissions for areas impacted by significant changes in AADT were modelled using the detailed ADMS-Roads dispersion model (Version 5.1) which has been developed by Cambridge Environmental Research Consultants (CERC) (CERC 2020). The model is a steady-state Gaussian plume model used to assess ambient pollutant concentrations associated with road sources.

The ADMS-Roads dispersion model (Version 5.1) has been used to predict the ground level concentrations (GLC) of NO_2 and PM_{10} / $PM_{2.5}$ in the vicinity of the impacted areas for the baseline year of 2019, the peak Construction Year (2024) and the Opening Year (2028) and Design Year (2043), respectively.

The modelling incorporated the following features:

- Hourly-sequenced meteorological information for Casement Aerodrome in 2019 has been used in the model (see Diagram 7.2) (Met Éireann 2020). The selection of the appropriate meteorological data has followed the guidance issued by the LAQM (TG22) (DEFRA 2022b). A primary requirement is that the data used should have a data capture of greater than 90% for all parameters; and
- Specific air sensitive receptors (ASRs) were also mapped into the model. Receptor heights were input at 1.5m to represent breathing height. Concentrations were reported for each ASR modelled for all modelling scenarios.

It is intended that the Proposed Scheme will have a peak Construction Year (2024) and an Opening Year (2028). Road traffic emission rates are derived using traffic data for the peak Construction Year (2024) and the Opening Year (2028) and Design Year (2043) provided in Chapter 6 (Traffic & Transport) and using emission factors from the COPERT V database (EMISIA 2020) which has been incorporated into the UK DEFRA Emission Factor Toolkit (EFT) Version 10.1 (DEFRA 2020).

The EFT Version 10.1 has been incorporated into the ADMS-Roads model. The toolkit provides emission rates from 2017 to 2030 and traffic emissions for the Proposed Scheme were based on the following assumptions:

- EFT Version 10.1 is based on eight vehicle categories including petrol cars, diesel cars, diesel Light Goods Vehicles (LGV), rigid Heavy Goods Vehicles (HGV) and buses;
- Systra (ENEVAL) fleet composition data for Ireland (2016 base year) were selected to input car, LGV and HGV proportions (Table 7.5). 2019 projections were used for detailed modelling of the 2020 base year, 2022 projections and 2024 projections were used as conservatively representative of the peak Construction Year (2024) and the Opening Year (2028), respectively;
- National Transport Model (NTM) fleet projections provided in UK Technical Advisory Group (TAG) (UK Department for Transport, 2020) have been used to estimate the proportions of cars, LGV and HGV in 2043. No fleet projection tools currently exist, Irish or UK based, that accurately predict the proportion of electric vehicles in 2043, or which take the 2021 Climate Action Plan measures into account. A conservative approach is therefore inevitable, and is based on the use of the UK NTM as the most up to date and robust alternative to the older 2016 base year Systra fleet;
- Predicted bus fleet composition data was developed for 2019, 2028 and 2043 (Table 7.5). The 2019 bus fleet was also applied to the Construction Year (2024);
- Emissions have been calculated using predicted emissions factors for 2019 (to represent the Base Year (2019), 2022 (to represent the peak Construction Year (2024), 2024 (to represent the Opening Year (2028)) and 2030 (to represent the Design Year (2043)). A conservative approach to emission years has been taken, similarly to the fleet projections, to counteract some of the uncertainty associated with improved vehicle standards;
- EFT Version 10.1 incorporates updated NO_X (defined as NO and NO_2) and PM speed emission coefficient equations for Euro 5 and 6 vehicles, taken from the European Environment Agency (EEA) COPERT V emission calculation tool which reflects the most recent evidence on the real-world emission performance of these vehicles;
- Fleet composition based on European emission standards from pre-Euro 1 to Euro 6/VI. Systra fleet data was used to estimate Euro class proportions for cars, LGV, and HGV. The NTA provided Euro class proportions for the bus fleet; and
- Improvements in the quality of fuel and some degree of retrofitting; technology conversion in the national fleet.

Table 7.5:Summary of Fleet Proportions

Vehicle Type		Base Year (2019)	Construction Year (2024)	Opening Year (2028)	Design Year (2043)
Car	Petrol Car	41%	38%	36%	38%
	Diesel Car	57%	60%	63%	25%
	Electric Car	2%	2%	2%	37%
LGV	LGV	99.9%	99.9%	99.9%	81.5%
	Electric LGV	0.1%	0.1%	0.1%	18.5%
HGV	Rigid HGV	86%	86%	86%	86%
	Artic HGV	14%	14%	14%	14%
Bus	Plug-in Hybrid Bus	0%	0%	24%	0%
	Fuel Cell Electric Bus	0%	0%	70%	100%
	Diesel Bus	100%	100%	6%	0%

Advancements in engine technology and the addition of a higher percentage of electric vehicles to the fleet will assist in significantly reducing emissions between 2028 and 2043, even in circumstances where the number of vehicles using a road link increases. Emissions per road link using the EFT Version 10.1 were calculated for the 2043 Do Something scenario and compared to the 2028 Do Something scenario. Conservative assumptions were made for future fleet and uptake of electric vehicles. Across the Proposed Scheme, emissions decreased in 2043, and therefore, 2028 modelled impacts can be considered worst case. As a result, detailed modelling of the Design Year (2043) was scoped out for all pollutants on the basis that emissions will be lower compared to 2028 emissions.

7.2.4.1.3 Verification Study – Year 2019 Traffic Data

Model verification investigates the level of agreement between modelled and measured concentrations. Differences between modelled and measured pollutant concentrations can arise due to uncertainties in, or limitations to, the model input data (such as traffic data and meteorological data), uncertainties in monitoring data and inherent modelling limitations. As outlined in LAQM (TG22) (DEFRA 2022b), an adjustment to the modelled results is usually required in order to ensure that the final concentrations presented are representative of monitoring information in the area.

A verification study was undertaken using the traffic data for the study area which was received from the NTA Eastern Regional Model (ERM) traffic model (See Chapter 6 (Traffic & Transport)) for the year 2020. The study compared the ambient NO_2 monitored concentration at a range of diffusion tube locations with the ADMS-Roads model output at these locations. DCC has undertaken a diffusion tube monitoring program at a range of locations in the study area for both 2018 and 2019. This data has been used to compare model predictions of NO_2 to monitored NO_2 concentrations.

Background data was based on NO_2 levels from Ballyfermot for 2019. Ballyfermot was selected as a suitable suburban background station as it is an ambient air monitoring station suitably removed from Dublin City Centre and at a distance of over 200m from a main roadway. The backgrounds were also utilised in the 2024 and 2028 modelling.

The emission data for the ADMS-Roads model was based on EFT Version 10.1 and the ADMS-Roads model input parameters selected is summarised in Table 7.6.

Table 7.6:Summary of the ADMS-Roads Model Input Parameters

Parameter	Description	Input Value
Coordinate System	Spatial data in ADMS-Roads is linked to a Cartesian coordinate system, measured in meters.	Irish Transverse Mercator (ITM) Coordinate system was used.
Pollutants	A range of preset pollutants can be selected in ADMS-Roads for modelling.	NO_X, NO_2 and PM_{10} were specifically modelled.
Road Source Emissions	Road sources emissions can be entered manually or calculated from traffic flow data.	Road emissions have been calculated from traffic flow data.
Street Canyons	ADMS-Roads has to the ability to model street canyon effects either by using the Basic Street Canyon module or the Advance Street Canyon Module to simulate turbulent flow patterns along streets with relatively tall buildings.	Basic Street Canyon module has been used where canyons have been identified.
Road Emission Factors	ADMS-Roads has a range of emission factors including the recent UK Emission Factor Tool (EFT) v.9.0 dataset.	UK Emission Factor Tool (EFT) v.10.1 (8 VC) dataset has been used based on Northern Ireland (Urban)
Traffic Speed	ADMS-Roads can adjust pollutant emission factors to take account of traffic speed.	Average traffic speed specific to each link, as advised by traffic consultant, has been used in the model.
Meteorological Data	ADMS-Roads requires hourly meteorological data from a suitable meteorological station for a full year.	2019 data from Casement Aerodrome has been used in the model.
Surface Roughness	The model requires a representative surface roughness value for both the modelling domain and the meteorological station.	A value of 1.0m has been selected for the modelling domain with a value of 0.1m selected for Casement Aerodrome
Time-varied Emissions	The model can accept a range of profiles including 3-day and 7-day diurnal profiles	3-day diurnal profile (Weekdays, Saturday, Sunday) has been used in the model.
Primary NO_2	Model will assume that a certain percentage of NO_X emissions are NO_2 when modelling chemistry	Primary NO_2 fractions (%) were calculated using the EFT for each modelled scenario: ▪ 2020 Base – 28.2% ▪ 2024 Do Minimum – 28.9% ▪ 2024 Do Something – 28.9% ▪ 2028 Do Minimum – 29.6% ▪ 2028 Do Something – 29.6%.
Complex Terrain	Where terrain exceeds 1;10, terrain effects may be modelled	Flat terrain has been used in the modelling domain

The first step of model verification, in line with LAQM (TG22), is to consider the performance of the model, prior to any adjustment, by comparing modelled and measured road NO_X contribution at each of the site-specific survey and DCC diffusion tube locations. Some of the monitoring locations were not considered suitable for model verification, due to missing traffic or monitoring data, or other spatial considerations. A total of 19 monitoring sites were included in the verification exercise. The comparison is shown in Diagram 7.1 as the red points and trendline, and also in Table 7.7. This shows that on average, the unadjusted model under predicts total NO_2 concentrations by around 16%.

Table 7.7: Diffusion Tube Monitoring Data Used for Model Verification

Diffusion Tube	Modelled NOX concentration (µg/m3)	Modelled NO2 concentration (µg/m3)	Monitored NOX concentration (µg/m3)	Monitored NO2 concentration (µg/m3)	Difference ([Modelled – Monitored]/[Monitored] *100)	Adjustment Factor
Bus Aras Environs 3 (Amiens St. Upper)	21.4	30.6	49.4	54.7	-44.1%	2.36
Bus Aras Environs 4 (Amiens St. Lower)	30.0	34.6	55.0	50.9	-31.9%	
Pearse Street 1	19.8	29.8	51.3	44.4	-32.9%	
Pearse Street 2 (2018)	22.3	31.0	43.3	40.9	-24.2%	
Pearse Street 3	22.7	31.2	66.8	50.9	-38.7%	
Pearse Street 4	15.8	27.8	56.4	46.6	-40.3%	
Pearse St Continuous Monitor	23.1	31.4	62.1	49.0	-35.9%	
North Wall 1	26.0	32.8	67.0	51.0	-35.7%	
North Wall 2	17.7	28.8	26.4	33.1	-13.1%	
North Wall 3	15.6	27.8	30.8	35.2	-21.2%	
Ringsend 3 (Fitzwilliam Street)	6.6	23.1	22.9	31.4	-26.3%	
North Wall 4	19.1	29.5	12.6	26.3	12.1%	0.93
Bus Aras Environs 1 (Beresford Place)	19.7	29.7	18.8	29.4	1.1%	
Ringsend 2 (Sean Moore Road)	9.6	24.7	3.6	21.6	14.4%	
Ringsend 4 (York Road)	4.7	22.2	8.9	24.4	-9.1%	
Ringsend Continuous Monitor	10.2	25.0	8.2	24.0	4.2%	
16.1	10.2	25.0	4.3	22.0	13.7%	
16.2	5.1	22.4	13.1	26.5	-15.5%	
16.6	17.5	28.7	14.9	27.5	4.3%	
16.5	35.0	36.9	37.2	38.1	-3.2%	

In line with LAQM (TG22), the model adjustment was based on NO_X rather than NO_2 with the NO_2 diffusion tube data first converted to NO_X using the NO_X to NO_2 Calculator (DEFRA 2020). Additionally, the adjustment was applied to the road source contribution only rather than total NO_X, again in line with LAQM (TG22). This process identified that the model performed better at some locations than others, and the adjustment of model bias took this into account.

The comparison of road NO_X contributions provided the following collective bias adjustment factors across the study area, which were then applied to the modelled road contributions at the air quality sensitive receptors most represented by them, before being converted into total NO_2 concentrations:

- 2.36 – 'More congested'. Applied to modelled receptors closest to Amiens Street, Tara Street, Pearse Street, Custom House Quay, North Wall Quay, Cardiff Lane, Macken Street and Ringsend Road; and
- 0.93 – 'Less congested'. Applied to all other receptors.

Following the application of the model bias adjustment factor, the modelled and measured values at these locations included in the verification exercise were compared again. This comparison is shown in Diagram 7.1 as the blue points and trendline. This shows that on average, the adjusted model is within the target 10% of the air quality limit value, with a root mean square error (RMSE) of 4.41µg/m³. In the absence of measured PM_{10} and $PM_{2.5}$ at roadside locations in the study area, the same factors calculated for the modelled road NO_X contribution were applied to the road PM_{10} and road $PM_{2.5}$ contributions.

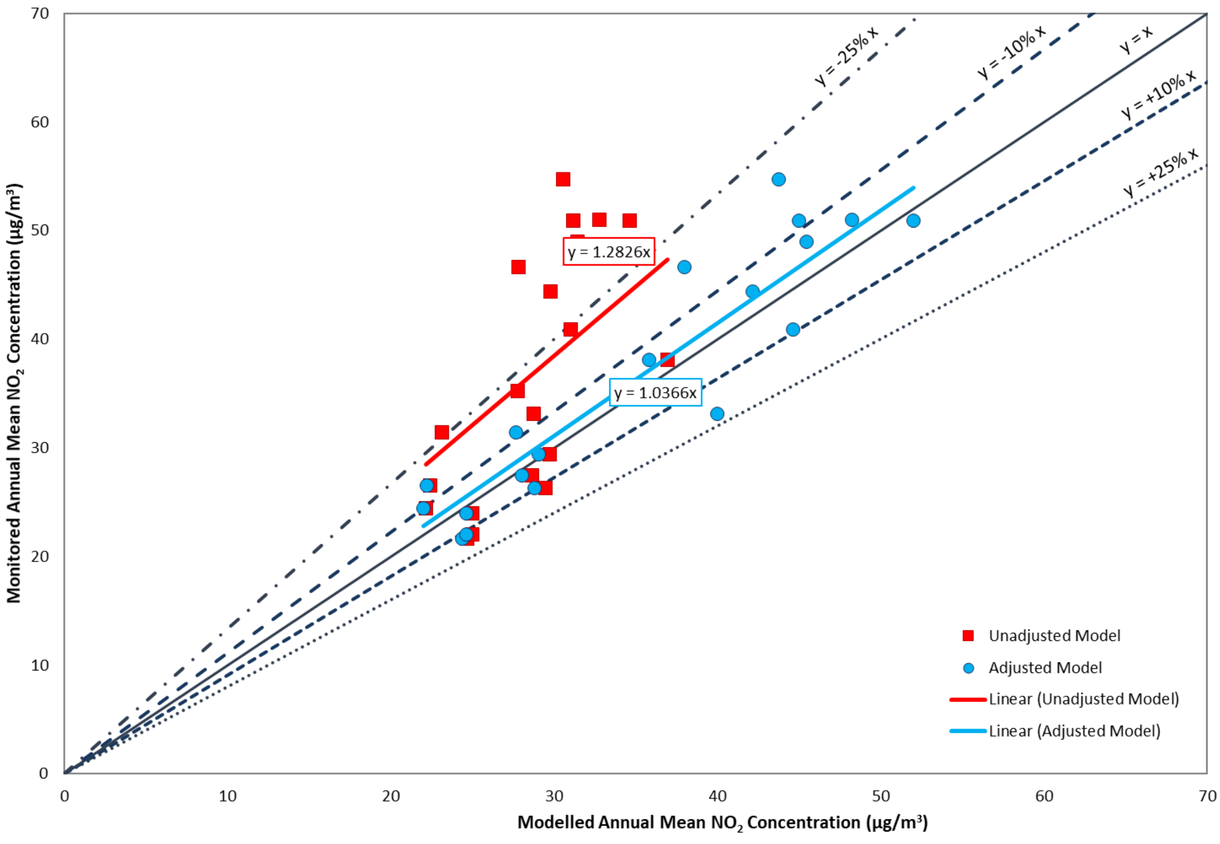


Diagram 7.1: Dispersion Model Verification - Comparison of Monitored and Modelled NO_2 Concentrations (µg/m³)

7.2.4.1.4 Air Quality Impact Significance Criteria

The TII Air Quality Guidelines (TII 2011) detail the methodology for determining air quality impact significance criteria for road schemes in Ireland. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. The significance criteria have been adopted for the Proposed Scheme and are detailed in Table 7.8, Table 7.9 and Table 7.10. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40µg/m³). However, the criteria have also been applied to the predicted annual $PM_{2.5}$ concentrations for the purpose of this assessment.

Table 7.8: 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 > 50µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥ 4µg/m^3	Increase / decrease >4 days	Increase / decrease ≥ 2.5µg/m^3
Medium	Increase / decrease 2µg/m^3 - < 4µg/m^3	Increase / decrease 3 or 4 days	Increase / decrease 1.25µg/m^3 - <2.5µg/m^3
Small	Increase / decrease 0.4µg/m^3 - < 2µg/m^3	Increase / decrease 1 or 2 days	Increase / decrease 0.25µg/m^3 - <1.25µg/m^3
Imperceptible	Increase / decrease < 0.4µg/m^3	Increase / decrease <1 day	Increase / decrease < 0.25µg/m^3

Table 7.9: 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 Proposed Scheme			
Above Objective / Limit Value with Proposed Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just Below Objective / Limit Value with Proposed Scheme (36µg/m^3 - <40µg/m^3 of NO_2 or PM_{10}) (22.5µg/m^3 - <25µg/m^3 of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below Objective / Limit Value with Proposed Scheme (30µg/m^3 - <36µg/m^3 of NO_2 or PM_{10}) (18.75µg/m^3 - <22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well Below Objective / Limit Value with Proposed Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Proposed Scheme			
Above Objective / Limit Value with Proposed Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just Below Objective/Limit Value with Scheme (36 - <40µg/m^3 of NO_2 or PM_{10}) (22.5µg/m^3 - <25µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below Objective / Limit Value with Proposed Scheme (30µg/m^3 - <36µg/m^3 of NO_2 or PM_{10}) (18.75µg/m^3 - <22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well Below Objective / Limit Value with Proposed Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

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

Table 7.10: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Proposed Scheme			
Above Objective/ Limit Value with Proposed Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective / Limit Value with Proposed Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective / Limit Value with Proposed Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective / Limit Value with Proposed Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Scheme			
Above Objective / Limit Value with Proposed Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective / Limit Value with Proposed Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective / Limit Value with Proposed Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective / Limit Value with Proposed Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

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

7.2.4.2 Regional Air Quality Assessment

The change in regional air quality emissions due to Operational Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Module. Emissions from the zonal level ENEVAL tool can provide information on the emissions of pollutants including NO_2, PM_{10}, CO_2 and VOCs for the different traffic scenarios on a regional basis. The ENEVAL software is recommended by Codema in the publication Developing CO_2 Baselines – A Step-by-Step Guide for Your Local Authority (Codema 2017). The ENEVAL tool is discussed in more detail in Section 7.2.4.1.

7.2.4.3 Ecology

For routes which pass within 2km of a designated area of conservation (either Irish or European designation) the TII Air Quality Guidelines (TII 2011) require the air quality specialist to consult with the project ecologist. However, in practice, the potential for impact on an ecological site is highest within 200m of the Proposed Scheme and within 200m of roads where significant changes in AADT (Section 7.2.4.1) occur. Sites identified within these parameters are considered Key Ecological Receptors.

The TII Ecological Guidelines (TII 2009) and the Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DEHLG 2010) provide details regarding the legal protection of designated conservation areas. Further guidance can also be found in the IAQM document A Guide To The Assessment Of Air Quality Impacts On Designated Nature Conservation Sites (IAQM 2020) and in LA105 Air Quality (UKHA 2019), both of which describe nitrogen deposition as the most likely source of significant impacts from road traffic. Pollutants such as CO_2, CO, SO_2, ammonia, particulate matter and volatile organic compounds are not considered in this guidance and have been scoped out of detailed assessment.

The following assessment criteria, in accordance with the TII guidance, is used to determine whether an assessment for nitrogen deposition should be conducted:

- There is a designated area of conservation within 200m of the Proposed Scheme; and

- There is a significant change in AADT flows (see Section 7.2.4.1).

In circumstances where the above criteria are met, there is the potential for impacts on ecology as a result of nitrogen deposition and thus an assessment should be undertaken. For road transport sources within 200m of a designated habitat, individual ecological receptors along a transect at 10m intervals are modelled. Ecological receptors are modelled up to a maximum distance of 200m regardless of whether the habitat extends beyond 200m. It is considered that the greatest impacts will have occurred in proximity to the road. LA 105 Air Quality notes that only sites that are sensitive to nitrogen deposition need to be included in the assessment. It is not necessary to include sites for example that have been designated as a geological feature or watercourse. The ecological receptors along the 200m transect are modelled using the methodology for sensitive human receptors in Section 7.2.4.1.2.

Designated sites which are within 2km of the boundary of the Proposed Scheme are shown in Figure 12.3 in Volume 3 of this EIAR and are as follows:

- The Grand Canal proposed National Heritage Area (pNHA) (Site Code 002104);
- South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) (Site Code 004024);
- South Dublin Bay pNHA (Site Code 000210); and
- South Dublin Bay Special Area of Conservation (SAC) (Site Code 000210).

Consultation with the ecologist has been undertaken. Habitats of particular ecological importance at these sites are:

- Tidal Mudflats and Sandflats;
- Annual vegetation of drift lines;
- Salicornia and other annuals colonising mud and sand; and
- Embryonic shifting dunes.

Species of particular ecological importance include:

- Light-bellied Brent Goose (*Branta bernicla hrota*);
- Oystercatcher (*Haematopus ostralegus*);
- Ringed Plover (*Charadrius hiaticula*);
- Grey Plover (*Pluvialis squatarola*);
- Knot (*Calidris canutus*);
- Sanderling (*Calidris alba*);
- Dunlin (*Calidris alpina*);
- Bar-tailed Godwit (*Limosa lapponica*);
- Redshank (*Tringa totanus*);
- Black-headed Gull (*Chroicocephalus ridibundus*);
- Roseate Tern (*Sterna dougallii*);
- Common Tern (*Sterna hirundo*);
- Arctic Tern (*Sterna paradisaea*); and
- Wetland and Waterbirds.

The Air Quality Regulations outline an annual critical level for NO_X for the protection of vegetation and natural ecosystems in general. The CAFE Directive defines 'Critical Levels' as:

> '*a level fixed on the basis of scientific knowledge, above which direct adverse effects may occur on some receptors, such as trees, other plants or natural ecosystems but not on humans*'.

The TII Ecological Guidelines reference the United Nations Economic Commission for Europe (UNECE) Critical Loads for Nitrogen where a *'Critical Load*' is defined by the UNECE as:

'*a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*' (UNECE 2003).

The TII Ecological Guidelines state that where the predicted environmental concentration (PEC) is less than 70% of the long-term critical level / load, the process contribution (PC) is likely to be insignificant.

The TII Ecological Guidelines outline a methodology to derive the road contribution to dry deposition and thereafter to compare with the published critical loads for the appropriate habitat.

The UNECE critical loads were subsequently updated in the 2010 Review and Revision of Empirical Critical Loads and Dose-Response Relationships (UNECE 2010). The pNHAs are not currently designated for the protection of a specific habitat type. In the absence of a specific designation, the most stringent published critical load in the 2010 Review and Revision of Empirical Critical Loads and Dose-Response Relationships for inland and surface water habitats (5kg(N)/ha/yr to 10kg(N)/ha/yr) (kilogrammes of nitrogen per hectare per year) has been used in the assessment.

In order to calculate the nitrogen deposition, the NO_2 / NO_X concentration determined through modelling, including the background concentration, must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency (UKEA) publication AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air (hereafter referred to as AGTAG06) (UKEA 2014):

Dry deposition flux (µg m^{-2} s^{-1}) = ground-level concentration (µg/m^3) x deposition velocity (m/s)

Deposition velocities are provided in both the TII Air Quality Guidelines (TII 2011) and A Guide to The Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020) for NO_2 in grassland and forestry. Once the dry deposition flux (µg m^{-2} s^{-1} (micrograms, per metre squared, per second)) is calculated it must then be converted to nitrogen equivalent acidification flux (k_{eq} ha^{-1} $year^{-1}$) for comparison with critical loads.

In order to convert the dry deposition flux from units of µg m^{-2} s^{-1} to units of kg ha^{-1} $year^{-1}$, the dry deposition flux is multiplied by the conversion factors. For NO_2 this factor is 96. In order to convert kg ha^{-1} $year^{-1}$ to k_{eq} ha^{-1} $year^{-1}$, where k_{eq} is a unit of equivalents (a measure of how acidifying the chemical species can be), the deposition flux in units of kg ha^{-1} $year^{-1}$ is multiplied by the conversion factor (taken from AQTAG06 (UKEA 2014)). The conversion factor for nitrogen is 0.071428. LA 105 Air Quality (UKHA 2019) states that if the change in nitrogen (N) deposition is greater than 0.4kg N/ha/yr (kilograms of Nitrogen, per hectare, per year) or 1% of the critical level / load consultation with the ecologist should occur.

7.2.4.4 Construction Phase Assessment

The greatest potential impact on air quality during the Construction Phase will be from construction dust emissions, PM_{10} / $PM_{2.5}$ emissions and the potential for nuisance dust. Dust is characterised as encompassing PM with a particle size of between 1 micron and 75 microns (1µm to 75µm). Deposition of dust typically occurs in close proximity to the source, and with IAQM Guidance (IAQM 2014) defining a maximum impact area of 350m from the dust generating activity. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

An appraisal has been carried out to assess the risk to sensitive receptors as a result of dust soiling, health impacts and ecology impacts due to the Construction Phase in accordance with the IAQM Guidance. This appraisal reviews the sensitivity of the site's location with respect to dust nuisance, human health and ecological impacts and then calculates a risk of impact using the magnitude of site activities.

Receptor sensitivity can be described, as follows, with respect to nuisance dust as per the IAQM Guidance:

- High sensitivity receptor with respect to dust nuisance – surrounding land where:
    - Users can reasonably expect enjoyment of a high level of amenity;

    - The appearance, aesthetics or value of their property would be diminished by soiling;
    - The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land; or
    - Examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.
- Medium sensitivity receptor with respect to dust nuisance – surrounding land where:
    - Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home;
    - The appearance, aesthetics or value of their property could be diminished by soiling;
    - The people or property would not reasonably be expected to be present continuously or regularly for extended periods as part of the normal pattern of use of the land; or
    - Indicative examples include parks and places of work.
- Low sensitivity receptor with respect to dust nuisance – surrounding land where:
    - The enjoyment of amenity would not reasonably be expected;
    - Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling;
    - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land; or
    - Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short-term car parks and roads.

Receptor sensitivity can be described, as follows, with respect to human health as per the IAQM Guidance:

- High sensitivity receptor with respect to human health – surrounding land where:
    - Locations where members of the public are exposed over a time period relevant to the air quality limit value for PM_{10} (in the case of the 24-hour limit value, a relevant location would be one where individuals may be exposed for eight hours or more in a day); or
    - Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.
- Medium sensitivity receptor with respect to human health – surrounding land where:
    - Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality limit value for PM_{10} (in the case of the 24-hour limit value, relevant location would be one where individuals may be exposed for eight hours or more in a day); or
    - Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.
- Low sensitivity receptor with respect to human health – surrounding land where:
    - Locations where human exposure is transient; or
    - Indicative examples include public footpaths, playing fields, parks and shopping streets.

Receptor sensitivity can be described, as follows, with respect to ecology as per the IAQM:

- High sensitivity receptor with respect to ecology – surrounding land where:
    - Locations with an international or national designation and the designated features may be affected by dust soiling; or
    - Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
- Medium sensitivity receptor with respect to ecology – surrounding land where:
    - Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
    - Indicative example is a National Heritage Area (NHA) with dust sensitive features.
- Low sensitivity receptor with respect to ecology – surrounding land where:

- Locations with a local designation where the features may be affected by dust deposition; or
- Indicative example is a local Nature Reserve with dust sensitive features.

Prior to assessing the impact from dust emissions, the sensitivity of the area must be established. The sensitivity of the area is determined using the headings:

- Dust soiling effects on people and property;
- Human health impacts; and
- Ecological impacts.

The sensitivity of the area is considered as per the criteria outlined in the IAQM Guidance, and as reproduced in Table 7.11, Table 7.12 and Table 7.13.

In terms of the sensitivity of the area to dust soiling effects on people and property, the receptor sensitivity, number of receptors and their distance from the source are considered. Using these criteria, as outlined in Table 7.11, the sensitivity of the area to dust soiling can be established.

The IAQM Guidance also outlines the criteria for assessing the human health impact from PM_{10} emissions from construction activities based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors effected as per Table 7.12.

An assessment of the Proposed Scheme was completed with respect to the sensitivity criteria in Table 7.11 and Table 7.12. Where the number of receptors was not clear (i.e. for an apartment building), conservative sensitivities were assumed. In addition, when calculating the sensitivity with respect to human health, the background concentrations of particulates was reviewed. The background air quality in the region of the Proposed Scheme is discussed in Section 7.3.2.

Table 7.11: Sensitivity of the Area to Dust Soiling Effects on People and Property (IAQM 2014)

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

Table 7.12: Sensitivity of the Area to Human Health Impacts (IAQM 2014)

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
High	> 32µg/m³	>100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28µg/m³ - 32µg/m³	>100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24µg/m³ - 28µg/m³	>100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	< 24µg/m³	>100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	> 32µg/m³	>10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28µg/m³ - 32µg/m³	>10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24µg/m³ - 28µg/m³	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	< 24µg/m³	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	1+	Low	Low	Low	Low	Low

Dust deposition impacts on ecology can occur due to chemical or physical effects. This includes a reduction in photosynthesis due to smothering from dust on the plants and chemical changes such as acidity to soils. Often impacts will be reversible once the works are completed, and dust deposition ceases. Designated sites within 50m of the boundary of the site, or within 50m of the Proposed Scheme used by construction vehicles on public highways up to a distance of 500m from a construction site entrance can be affected according to the IAQM Guidance. The sensitivity of the area to ecological impacts are considered using the sensitivity criteria outlined in Table 7.13. There are no sensitive ecological receptors within 50m of the Proposed Scheme.

Table 7.13: Sensitivity of the Area to Ecological Impacts (IAQM 2014)

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

In order to determine the level of dust mitigation required during the Construction Phase, the potential magnitude of dust emissions for each dust generating activity needs to be taken into account, along with the already established sensitivity of the area. These major dust generating activities are divided into four types (where relevant) to reflect their different potential impacts, as outlined below:

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

Trackout is defined by the IAQM Guidance as the '*transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network*'.

7.3 Baseline Environment

The following sections describe the baseline conditions in the vicinity of the Proposed Scheme based on a review of published data and on-site monitoring.

7.3.1 Meteorological Conditions

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 ($PM_{2.5}$ to PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

Casement Aerodrome meteorological station, which is located approximately 13km south-west of the Proposed Scheme at the closest point, collects meteorological data in the correct format for the purposes of this assessment and has a data collection of greater than 90%. Long-term hourly observations at Casement Aerodrome meteorological station provide an indication of the prevailing wind conditions for the region (see Diagram 7.2). Results indicate that the prevailing wind direction is from south to westerly in direction over the period 2015 to 2019.

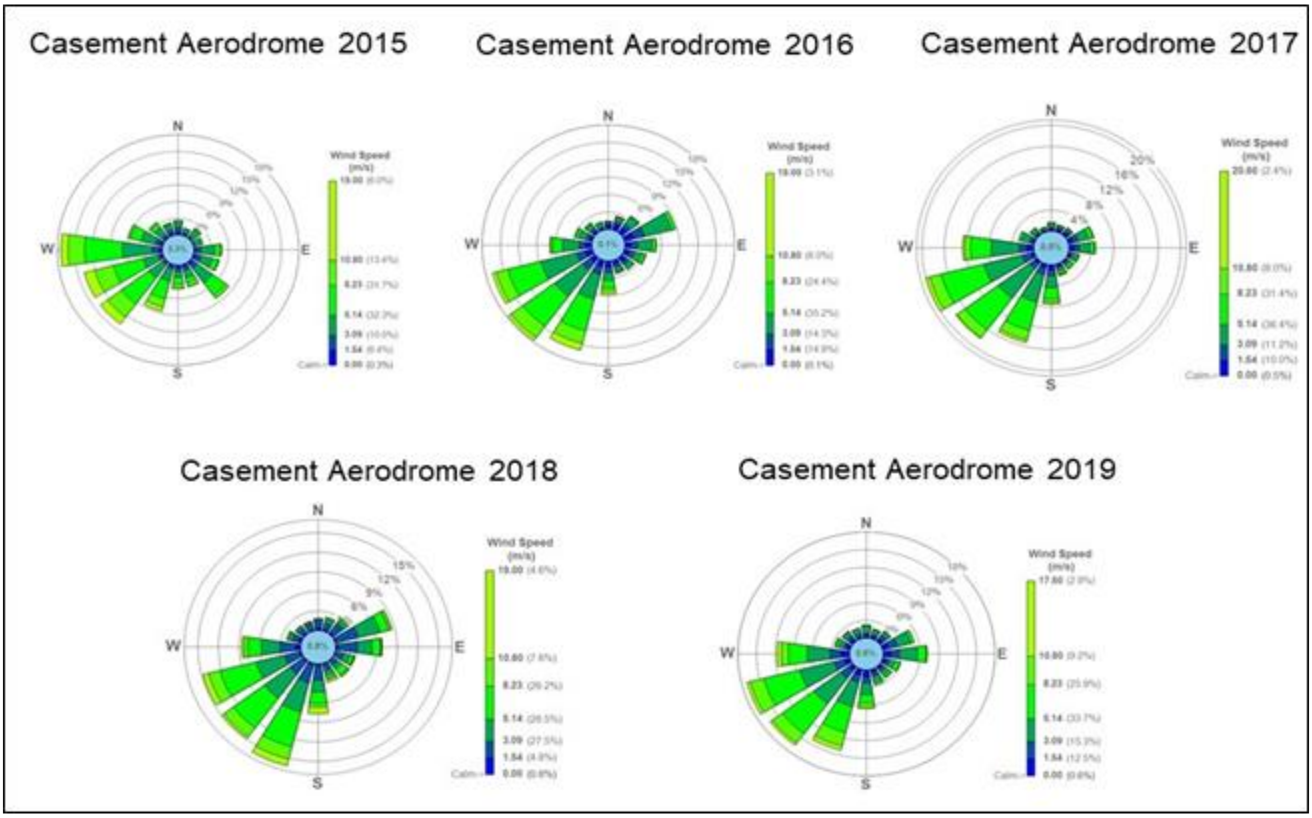


Diagram 7.2: Casement Aerodrome Meteorological Station Windrose 2015 to 2019 (Met Éireann 2020)

7.3.2 Baseline Ambient Air Quality

Background air quality is the air quality at a specific location when the local emissions of air quality have been subtracted from the measured air quality. Thus, a 'background' air concentration is usually representative of a wider area (such as an urban area or suburban area). Baseline air quality is the current air quality at a specific location including all local and non-local sources.

A desk study of the EPA air quality monitoring programs has been undertaken. The most recent annual report on air quality at the time of assessment, Air Quality in Ireland 2019 (EPA 2020a), details the range and scope of monitoring undertaken throughout Ireland. In addition, scheme-specific baseline air quality monitoring has been conducted. The data collected has been included to provide site-specific baseline concentrations of NO_2 in areas which have the potential to be impacted by the Proposed Scheme.

7.3.2.1 EPA Data

As part of the implementation of S.I. No. 271/2002 - Air Quality Standards Regulations 2002, four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 2020a). 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 zoning, the area of the Proposed Schemes is located within Zone A, as shown in Figure 7.2 Volume 3 of this EIAR (EPA 2020a).

With regard to NO_2, continuous monitoring data from the EPA at locations representative to the Proposed Scheme was reviewed (EPA 2020a). The stations reviewed included Ballyfermot, Ringsend, Dún Laoghaire, Rathmines and Winetavern Street. The Ringsend urban traffic monitoring station was reopened in 2017, as shown in Table 7.14 and is located to the eastern side of the Proposed Scheme. The annual average NO_2 concentration was 24µg/m^3 over a three-year period (2017 to 2019). The station had an average concentration of 24µg/m^3 in 2019 compared to the annual limit value of 40µg/m^3 with no exceedances of the one-hour limit value of 200µg/m^3.

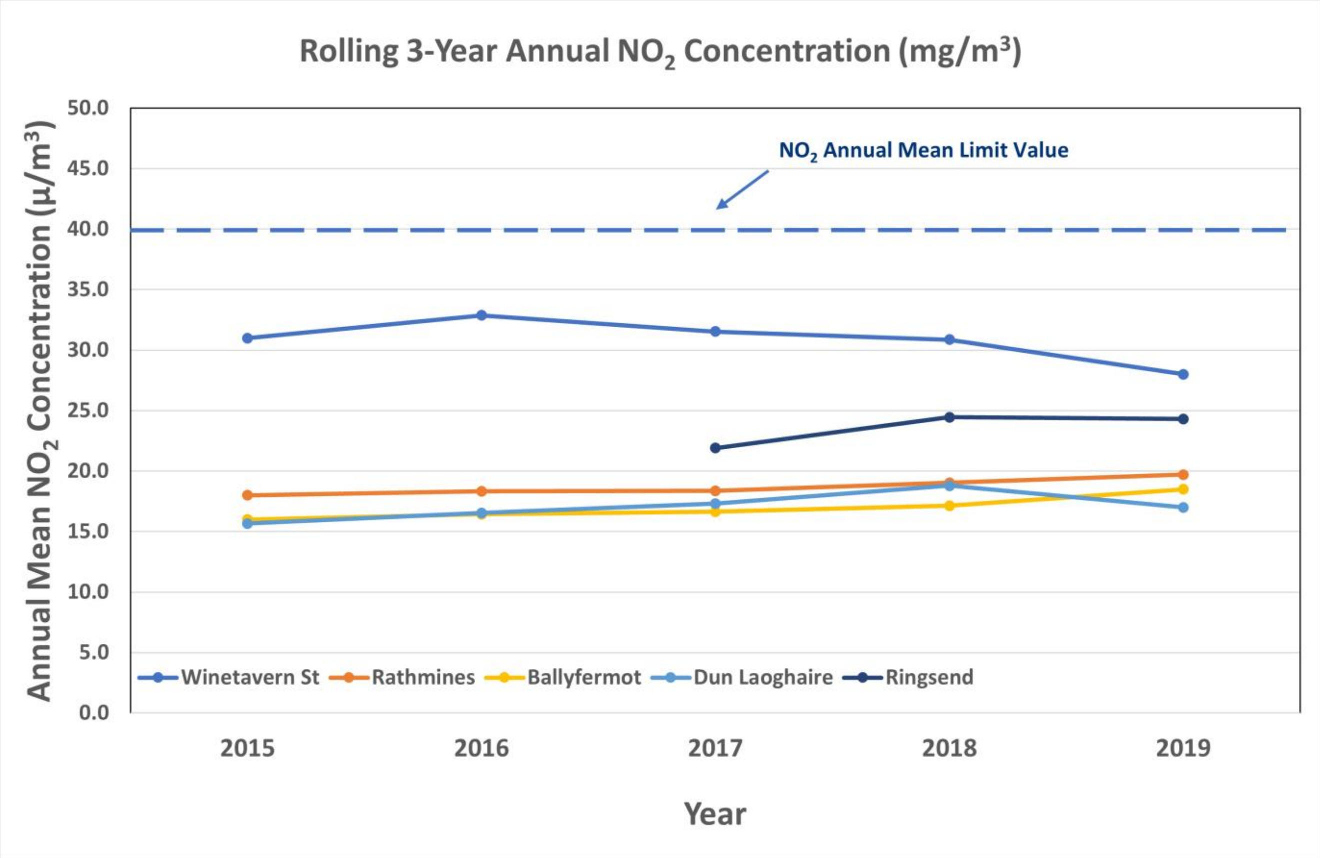
Long-term trends at the City Centre location of Winetavern Street are available and were also reviewed. Concentrations of NO_2 were below the annual and 1-hour limit values, with annual average levels ranging from 27µg/m³ to 37µg/m³ over the period 2015 to 2019 compared to the annual limit value of 40µg/m³. The average concentration in 2019 was 28µg/m³.

The ambient NO_2 monitoring results for Ballyfermot, Ringsend, Dún Laoghaire, Rathmines and Winetavern Street over the period 2015 to 2019, based on a three-year rolling average, are shown in in Diagram 7.3. The data and trend line indicate that levels are reasonably constant at each location over the five-year period.

Table 7.14: Trends in Suburban and Urban NO_2 Concentration (µg/m³) In Dublin 2015 to 2019

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year					Limit Value
			2015	2016	2017	2018	2019	
Winetavern Street	Urban Traffic	Annual Mean NO_2 (µg/m³)	31	37	27	29	28	40
		99.8th%ile 1-hr NO_2 (µg/m³)	128	120	110	115	115	200
Rathmines	Urban Background	Annual Mean NO_2 (µg/m³)	18	20	17	20	22	40
		99.8th%ile 1-hr NO_2 (µg/m³)	105	88	86	87	102	200
Ballyfermot	Suburban Background	Annual Mean NO_2 (µg/m³)	16	17	17	17	20	40
		99.8th%ile 1-hr NO_2 (µg/m³)	127	90	112	101	101	200
Dún Laoghaire	Suburban Background	Annual Mean NO_2 (µg/m³)	16	19	17	19	15	40
		99.8th%ile 1-hr NO_2 (µg/m³)	91	105	101	91	104	200
Ringsend	Urban Traffic	Annual Mean NO_2 (µg/m³)	-	-	22	27	24	40
		99.8th%ile 1-hr NO_2 (µg/m³)	-	-	100	87	109	200

* Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management



Note: Ringsend reopened in 2017

Diagram 7.3: Rolling Three-Year Annual NO_2 Concentration (µg/m³)

In addition to the continuous monitoring stations, the EPA has gathered NO_2 data using the passive diffusion tube methodology in proximity to the Proposed Scheme (EPA 2020b). The diffusion tube sampling was carried out in conjunction with DCC. Monitoring is for single year periods, therefore, long-term averages are not available at diffusion tube locations. Further details on the diffusion tube methodology are discussed in Section 7.3.2.2 as part of the site-specific monitoring study. The five roadside monitoring locations on Pearse Street, the Busáras Environs 2-4 and North Wall 1 were found to exceed the annual mean NO_2 concentration in 2018 and 2019.

Table 7.15 EPA NO_2 Diffusion Tube Monitoring Data

Monitoring Site	Monitoring Year	Annual Mean NO_2 Concentration (µg/m^3)
Busáras Environs 1 (Beresford Road)	2019	29.4
Busáras Environs 2 (Gardner St. Lower)	2019	57.2
Busáras Environs 3 (Amiens St. Upper)	2019	54.7
Busáras Environs 4 (Amiens St. Lower)	2019	50.9
Pearse Street 1	2018	44.4
Pearse Street 2 (2018)	2018	40.9
Pearse Street 3	2018	50.9
Pearse Street 4	2018	46.6
Pearse St Continuous Monitor	2019	49.0
North Wall 1	2018	51.0
North Wall 2	2018	33.1
North Wall 3	2018	35.2
North Wall 4	2018	26.3
Ringsend 2 (Sean Moore Road)	2018	21.6
Ringsend 3 (Fitzwilliam Street)	2018	31.4
Ringsend 2 (Sean Moore Road)	2018	21.6
Ringsend 4 (York Road)	2018	24.4
Ringsend Continuous Monitor	2019	24.0

Continuous PM_{10} monitoring carried out at the suburban locations of Ballyfermot, Davitt Road, Dún Laoghaire, Phoenix Park, Rathmines, Ringsend and Tallaght showed annual average levels ranging from 11µg/m^3 to 19µg/m^3 in 2019, with a maximum of 15 exceedances of the 24-hour limit value of 50µg/m^3 (35 exceedances are permitted per year). Longer term averages for Dún Laoghaire, Phoenix Park, Rathmines, Ringsend and Tallaght from 2015 to 2019 show annual average concentrations of between 9µg/m^3 to 20µg/m^3, as shown in Table 7.16.

The City Centre monitoring location of Winetavern Street has a long-term average (2015 to 2019) of 14µg/m^3 with an annual average in 2019 of 15µg/m^3. Average PM_{10} levels at the urban traffic monitoring location in Ringsend, which was reopened in 2017 after closing in 2013, which is in close proximity to the Proposed Scheme, were reviewed. The annual average level in 2019 was 19µg/m^3, with 12 exceedances of the 24-hour limit value of 50µg/m^3.

Continuous $PM_{2.5}$ monitoring carried out at the Zone A locations of Ballyfermot, Phoenix Park, Dún Laoghaire, Ringsend, Rathmines and Marino showed average levels of 9µg/m^3 in 2019. Longer term averages for Ringsend, Rathmines and Marino from 2015 to 2019 show annual average concentrations of between 6µg/m^3 to 10µg/m^3. The annual average level measured in Ringsend in 2019 was 10µg/m^3 compared to the 25µg/m^3 limit value. Rathmines monitors both PM_{10} and $PM_{2.5}$ allowing a ratio of PM_{10} to $PM_{2.5}$ to be calculated. The average $PM_{2.5}$ / PM_{10} ratio for Rathmines was 0.53 in 2019.

Table 7.16 Trends in Suburban and Urban PM_{10} Concentration (μg/m³) In Dublin 2015 to 2019

Station	Averaging Period	Year					Limit Value
		2015	2016	2017	2018	2019	
Ballyfermot	Annual Mean PM_{10} (μg/m³)	12	11	12	16	14	40
	90th%ile 24-hr PM_{10} (μg/m³)	22	21	21	24	26	50
Davitt Road	Annual Mean PM_{10} (μg/m³)	13	14	-	14	19	40
	90th%ile 24-hr PM_{10} (μg/m³)	6	2	-	1	15	50
Dún Laoghaire	Annual Mean PM_{10} (μg/m³)	13	13	12	13	12	40
	90th%ile 24-hr PM_{10} (μg/m³)	22	22	21	21	24	50
Phoenix Park	Annual Mean PM_{10} (μg/m³)	12	11	9	11	11	40
	90th%ile 24-hr PM_{10} (μg/m³)	20	20	16	18	18	50
Rathmines	Annual Mean PM_{10} (μg/m³)	15	15	13	15	15	40
	90th%ile 24-hr PM_{10} (μg/m³)	28	28	24	25	24	50
Ringsend	Annual Mean PM_{10} (μg/m³)	-	-	13	20	19	40
	90th%ile 24-hr PM_{10} (μg/m³)	-	-	-	35	-	50
Tallaght	Annual Mean PM_{10} (μg/m³)	14	14	12	15	12	40
	90th%ile 24-hr PM_{10} (μg/m³)	4	0	2	1	3	50
Winetavern Street	Annual Mean PM_{10} (μg/m³)	14	14	13	14	15	40
	90th%ile 24-hr PM_{10} (μg/m³)	25	23	21	24	25	50

7.3.2.2 Site-Specific Monitoring Data

Monitoring of NO_2 in proximity to the Proposed Scheme, and roads that have the potential to be impacted by it, was carried out using passive diffusion tubes. The baseline monitoring study was carried out close to the alignment of the Proposed Scheme, with monitoring focusing on areas of greatest potential impact. The results of the monitoring survey allow for an indicative comparison with the annual limit value for NO_2. Diffusion tubes are a useful tool for assessing the spatial variation of NO_2 as they do not require an electrical connection and allow for multiple locations to be monitored at the same time. The results also provide information on the influence of road sources relative to the prevailing background level of these pollutants in the area. The spatial variation in NO_2 levels away from air emission sources is particularly important, as a complex relationship exists between NO, NO_2 and Ozone (O_3) leading to a non-linear variation of NO_2 concentrations with distance from these sources.

A baseline NO_2 monitoring survey was undertaken as part of the air quality assessment for the BusConnects Dublin - Core Bus Corridor Infrastructure Works (hereafter referred to as the CBC Infrastructure Works). Monitoring at 112 locations was completed for a seven-month data collection period (with six diffusion tube change overs between 15 November 2019 to 8 June 2020). However, due to COVID-19 impacts on the baseline traffic environment, the final two data sets (16 March 2020 to 8 June 2020) are considered non ‘typical’ baseline data and therefore are not included in the baseline data set.

Under the TII Air Quality Guidelines (TII 2011), a minimum of one-month baseline monitoring is required, ideally extending to at least three months. The TII Air Quality Guidelines specifically state:

'Monitoring should ideally be carried out for a period of six months, including both summer and winter periods. However, for practical reasons, the monitoring period may be shorter, but, wherever possible, should extend for at least 3 months and should not be less than 1 month'.

In general, four months of typical (i.e. prior to COVID-19 traffic conditions) baseline data was collected which achieves the minimum monitoring period recommended in the TII Air Quality Guidelines.

Studies in the UK have shown that diffusion tube monitoring results generally have a positive or negative bias when compared to continuous analysers. This bias is laboratory specific and is dependent on the specific analysis procedures at each laboratory. A diffusion tube bias of 0.77 was obtained for the SOCOTEC laboratory (which analysed the diffusion tubes) from the UK DEFRA website (DEFRA 2018). In addition, three diffusion tubes were co-located with the continuous EPA NO_2 monitors at a number of locations across the CBC Infrastructure Works in order to develop a local bias adjustment factor specific to the CBC Infrastructure Works in order to develop a local bias adjustment factor specific to the Proposed Scheme. A bias adjustment factor was calculated for the St. John's Road (near Heuston Station) monitor of 0.76. A bias adjustment factor of 0.77 was selected for the diffusion tube monitoring results as this value was the more conservative of the laboratory derived and site-specific biases.

In addition to the bias adjustment, an annualisation factor is required as the monitoring period did not extend to a full year. The annualisation factor was prepared as per LAQM (TG22) (DEFRA 2022b). The annualisation factor is necessary as NO_2 concentrations vary across the year and this should be accounted for within the baseline monitoring. The factor was calculated using 2019 monitoring data from Ballyfermot, Winetavern, Davitt Road and St. Johns Road using Box 7.10 of LAQM (TG22). This factor was calculated to be 0.986 for the period of the diffusion tube monitoring.

The six monitored locations in the vicinity of the Proposed Scheme are shown Table 7.17, and Figure 7.1 in Volume 3 of this EIAR. Table 7.18 and Diagram 7.4 outlines the results of the baseline NO_2 diffusion tube monitoring over the period 15 November 2019 to 16 March 2020.

The highest four-month average concentration was recorded at a roadside location in proximity to 34 City Quay (tube no. 16.5). Concentrations at this location were 38.1µg/m^3 or 95% of the annual mean limit value with the bias adjustment and annualisation factor applied. No monitoring locations along the Proposed Scheme recorded an exceedance in the annual mean limit value for NO_2.

The lowest concentration was recorded along North Wall Quay (tube no. 16.4) (21.4µg/m^3). This location is along the Proposed Scheme however, results should be taken with caution due to data loss (owing to accidental damage or theft).

Based on LAQM (TG22), it can be considered that exceedances of the NO_2 one-hour limit value objective may occur at roadside sites if the annual mean is above 60µg/m^3 (DEFRA 2022b). None of the sites monitored are considered likely to exceed the NO_2 one-hour limit value objective.

Table 7.17: Air Quality Monitoring Locations

Tube No.	Reference	Site	East (ITM)	North (ITM)
16.1	CBC0016DT001	Ringsend, EPA Colocation (Triplicate Average)	718922	733893
16.2	CBC0016DT002	Portview House	717995	734166
16.3	CBC0016DT003	North Wall Quay (Near Castleforbes Road)	716795	734521
16.4	CBC0016DT004	North Wall Quay, DCC Docklands 1	717784	734440
16.5	CBC0016DT005	34 City Quay	716608	734399
16.6	CBC0016DT006	77 Sir John Rogerson Quay	717301	734305

Table 7.18: Air Quality Monitoring Results

Tube No.	Site	15 Nov – 15 Dec 2019 (µg/m³)	15 Dec 2019 – 15 Jan 2020 µg/m³)	15 Jan – 17 Feb 2020 (µg/m³)	15 Feb – 16 Mar 2020 (µg/m³)	Average	Locally Bias Adjusted and Annualised NO_2 Concentration (µg/m^{-3}) Note 1, Note 2
16.1	Ringsend, EPA Colocation (Triplicate Average)	33.9	34.4	24.4	23.2	29.0	22.0
16.2	Portview House	43.0	36.0	35.1	25.7	35.0	26.5
16.3	North Wall Quay (Near Castleforbes Road)	Lost	Lost	Lost	47.8	47.8	**36.3**
16.4	North Wall Quay, DCC Docklands 1	Lost	Lost	Lost	28.2	28.2	21.4
16.5	34 City Quay	60.7	48.8	53.9	37.5	50.2	**38.1**
16.6	77 Sir John Rogerson Quay	33.5	40.0	43.4	27.8	36.2	27.5
Average		42.8	39.8	39.2	31.7	37.7	28.6
Max		60.7	48.8	53.9	47.8	50.2	38.1
Min		33.5	34.4	24.4	23.2	28.2	21.4

Note 1: Bias adjustment factor: 0.77, Annualisation factor: 0.986

Note 2: Locally bias adjusted concentrations in bold exceed the 80% threshold value for screening modelling

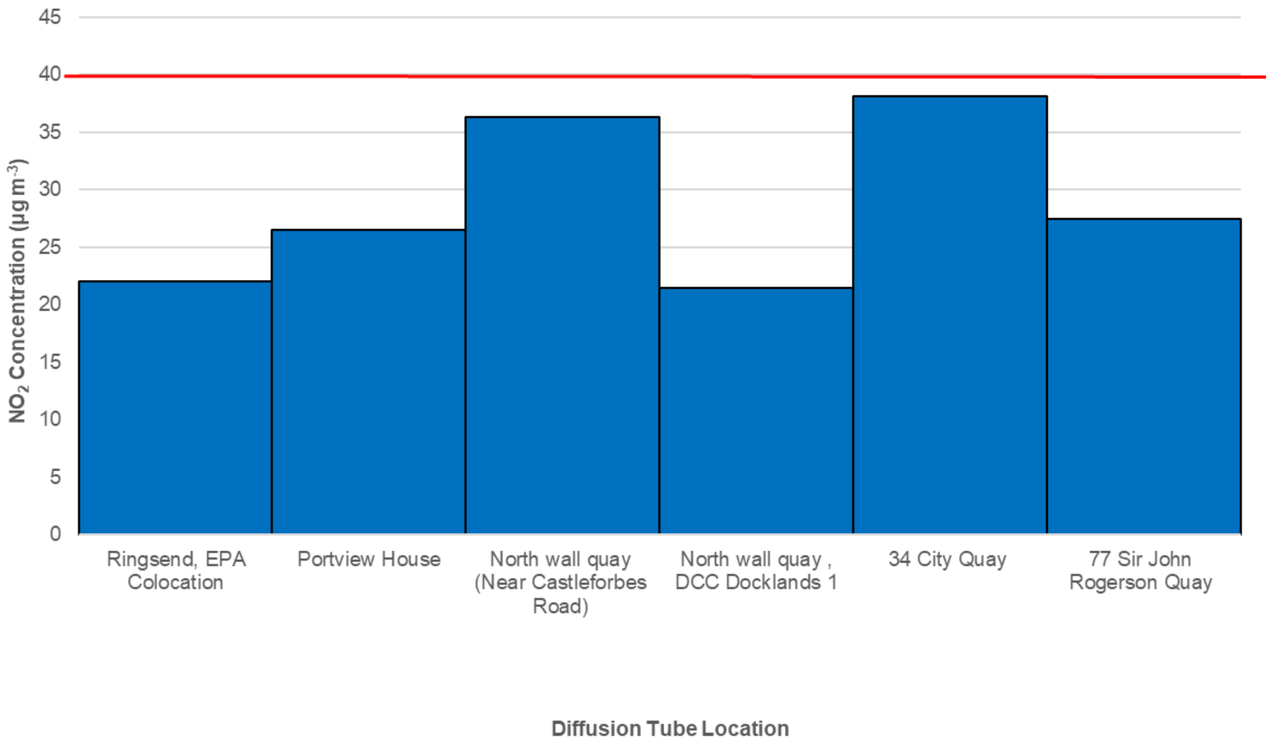


Diagram 7.4: Locally Bias Adjusted and Annualised NO_2 Concentration (µg/m³)

Note: Annual mean limit value denoted by red line

7.3.3 Existing Modelled Baseline Scenario

In the Existing Baseline Scenario, the current air quality environment experienced within the study area has been modelled. The Existing Baseline Modelled Scenario has been modelled using AMDS-Roads for the representative Baseline Year (2019), to establish baseline concentrations at receptors within the Proposed Scheme study area. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10}

limit value objective, at selected most impacted existing air quality sensitive receptors in the 2019 Existing Baseline scenario are listed in Table 7.19. Locations of these receptors are shown in Figure 7.3 to Figure 7.8 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 1.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR.

Table 7.19: Predicted Existing Baseline Scenario Pollutant Statistics At Most Impacted Receptor Locations

Existing Baseline (2019)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ37	718040,733867	41.7	17.7	12.4	1
AQ50	717789,733835	36.7	16.6	11.7	1
AQ57	717973,733842	37.0	16.7	11.7	1
AQ98	716554,734102	46.5	17.6	12.3	1
AQ106	716174,734420	49.8	17.5	12.3	1
AQ108	716370,734161	40.2	16.8	11.8	1
AQ112	716382,734156	41.9	17.0	11.9	1
AQ117	716430,734745	37.0	16.3	11.5	1
AQ129	716520,734962	38.7	16.7	11.7	1
AQ148	716318,734174	51.7	18.6	13.0	2
AQ149	716314,734151	37.7	16.5	11.6	1
AQ152	716221,734265	38.2	16.2	11.4	1
AQ172	717308,734481	34.2	16.1	11.3	1
AQ173	717326,734479	34.8	16.2	11.4	1
AQ174	717383,734475	33.2	16.0	11.2	1
AQ175	717405,734476	32.3	15.8	11.2	1
AQ176	717472,734472	32.2	15.8	11.1	1
AQ177	717528,734467	31.0	15.7	11.0	1
AQ181	717736,734441	31.7	15.6	11.0	1
AQ32	716517,734403	29.6	15.5	10.9	1
AQ67	716764,734356	28.2	15.1	10.7	<1
AQ90	716887,734000	35.6	16.0	11.3	1
AQ92	716900,733998	36.6	16.0	11.3	1
AQ102	717444,733895	38.0	16.5	11.6	1
AQ104	717280,733904	38.4	16.3	11.5	1
AQ133	717108,733931	41.8	16.9	11.9	1
AQ157	716483,734551	43.5	16.6	11.7	1
AQ158	716525,734547	38.2	16.4	11.5	1
AQ159	716629,734540	35.7	16.2	11.4	1
AQ160	716653,734538	35.8	16.3	11.4	1
AQ168	717030,734505	38.4	16.3	11.5	1
AQ169	717097,734499	46.3	17.3	12.2	1
AQ182	717801,734432	32.8	15.7	11.1	1
AQ196	717149,734312	37.6	16.4	11.6	1

Existing Baseline (2019)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ197	717170,734309	37.3	16.4	11.6	1
AQ161	716689,734531	37.7	16.5	11.6	1
AQ166	716927,734513	38.2	16.4	11.6	1
AQ167	716961,734509	38.5	16.4	11.5	1
AQ9	717126,734113	65.1	21.3	14.7	5
AQ153	717134,733956	58.0	19.7	13.7	3
AQ154	717114,733969	72.3	22.5	15.5	7
AQ162	716771,734524	44.1	16.9	11.9	1
AQ163	716787,734538	39.9	16.5	11.6	1
AQ164	716817,734521	39.8	16.6	11.7	1
AQ165	716895,734515	38.6	16.5	11.6	1
AQ6	718932,733934	30.5	15.5	11.0	1
AQ61	716388,734272	30.2	15.2	10.8	<1
AQ70	716393,734347	28.2	15.0	10.7	<1
AQ87	716579,734071	49.2	17.2	12.1	1
AQ88	716590,734091	55.4	18.2	12.8	2
AQ89	716784,734031	35.4	16.1	11.3	1
AQ96	716696,734057	34.1	16.0	11.3	1
AQ97	716573,734109	70.3	20.5	14.3	4
AQ109	716422,734146	51.4	18.3	12.8	2
AQ114	716743,734065	33.1	15.9	11.2	1
AQ118	716322,734693	41.0	16.8	11.8	1
AQ119	716485,734869	49.1	18.5	12.9	2
AQ128	716563,735038	39.9	16.9	11.9	1
AQ155	716595,734109	54.8	18.2	12.8	2
AQ156	716605,734086	45.7	17.0	12.0	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2019 Existing Baseline scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value in some areas. Twenty-three exceedances were modelled at receptors on Amiens Street, Eden Quay, Custom House Quay, North Wall Quay, Tara Street, Pearse Street, Lombard Street East, Macken Street, and Bridge Street. Concentrations for these receptors can be found in Table 1.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. Some of these have been excluded from results tables in this Chapter as these locations do not exceed the NO_2 limit value in the DM or DS scenarios and they experience a negligible impact due to the Proposed Scheme. They are therefore not considered most impacted receptors. Annual mean NO_2 concentrations exceeded 60µg/m^3 at three receptors on Lombard Street East and Macken Street, indicating that exceedances of the NO_2 1-hour mean may occur. Annual mean PM_{10} concentrations are below the relevant national air quality standard in 2019 for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than seven exceedances of the 50µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value for all modelled receptors.

7.4 Potential Impacts

This Section presents potential impacts that may occur due to the Proposed Scheme, in the absence of mitigation. This informs the need for mitigation or monitoring to be proposed (refer to Section 7.5). Potential 'residual' impacts taking into account any proposed mitigation are presented in Section 7.6.

7.4.1 Characteristics of the Proposed Scheme

In the context of the Proposed Scheme, the potential air quality impact on the surrounding environment must be considered for two distinct phases:

- Construction Phase; and
- Operational Phase.

7.4.2 Construction Phase

During the Construction Phase of the Proposed Scheme, works will predominately involve utility diversions, road widening works, road excavation works (where required), road and junction reconfiguration and resurfacing works, urban realm improvements including landscaping, and construction access routes including movement of machinery and materials to and from the four Construction Compounds along the Proposed Scheme.

Other works specific to the Proposed Scheme include:

- Preparatory and site clearance works including ground investigations and the relocation of the Scherzer Bridges and associated ancillary structures at George's Dock and the Royal Canal / Spencer Dock as well as the St. Patrick's Rowing Club and associated ancillary structures at Thorncastle Street;
- The setting up of four Construction Compounds;
- A range of structural works including:
    - A new pedestrian boardwalk at the former DCC Dublin Docklands offices at Custom House Quay;
    - A new pedestrian boardwalk at the junction of Excise Walk and North Wall Quay; and
    - A new bridge connection between Sir John Rogerson's Quay and York Road / Thorncastle Street (i.e. the Dodder Public Transport Opening Bridge (DPTOB)); and
- A range of pavement works including construction of general traffic carriageways, cycle tracks and bus stops.

During the Construction Phase, site clearance and preparation, landscaping, road and junction construction works all have the potential to generate dust and gaseous air emissions on-site.

Chapter 5 (Construction) provides a full description of the proposed construction phasing and works for the Proposed Scheme.

For the purposes of this EIAR, seven individual construction sections are set out. Sections may be completed simultaneously and combined in certain areas. Table 5.1 in Chapter 5 (Construction) includes a summary of each section with the estimated time for the completion of works in these areas.

It is envisaged that construction may be completed in the following sections:

- **Section 1:** Talbot Memorial Bridge to Tom Clarke East Link Bridge:
    - **Section 1a:** Talbot Bridge to Beckett Bridge: North Quays;
    - **Section 1b:** Talbot Bridge to Beckett Bridge: South Quays;
    - **Section 1c:** Beckett Bridge to Tom Clarke East Link Bridge: North Quays; and
    - **Section 1d:** Beckett Bridge to Tom Clarke East Link Bridge: South Quays.
- **Section 2:** Dodder Public Transport Opening Bridge (DPTOB); and
- **Section 3:** Tom Clarke East Link Bridge to Sean Moore Road.

Road works by their nature will be transient in nature as the works progress along the length of the route of the Proposed Scheme. This will include excavation and fill works, structures, and road completion works.

The potential air quality impacts associated with this phase are set out within Section 7.4.2.1 and Section 7.4.2.2.

7.4.2.1 Construction Dust Assessment

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the sensitivity of the area, as outlined in Section 7.2.4.4.

The IAQM Guidance (IAQM 2014) outlines the assessment criteria for assessing the impact of dust emissions from construction activities based on both receptor sensitivity and the number of receptors affected. In terms of receptor sensitivity, the study area is characterised as having high, medium and low sensitivity receptors within 350m of the construction activities associated with the Proposed Scheme.

Table 7.11 identifies how the sensitivity of an area may be determined for dust soiling, taking into account the number of receptors, the receptor sensitivity and distance from the source. The area in proximity to the Proposed Scheme would be an area of high sensitivity with greater than 100 receptors within 20m of the construction activities.

In addition, the IAQM Guidance outlines the assessment criteria for assessing the impact of PM_{10} emissions from construction activities based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected. The current PM_{10} concentration in Zone A locations, as reported in Section 7.3.2, is approximately 15µg/m^3. Based on the criteria outlined in Table 7.12, the risk to human health from PM_{10} emissions at the nearest residential receptor (high sensitivity, distance less than 20m and with receptor numbers >100) is considered medium under this guidance.

Table 7.13 identifies how the sensitivity of an area may be determined for ecological impacts taking into account the distance from the source to the ecological receptor and the sensitivity of the ecological receptor. The Grand Canal pNHA and the Royal Canal are ecological receptors of medium sensitivity in proximity to the Proposed Scheme with a particularly important plant species, where its dust sensitivity is uncertain or unknown within 20m of the construction activities.

The major dust generating activities are divided into four types within the IAQM Guidance to reflect their different potential impacts. These are:

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

7.4.2.1.1 Demolition

Demolition will primarily involve the relocation of the Scherzer Bridges and ancillary structures at George’s Dock and the Royal Canal / Spencer Dock, and St. Patrick’s Rowing Club and ancillary structures. The dust emission magnitude from demolition can be classified as small, medium or large based on the definitions from the IAQM Guidance (IAQM 2014), as transcribed below:

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

The dust emission magnitude for the proposed demolition activities can be classified as medium as the total building volume is likely to be 20,000m^3 to 50,000m^3 and there is low potential for dust release as the rowing club will be demolished from the roof downwards in small sections, while the Scherzer Bridges will be decommissioned and carefully dismantled and / or moved in accordance with the advice of the Industrial Heritage consultant for repair and restoration.

The magnitude for each dust generating activity is combined with the sensitivity of the area to define the risk of dust impacts in the absence of mitigation. The sensitivity of the area is considered to be high for dust soiling and medium for human health impacts. As outlined in Table 7.20, this will result in an overall medium risk of temporary dust soiling impacts and a medium risk of temporary human health impacts as a result of the proposed demolition activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed activities is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the demolition activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will not have a significant impact at nearby receptors.

Table 7.20:Risk of Dust Impacts - Demolition

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

7.4.2.1.2 Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling activities. Activities such as preparatory works, levelling and landscaping works are also considered under this category. The dust emission magnitude from earthworks can be classified as small, medium or large based on the definitions from the IAQM Guidance (IAQM 2014), as transcribed below:

- **Large:** Total site area > 10,000m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500m^2 to 10,000 m^2, moderately dusty soil type (e.g. silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4m to 8m in height, total material moved 20,000 tonnes to 100,000 tonnes; and
- **Small:** Total site area < 2,500m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The dust emission magnitude for the proposed earthwork activities required for the Proposed Scheme is conservatively considered as medium. As per the earthworks dust emission magnitude definitions listed in the bullet points above, the total site area is likely to be 2,500m^2 to 10,000m^2 and it is likely there would be five to ten heavy earth moving vehicles in use at any one time during construction.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. The sensitivity of the area would be described as high for dust soiling and medium for human health impacts. As outlined in Table 7.21, this will result in an overall medium risk of temporary dust soiling impacts and an overall medium risk of temporary human health impacts as a result of the proposed earthworks activities. In relation to an ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed earthwork activities is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the proposed earthwork activities, a range of dust mitigation measures associated with a low risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will not have a significant impact at nearby receptors.

Table 7.21:Risk of Dust Impacts - Earthworks

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

7.4.2.1.3 Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM Guidance (IAQM 2014), as transcribed below:

- **Large:** Total building volume > 100,000m^3, on-site concrete batching, sandblasting;
- **Medium:** Total building volume 25,000m^3 to 100,000m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching; and
- **Small:** Total building volume < 25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as medium. The Scherzer Bridges are being rebuilt and restored, the DPTOB and pedestrian boardwalks at Custom House Quay and the junction of Excise Walk and North Wall Quay are being constructed as part of the works, with a building volume of 25,000m^3 to 100,000m^3.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 7.22, this results in an overall medium risk of temporary dust soiling impacts and an overall medium risk of temporary human health impacts as a result of the proposed construction activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed construction activities is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the construction activities, a range of dust mitigation measures associated with a low risk of dust impacts must be implemented. When the dust mitigation measures detailed in Section 7.5.1.1 are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Table 7.22:Risk of Dust Impacts - Construction

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

7.4.2.1.4 Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM Guidance (IAQM 2014), as transcribed below:

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

The dust emission magnitude for the proposed trackout can be classified as medium with between approximately 10 and 50 HDV outward movements in any one day during peak construction activity and an unpaved road length of 50m to 100m.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 7.23, this will result in an overall medium risk of temporary dust soiling impacts and an overall medium risk of temporary human health impacts as a result of the proposed trackout activities. In relation to an ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed trackout is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the trackout activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. When the dust mitigation measures detailed in Section 7.5.1.1 are implemented, fugitive emissions of dust from the Proposed Scheme will be insignificant and will not pose significant nuisance at nearby receptors.

Table 7.23:Risk of Dust Impacts - Trackout

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

7.4.2.1.5 Summary of Potential Dust Impacts

The risk of dust impacts as a result of the Proposed Scheme are summarised in Table 7.24 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

In accordance with the EPA Guidelines (EPA 2022), the impacts associated with the Construction Phase dust emissions, pre-mitigation, are overall Negative, Not Significant and Short-Term.

Table 7.24:Summary of Dust Impact Risk Used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Medium Risk	Medium Risk	Medium Risk
Human Health	Medium Risk	Medium Risk	Medium Risk	Medium Risk
Ecological	Medium Risk	Medium Risk	Medium Risk	Medium Risk

7.4.2.2 Construction Traffic Assessment

In addition to direct impacts from the construction works including Construction Compounds, there is also the potential for air impacts from construction traffic along public roads.

A detailed analysis of construction traffic volumes has been conducted to determine the expected HDV movements required to transport the materials extracted and delivered to site. A total of nine public roads have been identified as required construction access routes where construction traffic will be permitted to travel along. Whilst the overall Construction Phase is of longer duration (as specified in Chapter 5 (Construction)), construction traffic movements are assumed to occur over a 12-month period along construction access roads accessing specific work zones as a worst-case. For national and regional roads serving multiple work zones, a construction period of 18 months has been assumed.

Traffic volumes for the base scenario are based on the 2024 Do Minimum flows projected along the local road network. These are AADT flows with percentage HDV flows. An additional 488 HDV vehicles per day associated with construction traffic along each road including construction deliveries and earthworks material haulage are added to the base traffic volumes. The estimated construction traffic volumes are based on the peak Construction Phase volumes and are therefore a worst-case assumption. In reality, the Proposed Scheme will be constructed in phases with lower volumes and the corridor of the Proposed Scheme will be used for a large bulk of construction delivery vehicles along its route.

In order to determine the potential air quality impacts associated with additional construction traffic on the identified construction access routes, a comparison between ambient air concentrations for the Do Minimum scenario and the 2024 Do Something (construction) scenario was carried out.

7.4.2.2.1 ‘Do Minimum’ Scenario

The Do Minimum (DM) is a defined scenario within the traffic modelling analysis in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, not including construction traffic associated with the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the Construction Year (2024). Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} limit value objective, at selected most impacted existing air quality sensitive receptors in the 2024 DM scenario are listed in Table 7.25. Locations of these receptors are shown in Figure 7.6 to Figure 7.9 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 2.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. ‘Most impacted’ refers to those receptors with non-negligible impacts due to the Construction Phase of the Proposed Scheme.

Table 7.25: Predicted 2024 Do Minimum Construction Pollutant Statistics at Most Impacted Receptor Locations

DM (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ37	718040,733867	41.2	17.6	12.2	1
AQ50	717789,733835	36.3	16.5	11.6	1
AQ57	717973,733842	36.7	16.6	11.6	1
AQ102	717444,733895	37.0	16.5	11.6	1
AQ104	717280,733904	37.3	16.4	11.5	1
AQ133	717108,733931	41.5	16.9	11.8	1
AQ153	717134,733956	57.3	19.7	13.6	3
AQ158	716525,734547	37.8	16.5	11.5	1
AQ172	717308,734481	34.3	16.3	11.4	1
AQ173	717326,734479	34.9	16.4	11.5	1
AQ174	717383,734475	33.1	16.2	11.3	1
AQ175	717405,734476	32.2	16.0	11.2	1
AQ176	717472,734472	32.1	16.0	11.2	1

DM (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ177	717528,734467	30.8	15.9	11.1	1
AQ181	717736,734441	31.2	15.8	11.1	1
AQ182	717801,734432	32.3	16.0	11.2	1
AQ196	717149,734312	38.0	16.5	11.6	1
AQ197	717170,734309	37.7	16.6	11.6	1
AQ154	717114,733969	71.7	22.5	15.3	7
AQ161	716689,734531	37.2	16.6	11.6	1
AQ162	716771,734524	43.5	17.0	11.9	1
AQ163	716787,734538	39.1	16.6	11.6	1
AQ164	716817,734521	39.4	16.8	11.7	1
AQ165	716895,734515	38.3	16.7	11.6	1
AQ166	716927,734513	37.9	16.6	11.6	1
AQ167	716961,734509	38.2	16.5	11.6	1
AQ168	717030,734505	38.2	16.5	11.6	1
AQ157	716483,734551	43.0	16.7	11.7	1
AQ169	717097,734499	46.3	17.5	12.2	1
AQ87	716579,734071	48.7	18.8	13.0	2
AQ88	716590,734091	55.3	19.1	13.2	3
AQ89	716784,734031	35.6	16.2	11.4	1
AQ90	716887,734000	35.7	16.0	11.3	1
AQ92	716900,733998	36.9	16.1	11.3	1
AQ97	716573,734109	70.2	21.2	14.6	5
AQ98	716554,734102	46.2	18.2	12.6	2
AQ106	716174,734420	49.0	17.5	12.2	1
AQ108	716370,734161	39.8	16.9	11.8	1
AQ112	716382,734156	41.4	17.0	11.9	1
AQ117	716430,734745	36.4	16.4	11.5	1
AQ118	716322,734693	40.1	17.4	12.1	1
AQ148	716318,734174	51.1	18.6	12.7	2
AQ149	716314,734151	37.2	16.5	11.5	1
AQ152	716221,734265	37.4	16.2	11.4	1
AQ155	716595,734109	54.7	18.6	13.0	2
AQ156	716605,734086	45.7	17.6	12.3	1
AQ109	716422,734146	50.7	18.4	12.8	2
AQ119	716485,734869	48.3	18.5	12.8	2
AQ128	716563,735038	39.1	16.8	11.7	1
AQ129	716520,734962	37.9	16.7	11.6	1

DM (2024)					
Receptor	**Receptor Location (ITM)**	**Annual Mean Conc. (µg/m³)**			**No of PM_{10} days > 50µg/m³**
		NO_2	PM_{10}	$PM_{2.5}$	
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2024 DM, annual mean concentrations of NO_2 are above the relevant national air quality limit value in some areas. Twenty-one exceedances were modelled at receptors on the Amiens Street, Eden Quay, Custom House Quay, North Wall Quay, Tara Street, Pearse Street, Lombard Street East, Macken Street, and Bridge Street. Concentrations at all receptors with exceedances can be found in Table 2.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a worst-case receptor. Annual mean NO_2 concentrations exceeded 60µg/m³ at three receptors on Lombard Street East and Macken Street, indicating that exceedances of the NO_2 1-hour mean may occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than seven exceedances of the 50µg/m³ ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value for all modelled receptors.

7.4.2.2.2 'Do Something' Scenario

The Do Something (DS) is a defined scenario within the traffic modelling analysis in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, including the construction traffic associated with the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the Construction Year (2024) in line with the methodology set out in Section 7.2.4.1. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24 hour PM_{10} limit value objective, at selected most impacted existing air quality sensitive receptors in the 2024 DS scenario are listed in Table 7.26. Locations of these receptors are shown in Figure 7.6 to Figure 7.8 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 2.2 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the Construction Phase of the Proposed Scheme.

Table 7.26: Predicted 2024 Do Something Construction Scenario Pollutant Statistics At Most Impacted Receptor Locations

DS (2024)					
Receptor	**Receptor Location (ITM)**	**Annual Mean Conc. (µg/m³)**			**No of PM_{10} days > 50µg/m³**
		NO_2	PM_{10}	$PM_{2.5}$	
AQ37	718040,733867	40.5	17.5	12.2	1
AQ50	717789,733835	35.7	16.4	12.2	1
AQ57	717973,733842	36.1	16.5	11.7	1
AQ102	717444,733895	36.3	16.4	11.6	1
AQ104	717280,733904	36.9	16.3	11.4	1
AQ133	717108,733931	40.9	16.8	11.8	1
AQ153	717134,733956	55.5	19.3	13.3	3
AQ158	716525,734547	37.0	16.0	11.2	1
AQ172	717308,734481	31.9	15.5	11.0	1
AQ173	717326,734479	31.7	15.6	11.0	1
AQ174	717383,734475	29.8	15.5	10.9	<1
AQ175	717405,734476	29.3	15.4	10.9	<1

DS (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ176	717472,734472	29.4	15.4	10.9	<1
AQ177	717528,734467	27.8	15.2	10.8	<1
AQ181	717736,734441	28.7	15.0	10.6	<1
AQ182	717801,734432	29.6	15.1	10.7	<1
AQ196	717149,734312	36.3	16.2	11.4	1
AQ197	717170,734309	36.0	16.2	11.4	1
AQ154	717114,733969	68.8	21.8	14.9	6
AQ161	716689,734531	35.0	16.0	11.2	1
AQ162	716771,734524	40.9	16.2	11.4	1
AQ163	716787,734538	36.2	15.9	11.2	1
AQ164	716817,734521	34.6	15.8	11.2	1
AQ165	716895,734515	33.2	15.7	11.1	1
AQ166	716927,734513	33.0	15.7	11.0	1
AQ167	716961,734509	33.6	15.6	11.0	1
AQ168	717030,734505	33.9	15.6	11.0	1
AQ157	716483,734551	38.9	16.2	11.4	1
AQ169	717097,734499	42.2	16.5	11.6	1
AQ87	716579,734071	49.6	19.0	13.1	2
AQ88	716590,734091	56.8	19.3	13.4	3
AQ89	716784,734031	36.9	16.4	11.8	1
AQ90	716887,734000	36.3	16.1	11.7	1
AQ92	716900,733998	37.6	16.2	11.8	1
AQ97	716573,734109	71.4	21.4	14.7	5
AQ98	716554,734102	47.4	18.4	12.7	2
AQ106	716174,734420	50.1	17.7	12.3	1
AQ108	716370,734161	40.9	17.0	11.9	1
AQ112	716382,734156	42.7	17.2	12.0	1
AQ117	716430,734745	38.1	16.6	11.6	1
AQ118	716322,734693	41.5	17.6	12.3	1
AQ148	716318,734174	53.0	18.9	13.1	2
AQ149	716314,734151	38.2	16.6	11.6	1
AQ152	716221,734265	38.2	16.3	11.4	1
AQ155	716595,734109	55.6	18.8	13.1	2
AQ156	716605,734086	47.3	17.8	12.4	1
AQ109	716422,734146	52.8	18.7	13.0	2
AQ119	716485,734869	52.2	19.1	13.2	3
AQ128	716563,735038	41.3	17.2	12.0	1
AQ129	716520,734962	40.1	17.0	11.9	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2024 DS scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value in some areas. Twenty-three exceedances were modelled at receptors on Amiens Street, Eden Quay, Custom House Quay, North Wall Quay, Tara Street, Pearse Street, Lombard Street East, Macken Street, and Bridge Street. This is an increase from 21 exceedances modelled in the DM scenario. Concentrations at all receptors with exceedances can be found in Table 2.2 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations exceeded 60µg/m^3 at three receptors on Lombard Street East and Macken Street, indicating that exceedances of the NO_2 1-hour mean may occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than six exceedances of the 50µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value for all modelled receptors.

7.4.2.2.3 Comparison of Do Something with Do Minimum

Table 7.27 provides the predicted change in and impact on pollutant concentrations, between the DM and DS in 2024. Statistics for the full list of modelled receptors can be found in Table 2.3 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR and Figure 7.6 to Figure 7.8 in Volume 3 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the Construction Phase of the Scheme.

Table 7.27: Predicted Changes in Construction DM and DS and Impact Significance Criteria at Most Impacted Receptor Locations

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m^3)			Change in No of PM_{10} days > 50µg/m^3	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ37	718040,733867	-0.7	-0.1	<0.1	<1	Slight Beneficial	Negligible	Negligible
AQ50	717789,733835	-0.6	-0.1	0.7	<1	Slight Beneficial	Negligible	Negligible
AQ57	717973,733842	-0.6	-0.1	0.1	<1	Slight Beneficial	Negligible	Negligible
AQ102	717444,733895	-0.6	-0.1	<0.1	<1	Slight Beneficial	Negligible	Negligible
AQ104	717280,733904	-0.5	-0.1	<0.1	<1	Slight Beneficial	Negligible	Negligible
AQ133	717108,733931	-0.6	-0.1	-0.1	<1	Slight Beneficial	Negligible	Negligible
AQ153	717134,733956	-1.8	-0.4	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ158	716525,734547	-0.8	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ172	717308,734481	-2.3	-0.8	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ173	717326,734479	-3.2	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ174	717383,734475	-3.3	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ175	717405,734476	-3.0	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ176	717472,734472	-2.7	-0.6	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ177	717528,734467	-3.0	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ181	717736,734441	-2.5	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ182	717801,734432	-2.7	-0.9	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ196	717149,734312	-1.7	-0.3	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ197	717170,734309	-1.7	-0.3	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ154	717114,733969	-2.9	-0.7	-0.4	-1	Moderate Beneficial	Negligible	Negligible
AQ161	716689,734531	-2.2	-0.7	-0.4	<1	Moderate Beneficial	Negligible	Negligible
AQ162	716771,734524	-2.6	-0.9	-0.5	<1	Moderate Beneficial	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ163	716787,734538	-2.9	-0.7	-0.4	<1	Moderate Beneficial	Negligible	Negligible
AQ164	716817,734521	-4.8	-0.9	-0.6	<1	Moderate Beneficial	Negligible	Negligible
AQ165	716895,734515	-5.1	-0.9	-0.6	<1	Moderate Beneficial	Negligible	Negligible
AQ166	716927,734513	-4.9	-0.9	-0.6	<1	Moderate Beneficial	Negligible	Negligible
AQ167	716961,734509	-4.7	-0.9	-0.6	<1	Moderate Beneficial	Negligible	Negligible
AQ168	717030,734505	-4.3	-0.9	-0.5	<1	Moderate Beneficial	Negligible	Negligible
AQ157	716483,734551	-4.1	-0.5	-0.3	<1	Substantial Beneficial	Negligible	Negligible
AQ169	717097,734499	-4.1	-1.0	-0.6	<1	Substantial Beneficial	Negligible	Negligible
AQ87	716579,734071	1.0	0.1	0.1	<1	Slight Adverse	Negligible	Negligible
AQ88	716590,734091	1.5	0.2	0.2	<1	Slight Adverse	Negligible	Negligible
AQ89	716784,734031	1.3	0.2	0.5	<1	Slight Adverse	Negligible	Negligible
AQ90	716887,734000	0.7	0.1	0.5	<1	Slight Adverse	Negligible	Negligible
AQ92	716900,733998	0.7	0.1	0.4	<1	Slight Adverse	Negligible	Negligible
AQ97	716573,734109	1.2	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ98	716554,734102	1.1	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ106	716174,734420	1.1	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ108	716370,734161	1.1	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ112	716382,734156	1.3	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ117	716430,734745	1.7	0.3	0.2	<1	Slight Adverse	Negligible	Negligible
AQ118	716322,734693	1.3	0.2	0.1	<1	Slight Adverse	Negligible	Negligible
AQ148	716318,734174	1.9	0.3	0.4	<1	Slight Adverse	Negligible	Negligible
AQ149	716314,734151	1.0	0.1	0.1	<1	Slight Adverse	Negligible	Negligible
AQ152	716221,734265	0.8	0.1	0.1	<1	Slight Adverse	Negligible	Negligible
AQ155	716595,734109	1.0	0.1	0.1	<1	Slight Adverse	Negligible	Negligible
AQ156	716605,734086	1.6	0.2	0.2	<1	Slight Adverse	Negligible	Negligible
AQ109	716422,734146	2.0	0.3	0.2	<1	Moderate Adverse	Negligible	Negligible
AQ119	716485,734869	3.9	0.7	0.4	1	Moderate Adverse	Negligible	Negligible
AQ128	716563,735038	2.2	0.3	0.2	<1	Moderate Adverse	Negligible	Negligible
AQ129	716520,734962	2.1	0.3	0.2	<1	Moderate Adverse	Negligible	Negligible

The significance of the changes in the concentration of each of the ambient receptors has been determined in the context of the TII significance criteria (TII 2011). As shown in Table 7.27, and Figure 7.6 in Volume 3 of this EIAR, the majority of modelled receptors are estimated to experience a negligible impact due to the Proposed Scheme in terms of the annual mean NO_2 concentration. A slightly beneficial impact is estimated at 18 receptors, a moderate beneficial impact at nine receptors and a substantial beneficial impact at two receptors. All beneficial impacts are modelled along the Proposed Scheme due to the diversion of traffic off these routes. A slight adverse impact is expected at 17 receptors and a moderate adverse impact at four receptors on Amiens Street and Pearse Street. These localised moderate adverse impacts are considered Negative, Significant and Short-Term, as NO_2 concentrations exceed the limit value but only occur during the short-term Construction Phase. As shown in Table 7.27, and Figure 7.7 in Volume 3 of this EIAR, the Proposed Scheme will be neutral overall in terms of annual mean PM_{10} concentrations, with all receptors experiencing a negligible impact. As shown in Table 7.27, and Figure 7.8 in Volume 3 of this EIAR, the Proposed Scheme will be neutral overall in terms of the annual mean $PM_{2.5}$ concentration with all receptors experiencing a negligible impact.

In accordance with the EPA Guidelines (EPA 2022), the impacts associated with the Construction Phase traffic emissions will overall be Neutral and Short-Term.

7.4.2.2.4 Ecological Assessment

An assessment of the impact of the Proposed Scheme has been undertaken using the approach outlined in A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020). The guidance states that where the PEC is less than 70% of the long-term critical level / load, the PC is likely to be insignificant. Where the process contribution is greater than 1% of the critical level / load it is recommended that the project ecologist be consulted.

The impact of the Proposed Scheme on the nearby ecologically sensitive areas within 200m of roads impacted by the Proposed Scheme, as defined in Section 7.2.4.1, is outlined in Table 7.28. The annual mean NO_X concentration has been compared to the critical level of 30µg/m^3 at the designated habitat site. All sites exceed the critical level for NO_X in both the DM and the DS scenarios.

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Table 7.29. The lower critical load is exceeded in both the DM and DS by North Wall Quay at the Royal Canal pNHA and at the Grand Canal pNHA (DPTOB and MacMahon Bridge (northern and southern side)). However, nitrogen deposition decreases as a result of the Proposed Scheme.

In accordance with the EPA Guidelines (EPA 2022), the ecological impacts associated with the Construction Phase traffic emissions will be overall Positive, Slight and Short-Term.

Table 7.28: Significance of Impacts at Key Ecological Receptors (NO_X Annual Mean Concentration In 2024)

Annual Mean NO_X in 2024 At Closest Point Within Ecological Site to Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (µg/m^3)**	**Distance from Road Beyond which Concentration is Below Critical Level (30 µg/m^3) (m)**	**Do Something (µg/m^3)**	**Distance from Road Beyond which Concentration is Below Critical Level (30 µg/m^3) (m)**	**Impact (DS – DM) (µg/m^3)**	**Change as a Percentage of Critical Level (30 µg/m^3) (%)**
Grand Canal pNHA (DPTOB)	717816, 734054	33.6	>200m	33.4	>200m	-0.1	0%
Grand Canal pNHA (MacMahon Bridge, northern side)	717357, 733908	106.2	>200m	102.7	>200m	-3.5	-12%
Grand Canal pNHA (MacMahon Bridge, southern side)	717396, 734104	83.3	>200m	81.1	>200m	-2.2	-7%
Royal Canal pNHA (North Wall Quay)	717149, 734489	45.6	>200m	45.1	>200m	-0.5	-2%

Table 7.29: Significance of Impacts at Key Ecological Receptors (N Deposition In 2024)

Annual Mean N Deposition in 2024 At Closest Point Within Ecological Site to Road									
Receptor	Receptor Location (ITM)	Lower Critical Load for Most Sensitive Feature (kgN/ha/yr)	Do Minimum (kgN/ha/yr)	Distance from Road Beyond which Deposition is Below Critical Load (m)	Do Something (kgN/ha/yr)	Distance from Road Beyond which Deposition is Below Critical Load (m)	Change relative to lower critical load (%)	Distance from Road Beyond which the Change is <1% (m)	Change in Deposition (kgN/ha/yr)
Grand Canal pNHA (Dodder Bridge)	717816, 734054	5	2.26	0m	2.25	0m	0%	0m	-0.01
Grand Canal pNHA (MacMahon Bridge, northern side)	717357, 733908	5	5.53	10m	5.41	0m	-3%	0m	-0.13
Grand Canal pNHA (MacMahon Bridge, southern side)	717396, 734104	5	4.60	0m	4.52	0m	-2%	0m	-0.09
Royal Canal pNHA (North Wall Quay)	717149, 734489	5	6.49	10m	5.56	10m	-19%	0m	-0.93

7.4.2.3 Regional Air Quality Assessment

The potential changes in regional air emissions due to the Construction Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. ENEVAL measures the regional emissions associated with road transport based on the various road links and their corresponding emissions.

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the Construction Year (2024) of the Construction Phase are shown in Table 7.30. The Proposed Scheme will result in increases in emissions of all pollutants modelled. The majority of these emission increases result from the redistribution of vehicles onto other longer routes, while construction of the Proposed Scheme takes place. To produce these emissions estimates, the traffic model and therefore the ENEVAL tool have applied the peak construction day in 2024 across the whole year. Emissions are therefore worst-case and likely to be lower in reality.

Table 7.30. Construction Phase Regional Pollutant Emissions (tonnes) – Construction Year (2024)

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	1624	489	18.43	17.51	86	1951	1.48	1.21
DS		1625	489	18.44	17.52	87	1952	1.48	1.21
Change		0.91	0.26	0.01	0.01	0.07	0.26	0.001	0.001
% Change		0.06%	0.05%	0.06%	0.06%	0.08%	0.01%	0.08%	0.06%
DM	Goods	1436	408	11.26	10.70	43	223	0.36	0.47
DS		1437	408	11.26	10.70	43	223	0.36	0.47
Change		0.58	0.10	0.003	0.003	0.04	0.51	0.001	0.0005
% Change		0.04%	0.02%	0.02%	0.02%	0.09%	0.23%	0.39%	0.11%
DM	Urban Bus	44	4.47	0.74	0.71	1.95	8.86	0	0.05
DS		44	4.50	0.75	0.71	1.96	8.93	0	0.05
Change		0.38	0.04	0.004	0.004	0.01	0.07	0	0.0002
% Change		0.86%	0.86%	0.58%	0.58%	0.63%	0.80%	0%	0.41%
DM	**Total**	**3105**	**901**	**30**	**29**	**132**	**2183**	**1.84**	**1.72**
DS		**3107**	**902**	**30**	**29**	**132**	**2184**	**1.84**	**1.72**
Change		**1.86**	**0.40**	**0.02**	**0.02**	**0.12**	**0.84**	**0.003**	**0.001**
% Change		**0.06%**	**0.04%**	**0.06%**	**0.06%**	**0.09%**	**0.04%**	**0.14%**	**0.08%**

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in concentrations will be within the traffic model and ENEVAL tool margin of variability, the regional impacts associated with the Construction Phase traffic emissions (pre-mitigation) will be overall Neutral and Short-Term.

7.4.3 Operational Phase

7.4.3.1 'Do Minimum' Scenario

The Do Minimum (DM) is a defined scenario within the traffic modelling exercise in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, not including the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the Opening Year (2028). Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} objective, at selected most impacted existing air quality sensitive receptors in the 2028 DM scenario are listed in Table 7.31. Locations of these receptors are shown in Figure 7.3 to Figure 7.5 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 3.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the Operational Phase of the Proposed Scheme.

Table 7.31: Predicted 2028 DM Scenario Pollutant Statistics at Most Impacted Receptor Locations

DM (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ32	716517,734403	30.3	15.5	10.9	1
AQ67	716764,734356	30.3	15.4	10.9	<1
AQ90	716887,734000	36.9	16.2	11.3	1
AQ92	716900,733998	38.3	16.3	11.4	1

DM (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ102	717444,733895	38.6	16.6	11.6	1
AQ104	717280,733904	38.6	16.4	11.4	1
AQ133	717108,733931	41.9	17.0	11.8	1
AQ157	716483,734551	42.6	16.7	11.6	1
AQ158	716525,734547	37.9	16.6	11.5	1
AQ159	716629,734540	35.8	16.5	11.4	1
AQ160	716653,734538	35.8	16.5	11.5	1
AQ168	717030,734505	40.5	16.7	11.6	1
AQ169	717097,734499	48.8	17.6	12.2	1
AQ182	717801,734432	32.4	16.0	11.2	1
AQ196	717149,734312	40.7	16.6	11.6	1
AQ197	717170,734309	40.5	16.6	11.6	1
AQ161	716689,734531	37.9	16.8	11.6	1
AQ166	716927,734513	39.9	16.8	11.7	1
AQ167	716961,734509	40.5	16.8	11.7	1
AQ9	717126,734113	64.7	20.6	14.0	4
AQ153	717134,733956	58.2	19.7	13.4	3
AQ154	717114,733969	72.9	22.5	15.1	7
AQ162	716771,734524	47.6	17.2	11.9	1
AQ163	716787,734538	42.3	16.7	11.6	1
AQ164	716817,734521	41.7	17.0	11.8	1
AQ165	716895,734515	40.3	16.9	11.7	1
AQ6	718932,733934	27.5	15.4	10.8	<1
AQ61	716388,734272	29.9	15.4	10.8	<1
AQ70	716393,734347	28.1	15.0	10.6	<1
AQ87	716579,734071	47.7	17.4	12.0	1
AQ88	716590,734091	57.3	18.5	12.8	2
AQ89	716784,734031	36.7	16.3	11.4	1
AQ96	716696,734057	35.4	16.3	11.4	1
AQ97	716573,734109	75.2	20.9	14.2	5
AQ109	716422,734146	49.9	18.4	12.7	2
AQ114	716743,734065	34.8	16.3	11.3	1
AQ118	716322,734693	39.0	16.7	11.6	1
AQ119	716485,734869	46.0	18.2	12.5	2
AQ128	716563,735038	37.3	16.7	11.6	1
AQ155	716595,734109	57.9	18.4	12.7	2
AQ156	716605,734086	47.1	17.2	12.0	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2028 DM scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value in some areas; 27 exceedances were modelled at receptors on the Amiens Street, Eden Quay, Custom House Quay, North Wall Quay, Tara Street, Pearse Street, Lombard Street East, Macken Street, and Bridge Street. Concentrations at all receptors with exceedances can be found in Table 3.1 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations exceeded 60µg/m^3 at three receptors on Lombard Street East and Macken Street, indicating that exceedances of the NO_2 1-hour mean may occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than seven exceedances of the 50µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value limit value for all modelled receptors. Reported concentrations are lower in 2028 due to the assumed modest improvements in vehicle emissions rates between now and then.

7.4.3.2 'Do Something' Scenario

The Do Something (DS) is a defined scenario within the traffic modelling exercise in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, including the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the Opening Year (2028) in line with the methodology set out in Section 7.2.4.1. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} limit value, at selected most impacted existing air quality sensitive receptors both along the Proposed Scheme and on routes affected by traffic diversions in the 2028 DS scenario are listed in Table 7.32. Locations of these receptors are shown in Figure 7.3 to Figure 7.5 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 3.2 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the Operational Phase of the Proposed Scheme.

Table 7.32: Predicted 2028 DS Scenario Pollutant Statistics at Worst-Case Receptor Locations

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ32	716517,734403	26.0	14.8	10.5	<1
AQ67	716764,734356	26.7	14.9	10.5	<1
AQ90	716887,734000	35.9	16.0	11.2	1
AQ92	716900,733998	36.7	16.0	11.2	1
AQ102	717444,733895	38.0	16.5	11.5	1
AQ104	717280,733904	37.9	16.3	11.4	1
AQ133	717108,733931	41.0	16.8	11.7	1
AQ157	716483,734551	41.5	16.6	11.5	1
AQ158	716525,734547	36.0	16.3	11.4	1
AQ159	716629,734540	33.2	16.1	11.2	1
AQ160	716653,734538	33.4	16.2	11.3	1
AQ168	717030,734505	38.6	16.1	11.3	1
AQ169	717097,734499	47.3	17.2	11.9	1
AQ182	717801,734432	30.3	15.6	10.9	1
AQ196	717149,734312	40.0	16.4	11.5	1
AQ197	717170,734309	39.9	16.4	11.5	1

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ161	716689,734531	35.3	16.4	11.4	1
AQ166	716927,734513	34.8	16.1	11.2	1
AQ167	716961,734509	37.8	16.1	11.3	1
AQ9	717126,734113	46.4	17.5	12.1	1
AQ153	717134,733956	53.5	18.8	12.9	2
AQ154	717114,733969	64.0	20.6	14.0	4
AQ162	716771,734524	42.6	16.5	11.5	1
AQ163	716787,734538	36.5	15.9	11.1	1
AQ164	716817,734521	35.5	16.3	11.3	1
AQ165	716895,734515	34.3	16.2	11.3	1
AQ6	718932,733934	31.1	15.5	10.9	<1
AQ61	716388,734272	33.5	15.7	11.0	1
AQ70	716393,734347	31.8	15.3	10.8	<1
AQ87	716579,734071	48.4	17.4	12.1	1
AQ88	716590,734091	58.5	18.6	12.8	2
AQ89	716784,734031	38.2	16.4	11.5	1
AQ96	716696,734057	36.1	16.4	11.4	1
AQ97	716573,734109	76.9	20.9	14.2	5
AQ109	716422,734146	50.4	18.4	12.7	2
AQ114	716743,734065	36.5	16.4	11.5	1
AQ118	716322,734693	40.0	16.8	11.7	1
AQ119	716485,734869	46.5	18.2	12.5	2
AQ128	716563,735038	37.8	16.7	11.6	1
AQ155	716595,734109	59.3	18.5	12.7	2
AQ156	716605,734086	48.0	17.3	12.0	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2028 DS scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas. Nine exceedances were modelled at receptors on Amiens Street, Eden Quay, Custom House Quay, North Wall Quay, Tara Street, Pearse Street, Lombard Street East, Macken Street, and Bridge Street. This is a decrease from 27 exceedances modelled in the DM scenario. Concentrations at all receptors with exceedances can be found in Table 3.2 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR. Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations exceeded 60µg/m^3 at two receptors on Lombard Street East and Macken Street, indicating that exceedances of the NO_2 1-hour mean may occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objective for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than five exceedances of the 50µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value objective for all modelled receptors.

7.4.3.3 Comparison of Do Something with Do Minimum

Table 7.33 provides the predicted change in and impact on pollutant concentrations, between the DM and DS in 2028. Statistics for the full list of modelled receptors can be found in Table 3.3 of Appendix A7.1 (Detailed Air Quality Modelling Results) in Volume 4 of this EIAR, and Figure 7.3 to Figure 7.5 in Volume 3 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the Operational Phase of the Proposed Scheme.

Table 7.33: Predicted Changes in Operational DM and DS and Impact Significance Criteria at Most Impacted Receptor Locations

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ32	716517,734403	-4.3	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ67	716764,734356	-3.6	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ90	716887,734000	-1.0	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ92	716900,733998	-1.6	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ102	717444,733895	-0.6	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ104	717280,733904	-0.7	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ133	717108,733931	-0.9	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ157	716483,734551	-1.1	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ158	716525,734547	-1.9	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ159	716629,734540	-2.6	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ160	716653,734538	-2.3	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ168	717030,734505	-1.9	-0.6	-0.4	0	Slight Beneficial	Negligible	Negligible
AQ169	717097,734499	-1.5	-0.5	-0.3	0	Slight Beneficial	Negligible	Negligible
AQ182	717801,734432	-2.1	-0.5	-0.3	0	Slight Beneficial	Negligible	Negligible
AQ196	717149,734312	-0.7	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ197	717170,734309	-0.6	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ161	716689,734531	-2.6	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ166	716927,734513	-5.1	-0.7	-0.4	0	Moderate Beneficial	Negligible	Negligible
AQ167	716961,734509	-2.7	-0.7	-0.4	0	Moderate Beneficial	Negligible	Negligible
AQ9	717126,734113	-18.4	-3.1	-1.9	-3	Substantial Beneficial	Negligible	Negligible
AQ153	717134,733956	-4.8	-1.0	-0.6	-1	Substantial Beneficial	Negligible	Negligible
AQ154	717114,733969	-8.9	-1.9	-1.1	-3	Substantial Beneficial	Negligible	Negligible
AQ162	716771,734524	-5.0	-0.7	-0.4	0	Substantial Beneficial	Negligible	Negligible
AQ163	716787,734538	-5.7	-0.8	-0.5	0	Substantial Beneficial	Negligible	Negligible
AQ164	716817,734521	-6.2	-0.7	-0.5	0	Substantial Beneficial	Negligible	Negligible
AQ165	716895,734515	-6.0	-0.7	-0.5	0	Substantial Beneficial	Negligible	Negligible
AQ6	718932,733934	3.6	<0.1	0.1	<1	Slight Adverse	Negligible	Negligible
AQ61	716388,734272	3.6	0.3	0.2	<1	Slight Adverse	Negligible	Negligible
AQ70	716393,734347	3.7	0.3	0.2	<1	Slight Adverse	Negligible	Negligible
AQ87	716579,734071	0.7	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ88	716590,734091	1.2	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m^3)			Change in No of PM_{10} days > 50µg/m^3	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ89	716784,734031	1.6	0.1	0.1	0	Slight Adverse	Negligible	Negligible
AQ96	716696,734057	0.7	0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ97	716573,734109	1.7	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ109	716422,734146	0.5	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ114	716743,734065	1.7	0.2	0.1	0	Slight Adverse	Negligible	Negligible
AQ118	716322,734693	1.0	0.1	0.1	0	Slight Adverse	Negligible	Negligible
AQ119	716485,734869	0.5	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ128	716563,735038	0.6	0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ155	716595,734109	1.3	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible
AQ156	716605,734086	0.9	<0.1	<0.1	0	Slight Adverse	Negligible	Negligible

The significance of the changes in the concentration of each of the ambient receptors has been determined in the context of the TII significance criteria (TII 2011). As shown in Table 7.33, and Figure 7.3 in Volume 3 of this EIAR, the majority of modelled receptors are estimated to experience a negligible impact due to the Proposed Scheme in terms of the annual mean NO_2 concentration. A slightly beneficial impact is estimated at 16 receptors, a moderate beneficial impact at three receptors and a substantial beneficial impact at seven receptors due to the diversion of traffic off the route of the Proposed Scheme. A slight adverse impact is expected at 15 receptors. As shown in Table 7.33, and Figure 7.4 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of annual mean PM_{10} concentrations, with all receptors experiencing a negligible impact. As shown in Table 7.33, and Figure 7.5 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of the annual mean $PM_{2.5}$ concentration with all receptors experiencing a negligible impact.

In accordance with the EPA Guidelines (EPA 2022), the impacts associated with the Operational Phase traffic emissions (pre-mitigation) will be overall Neutral and Long-Term.

The predictions reported are based on conservative assumptions regarding background pollutant concentrations and the improvement in vehicle emission rates. 2019 background pollutant concentrations have been used to represent 2028 and are likely be lower by the Opening Year (2028), than in 2019. Older fleet projections were used in the absence of a fleet that incorporates the effects of the 2021 Climate Action Plan measures (i.e. a larger proportion of electric vehicles is planned by the Opening Year (2028) than has been modelled). In reality, total concentrations (and magnitude of change) are likely to be lower than those reported here.

7.4.3.4 Ecological Assessment

An assessment of the impact of the Proposed Scheme on nearby ecological sensitive areas has been undertaken using the approach outlined in A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020). The guidance states that where the PEC is less than 70% of the long-term critical level / load, the PEC is likely to be insignificant. Where the PEC is greater than 1% of the critical level / load, it is recommended that the project ecologist be consulted.

The impact of the Proposed Scheme on the nearby ecologically sensitive areas within 200m of roads impacted by the Proposed Scheme, as defined in Section 7.2.4.1, is outlined in Table 7.34. The annual mean NO_X concentration has been compared to the critical level of 30µg/m^3 at each of the designated habitat sites. All sites exceed the critical level for NO_X in both the DM and the DS scenarios.

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Table 7.35. Most sites are below the lower critical load for the designated habitat site in both the DM and the DS scenarios. The lower critical load is exceeded in both the DM and DS at the Royal Canal pNHA on North Wall Quay and at the Grand Canal pNHA (MacMahon Bridge). However, nitrogen deposition decreases at most sites due to the Proposed Scheme.

In accordance with the EPA Guidelines (EPA 2022), the ecological impacts associated with the Operational Phase traffic emissions will overall be Negative, Slight and Long-Term.

Table 7.34: Significance of Impacts at Key Ecological Receptors (NO_2 Annual Mean Concentration In 2028)

Annual Mean NO_2 in 2028 At Closest Point Within Ecological Site To Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (μg/m³)**	**Distance from Road Beyond which Concentration is Below Critical Level (30 μg/m³) (m)**	**Do Something (μg/m³)**	**Distance from Road Beyond which Concentration is Below Critical Level (30 μg/m³) (m)**	**Impact (DS – DM) (μg/m³)**	**Change as a Percentage of Critical Level (30 μg/m³) (%)**
Grand Canal pNHA (Dodder Bridge)	717816, 734054	33.8	>200m	33.7	>200m	-0.2	-1%
Grand Canal pNHA (Hanover Quay)	717355, 734109	48.4	>200m	55.3	>200m	6.9	23%
Grand Canal pNHA (MacMahon Bridge, northern side)	717357, 733908	113.9	>200m	110.6	>200m	-3.3	-11%
Grand Canal pNHA (MacMahon Bridge, southern side)	717396, 734104	88.2	>200m	85.9	>200m	-2.3	-8%
Royal Canal pNHA (North Wall Quay)	717149, 734489	48.4	>200m	55.3	>200m	6.9	23%

Table 7.35: Significance of Impacts at Key Ecological Receptors (NO_2 Deposition In 2028)

Annual Mean NO_2 in 2028 At Closest Point Within Ecological Site to Road									
Receptor	**Receptor Location (ITM)**	**Lower Critical Load for Most Sensitive Feature (kgN/ha/yr)**	**Do Minimum (kgN/ha/yr)**	**Distance from Road Beyond which Deposition is Below Critical Load (m)**	**Do Something (kgN/ha/yr)**	**Distance from Road Beyond which Deposition is Below Critical Load (m)**	**Change Relative to Lower Critical Load (%)**	**Distance from Road Beyond which the Change is <1% (m)**	**Change in Deposition >0.4 kgN/ha/yr?**
Grand Canal pNHA (Dodder Bridge)	717816, 734054	5	2.28	0m	2.27	0m	0%	0m	-0.01
Grand Canal pNHA (Hanover Quay)	717355, 734109	5	3.02	0m	3.36	0m	7%	20m	0.34
Grand Canal pNHA (MacMahon Bridge, northern side)	717357, 733908	5	5.88	6m	5.75	6m	-3%	0m	-0.13
Grand Canal pNHA (MacMahon Bridge, southern side)	717396, 734104	5	4.84	0m	4.74	0m	-2%	0m	-0.10
Royal Canal pNHA (North Wall Quay)	717149, 734489	5	6.47	10m	6.17	10m	-6%	0m	-0.30

7.4.3.5 Regional Air Quality Assessment

The potential changes in regional air emissions due to the Operational Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. ENEVAL measures the regional emissions associated with road transport based on the various road links and their corresponding emissions.

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the Opening Year (2028) of the Operational Phase are shown in Table 7.36. The Proposed Scheme is overall beneficial, with reductions in emissions of all pollutants modelled. The majority of these reductions will result from a predicted modal shift, with decreased car usage (see Chapter 6 (Traffic & Transport)) and a cleaner and more efficiently routed bus fleet. The NTA has committed to replacing its diesel powered vehicles with plug-in hybrid and fuel cell electric buses by 2028 and with zero emission vehicles by 2043, so the reductions in emissions due to the Proposed Scheme will be due to more efficiently operated routes, meeting the Proposed Scheme objectives.

Table 7.36. Operational Phase Regional Pollutant Emissions (tonnes) – Opening Year (2028)

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	150	43	1.2	1.1	10	152	0.1	0.2
DS		149	43	1.2	1.1	10	152	0.1	0.2
Change		-0.6	-0.2	-0.004	-0.003	-0.03	-0.4	-0.0003	-0.001
% Change		-0.4%	-0.4%	-0.3%	-0.3%	-0.3%	-0.3%	-0.2%	-0.5%
DM	Goods	186	50	0.5	0.5	6	43	0.1	0.1
DS		187	50	0.5	0.5	6	43	0.1	0.1
Change		0.5	0.1	0.0001	0.0001	0.001	0.3	0.001	-0.00003
% Change		0.3%	0.2%	0.02%	0.02%	0.01%	0.6%	1%	-0.03%
DM	Urban Bus	6	0.6	0.1	0.1	0.2	1.9	0	0.002
DS		6	0.6	0.1	0.1	0.2	1.9	0	0.002
Change		-0.05	-0.005	-0.001	-0.001	-0.003	-0.02	0	-0.00003
% Change		-1%	-1%	-1%	-1%	-1%	-1%	0%	-2%
DM	Total	342	94	2	2	17	197	0.2	0.2
DS		342	94	2	2	17	197	0.2	0.2
Change		-0.1	-0.05	-0.004	-0.004	-0.03	-0.1	0.001	-0.001
% Change		-0.03%	-0.1%	-0.2%	-0.2%	-0.2%	-0.1%	0.4%	-0.3%

Pollutant emissions (in tonnes) that will be produced in both the DM and DS scenarios during the Design Year (2043) of the Operational Phase are shown in Table 7.37. The Proposed Scheme is overall beneficial, with reductions in emissions of all pollutants modelled, with the exception of a slight increase in NO_X and NO_2 from goods vehicles.

Table 7.37. Operational Phase regional pollutant emissions (tonnes) – Design Year (2043)

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	55	16	0.5	0.5	5	60	0.05	0.1
DS		54	16	0.5	0.5	5	60	0.05	0.1
Change		-0.4	-0.1	-0.006	-0.006	-0.06	-0.2	-0.001	-0.001
% Change		-1%	-1%	-1%	-1%	-1%	-0.3%	-1%	-1%
DM	Goods	123	27	0.5	0.5	4	30	0.0	0.1
DS		124	27	0.5	0.5	4	29	0.0	0.1
Change		1	0.2	-0.01	-0.01	-0.06	-0.4	-0.001	-0.001
% Change		1%	1%	-2%	-2%	-1%	-2%	-1%	-1%
DM	Urban Bus	0	0	0.1	0.05	0	0	0	0
DS		0	0	0.05	0.05	0	0	0	0
Change		0	0	-0.001	-0.001	0	0	0	0
% Change		0%	0%	-2%	-2%	0%	0%	0%	0%
DM	Total	178	42	1	1	9	89	0.1	0.1
DS		178	42	1	1	9	89	0.1	0.1
Change		**0.9**	**0.1**	**-0.02**	**-0.02**	**-0.1**	**-0.6**	**-0.001**	**-0.002**
% Change		0.5%	0.2%	-2%	-2%	-1%	-1%	-1%	-1%

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in emissions is within the traffic model and ENEVAL tool margin of variability, the regional impacts associated with the Operational Phase traffic emissions (pre-mitigation) will overall be Neutral and Long-Term.

7.5 Mitigation and Monitoring Measures

In order to sufficiently ameliorate the likely air quality impacts, a schedule of mitigation measures has been formulated for the Construction Phase of the Proposed Scheme.

7.5.1 Construction Phase

7.5.1.1 Construction Dust

In order to minimise dust nuisance impacts, a series of mitigation measures that are applicable to the Construction Phase of the Proposed Scheme will be implemented by the appointed contractor. In summary, the mitigation measures will include:

- Public roads affected by the Proposed Scheme works will be regularly inspected for soiling associated with construction activities 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 (or similar dust suppression methods) will be used as required if particularly dusty activities are necessary during dry or windy periods;
- During movement of dust-generating materials both on and off site, trucks will be covered with tarpaulin and before entrance onto public roads, trucks will be checked to ensure the tarpaulins are properly in place; and
- The appointed contractor will provide a site hoarding of 2.4m height along noise sensitive boundaries, at a minimum, at the Construction Compounds, which will assist in minimising the potential for dust impacts off site.

The appointed contractor will keep the effectiveness of the mitigation measures under review and revise them as necessary. In the event of dust nuisance occurring outside the works boundary associated with the Proposed

Scheme, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem.

7.5.1.2 Construction Traffic

Construction vehicles, generators etc. may give rise to some NO_2 and PM_{10} / $PM_{2.5}$ emissions. Table 7.38 summarises the Construction Phase impacts prior to and post-mitigation. In terms of construction traffic impacts, the Proposed Scheme will have a generally neutral impact on air quality, with some slight adverse and moderate adverse impacts locally. Due to worst-case scenario modelling, where in reality the works will be short-term and temporary in nature, the impact on air quality will not be significant. Therefore, no specific Construction Phase mitigation measures for construction traffic are required.

7.5.1.3 Summary of Predicted Construction Phase Impacts

Table 7.38:Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Construction dust	Negative, Not Significant and Short-Term	Neutral and Short-Term
Road traffic impacts on local human receptors	Neutral and Short-Term	Neutral and Short-Term
Road traffic impacts on local ecological receptors	Positive, Slight and Short-Term	Positive, Slight and Short-Term
Regional air quality	Neutral and Short-Term	Neutral and Short-Term

7.5.2 Operational Phase

Table 7.39 summarises the Operational Phase impacts, prior to and post-mitigation. As the Proposed Scheme will have a generally neutral impact on air quality, no specific Operational Phase mitigation measures are recommended.

7.5.2.1 Summary of Predicted Operational Phase Impacts

Table 7.39: Summary of Predicted Operational Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Road traffic impacts on local human receptors	Neutral and Long-Term	Neutral and Long-Term
Road traffic impacts on local ecological receptors	Negative, Slight and Long-Term	Negative, Slight and Long-Term
Regional air quality	Neutral and Long-Term	Neutral and Long-Term

7.6 Residual Impacts

7.6.1 Construction Phase

When the dust minimisation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors. Thus, there will be no residual Construction Phase dust impacts.

The air dispersion modelling assessment of Construction Phase traffic emissions has found that the Proposed Scheme will be neutral overall in the study area, with some moderate adverse impacts locally. However, a worst-case scenario has been modelled, where in reality the works will be short-term and temporary in nature.

Therefore, overall it is considered that the residual effects as a result of the Proposed Scheme's construction are Neutral and Short-Term. No significant residual impacts have been identified during the Construction Phase of the Proposed Scheme, whilst meeting the scheme objectives set out in Chapter 1 (Introduction).

7.6.2 Operational Phase

The air dispersion modelling assessment has found that that the majority of all modelled receptors are predicted to experience negligible impacts due to the Proposed Scheme, which is therefore neutral overall in the study area. The number of receptors where an exceedance of the NO_2 limit value is predicted decreases as a result of the Proposed Scheme. In 2043, all receptors are expected to have ambient air quality in compliance with the ambient air quality limit values for the Do Something (and Do Minimum) scenario. There will be no substantial or moderate adverse effects expected as a result of the Operational Phase of the Proposed Scheme.

Therefore, overall it is considered that the residual impacts as a result of the Proposed Scheme's operation are Neutral and Long-Term.

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