12 Air Quality

12.1 Introduction

The likely impact on ambient air quality associated with the proposed scheme is assessed in this chapter of the EIS. The air quality assessment focuses on traffic-related pollutants – nitrogen oxides (NO_x) and particulate matter (PM_{10} and $PM_{2.5}$). The potential impacts at local and regional level are assessed.

Section 12.2 sets out the Methodology. The data available on the existing air quality is reviewed in Section 12.3, the likely air quality impact is predicted in Section 12.4 and mitigation measures are proposed where required in Section 12.5.

A qualitative assessment of the potential impact due to construction dust is also undertaken.

12.2 Methodology

This chapter is prepared having regard to the requirements of the National Roads Authority (NRA) document *'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'*, 2011.

The impact of the proposed development on air quality is assessed for both the construction and operational phases by considering the pollutant background concentrations, emissions from road traffic and the potential for construction dust. Predicted concentrations are compared to the relevant limit values.

12.2.1 Limit Values and Other Relevant Guidance

In order to reduce the risk of poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values are set for the protection of human health and ecosystems.

On 12 April 2011, the Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011) came into force and transposed EU Directive 2008/50/EC into Irish law. The purpose of the 2011 regulations is to establish limit values and alert thresholds for concentrations of certain pollutants, to provide for the assessment of certain pollutants using methods and criteria common to other European Member States, to ensure that adequate information on certain pollutant concentrations is obtained and made publically available and to provide for the maintenance and improvement of ambient air quality where necessary.

The Regulations establish a target value to be attained in 2010 as well as limit values for concentrations of $PM_{2.5}$. In addition, the Regulations provide for a review of the proposed limit value for $PM_{2.5}$ in 2013.

The limit values established under these regulations relevant to the assessment of road schemes are included in Table 12.1 below.

Table 12.1: Air Quality Standards (AQS) from AQS Regulations 2011 (S.I. No. 180 of 2011)

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu g/m^3$)	Basis of application of limit value	Limit value attainment date
NO_2	Human Health	1-hour	200	≤18 exceedances p.a. (99.79 %ile)	1 January 2010
		Calendar year	40	Annual mean	1 January 2010
NOx	Vegetation	Calendar year	30	Annual mean	1 January 2010
PM_{10}	Human Health	24-hours	50	≤35 exceedances p.a. (90%ile)	1 January 2005
		Calendar year	40	Annual mean	1 January 2005
$PM_{2.5}$	Human Health	Calendar year	25[1]	Annual mean	1 January 2010
		Calendar year	20[2]	Annual mean	1 January 2020

[1] Target value

[2] Limit value to be reviewed by the Commission in 2013 in light of further information on health and environmental effects, technical feasibility and experience of the Target Value in Member States.

There are no national or EU limits for dust deposition. However, the *Technical Instructions on Air Quality* (TA Luft, 2002) provide a guideline for the rate of dust deposition of 350 mg/m^2/day averaged over one year. The Environmental Protection Agency (EPA) concurs that this guideline may be applied, although applied as a 30-day average, in its document *Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* (EPA, 2006).

The Gothenburg Protocol is a multi-pollutant protocol which sets targets for NO_x. The implementation of targets at European level is met by the EU National Emissions Ceiling (NEC) Directive (2001/81/EC). Ireland's limits specified in the directive for 2010 are as follows:

- NO_x - 65 kilotonnes

A revised NEC Directive for emissions is due to be developed during 2013 which will establish new targets in EU legislation.

12.2.2 Significance Criteria

Significance criteria have been adopted from the National Roads Authority (NRA, 2011) document *'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'*. These are presented in Tables 12.2, 12.3 and 12.4.

Table 12.2: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. days with PM_{10} concentration greater than 50 ug/m^3	Annual Mean PM
Large	Increase/decrease ≥4µg/m^3	Increase/decrease >4days	Increase/decrease ≥2.5µg/m^3
Medium	Increase/decrease 2-<4µg/m^3	Increase/decrease 3or4days	Increase/decrease 1.25-<2.5µg/m^3
Small	Increase/decrease 0.4-<2µg/m^3	Increase/decrease 1or2days	Increase/decrease 0.25-<1.25µg/m^3
Imperceptible	Increase/decrease <0.4µg/m^3	Increase/decrease <1day	Increase/decrease <0.25µg/m^3

Table 12.3: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[1]		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/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 Scheme (36≤40 µg/m^3 of NO_2 or PM_{10}) (22.5≤25µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30≤36 µg/m^3 of NO_2 or PM_{10}) (18.75≤22.5 µg/m3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse

[1] Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration[1]		
	Small	**Medium**	**Large**
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Sight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-<40 µg/m^3 of NO_2 or PM_{10}) (22.5-<25µg/m^3 of $PM_{2.5}$)	Sight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-<36 µg/m3 of NO_2 or PM_{10}) (18.75-<22.5 µg/m3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<30 µg/m3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Table 12.4: Air Quality Impact Descriptors for Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor

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

Absolute Concentration in Relation to Objective/Limit Value	Changes in Concentration		
	Small	**Medium**	**Large**
With Scheme (<26 days)			
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (32-<35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (26-<32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

12.2.3 Construction Impacts Assessment Methodology

The NRA AQ guidance states that dust emissions from construction sites can lead to elevated PM_{10} concentrations and can cause soiling of properties. The assessment criteria, taken from the NRA guidance, are outlined in Table 12.5 below.

Table 12.5: Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

Source		**Potential distance for Significant Effects (Distance from Source)**		
Scale	**Description**	**Soiling**	**PM_{10}[a]**	**Vegetation Effects**
Major	Large construction sites, with high use of haul routes	100 m	25 m	25 m
Moderate	Moderate sized construction sites, with moderate use of haul routes	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul routes	25 m	10 m	10 m

[a] Significance based on the PM_{10} Limit Values specified in SI No. 180 of 2011, which allows 35 daily exceedances/year of 50 µg/m³

The impact of dust emissions during the construction phase is assessed by estimating the area over which there is a risk of significant impacts, in line with the NRA guidance. The impact of construction dust on sensitive habitats is also considered, and additional mitigation measures proposed, as required.

Emissions from construction vehicles are assessed where construction traffic results in a significant (>10%) increase in AADT flows near sensitive receptors.

The assessment was carried out using the DMRB screening model, as recommended by the NRA guidance.

Significance criteria outlined in Tables 12.2, 12.3 and 12.4 are used to assess the impact of the construction traffic on worst-case sensitive receptors.

12.2.4 Air Quality Assessment Methodology

The scenarios modelled for the purpose of the air quality assessment are described below:

- The '**Do-Minimum'** (DM) Scenario assumes that the M7 Osberstown Interchange and R407 Sallins Bypass scheme is not constructed with traffic scenarios for 2015 and 2030. This scenario assumes the M7 Naas to Newbridge By-Pass Upgrade Scheme has been developed.
- The '**Do-Something**' (DS) Scenario assumes that the proposed scheme is operational and development of the surrounding area occurs in line with the current Development Plan and Local Area Plan zoning.

The air quality assessment utilises traffic predictions for 2015 and 2030.

The NRA Guidelines state that *"Where predicted environmental concentrations from the DMRB screening model exceed 90% of the relevant air quality standard, or where there are complex or unusual features of the scheme, a detailed dispersion modelling assessment should normally be carried out. It should be noted that it will usually only be necessary to carry out detailed dispersion modelling in the immediate area of the complex feature, such as a specific junction, and not for the scheme as a whole, although many practitioners may find it simpler to use a single approach for the scheme assessment"*.

As there are no sensitive receptors located within 50 m of the M7 Osberstown Interchange, a screening assessment of the proposed scheme is carried out using the UK Design Manual for Roads and Bridges (DMRB) methodology as advised by the NRA Guidelines. The air quality spreadsheet provided in the DMRB was used to assess the impact of the proposed scheme on sensitive receptors in the vicinity of the proposed scheme. The NRA Guidelines state that increases in Annual Average Daily Traffic Flows (AADT) less than 5% are unlikely to result in significant air quality impacts, therefore links where increases greater than 5% are only considered in this assessment. For construction traffic an increase of greater than 10% requires assessment.

The most recent air quality assessment methodology is included in the August 2007 revision of the DMRB. This revision includes the DMRB Screening Method (Version 1.03c) spreadsheet used in this assessment. This spreadsheet calculates annual average concentrations of NO_x, NO_2 and PM_{10}.

The DMRB spreadsheet method computes concentrations of pollutants based on factors including:

- Location and distance of sensitive receptors to road.
- AADT flows.
- Average speed of traffic.

- Traffic composition.
- Road type.
- Background pollutant concentrations.

Representative receptors were chosen at each link or road where predicted traffic as a result of the proposed scheme was equal to or greater than 5% of predicted traffic without the proposed scheme. Representative receptors in the vicinity of these links were identified based on their sensitivity (e.g. school, hospital or house) and proximity to the roads affected by the proposed road development. All sections of the proposed Scheme were modelled (see Table 12.6 and **Figure 12.1 V3** for details of the receptor locations).

Annual average concentrations for the traffic related pollutants NO_2, PM_{10}, and $PM_{2.5}$ were modelled at each receptor. The predicted concentrations were compared to the relevant air quality standards.

Background concentrations were taken from EPA background air quality monitoring data 2010 and 2011 (refer to Section 12.3).

Table 12.6: Details of Receptor Locations used in the DMRB model

Receptor Location Reference	Grid Reference	
	E	N
R01	288053	221697
R02	288334	221994
R03	288516	222068
R04	288040	222556
R05	288693	223237
R06	288895	223084
R07	287560	221110
R08	287890	221522
R09	287715	220864
R10	288767	224315
R11	288523	221080
R12	289031	221933
R13	287074	219993
R14	288139	222580
R15	289351	221316
R16	289293	220188
R17	288051	219452
R18	286546	219826
R19	288237	219004

12.3 Receiving Environment

The Environmental Protection Agency's (EPA) *"Air Quality in Ireland 2010 and 2011"* (2012) describes the air quality zoning adopted in Ireland under the Air Quality Framework Directive 96/62/EC as follows:

- Zone A (Dublin Conurbation).
- Zone B (Cork Conurbation).
- Zone C (16 Cities and Towns with population greater than 15,000, including Naas).
- Zone D (Rural Ireland: areas not in Zones A, B and C).

The proposed road development site falls within the Naas Town boundary and is therefore considered in Zone C.

Background levels from 2011 air quality monitoring of NO_x, NO_2, $PM_{2.5}$ and PM_{10} in Zone C provided by the EPA are presented in Table 12.7.

Concentrations of each pollutant recorded in Zone C are averaged to represent typical background levels. Average concentrations were obtained from all stations where 90% data capture was achieved. This is in accordance with Directive 1999/30/EC which specifies that any site used for assessment purposes must comply with 90% data capture. For pollutants where the 90% capture rule was not achieved at any Zone C sites, the average of all sites was taken instead.

Pollutant background concentrations are included in Table 12.7 below. The DEFRA Netcen calculator is used to predict background levels for assessment years of 2015 and 2030.

Table 12.7: Annual Mean Background Pollutant Concentrations for Zone C (EPA, 2011)

[1]Background Values	Annual Average NO_x µg/m³	Annual Average NO_2 µg/m³	Annual Average PM_{10} µg/m³	[2]Annual Average $PM_{2.5}$ µg/m³
2013	30.82	17	18	16.20
2015	27.45	15.45	17.83	16.05
2030	13.18	8.55	17.45	15.71

[1] Reduction in future years using the Netcen background calculator (November 2002) and Netcen background calculator 3.2 (2012).

[2] A ratio of 0.9 has been used for the ratio of $PM_{2.5}$ / PM_{10} as recommended by the NRA

In 2013, the EPA reported that emissions of nitrogen oxides (NO_x) decreased by 47% between 1990 and 2011. Between 2010 and 2011 there was a 10% reduction, caused by reductions across all sectors and in particular power generation. Despite this reduction, Ireland is currently exceeding its 2010 NO_x ceiling of 65 kilotonnes by 10.4 kilotonnes in 2010 and 2.6 kilotonnes in 2011.

The road transport sector represents the largest source of NO_x emissions, accounting for 55 % of total NO_x emissions in 2011.

Stricter EU standards for emissions from cars and heavy duty vehicles have delivered significant reductions in emissions from road transport in combination with the economic downturn in more recent years.

However, while the benefits achieved by these more stringent standards achieved substantial decreases in NO_x emissions, they did not deliver in full the anticipated emission reductions particularly in relation to diesel cars and goods vehicles.

This failure and the large increase in traffic volumes and associated fuel use during a time of economic growth largely offset the emissions reductions.

12.4 Predicted Air Quality Impacts

12.4.1 Construction Phase

12.4.1.1 Construction Activities

The construction of the proposed scheme will require earthworks, particularly during site clearance and excavation. Dust emissions are likely to arise from the following activities:

- Site earthworks.
- Windblow from temporary stockpiles.
- Handling of construction materials.
- Landscaping.
- Construction traffic movements.

In general, any additional airborne concentrations of particulate matter arising from construction would be small and very local to the construction activity (minimising human exposure). Particles generated by most construction activities tend to be larger than 10µm in diameter which are too large to enter the human lung.

As stated in the NRA Guidance it is *"very difficult to accurately quantify dust emissions arising from construction activities". "A semi quantitative approach is recommended to determine the likelihood of a significant impact, which should be combined with an assessment of the proposed mitigation measures".* The semi-quantitative assessment methodology outlined in Table 12.5 is used to assess the impact of dust during the construction phase. It should be noted that it is likely that the construction works of the M7 Naas to Newbridge By-Pass Upgrade Scheme will occur simultaneous to the M7 Osberstown Interchange works, so this scenario is considered in the assessment.

M7 Osberstown Interchange/ M7 Naas to Newbridge By-Pass Upgrade Scheme

The M7 Naas to Newbridge By-pass Upgrade Scheme will take place in the median at the location of the M7 Osberstown Interchange.

The construction of the junction will require significant earthworks and the development of major structures; therefore this construction site would be considered to be of a major scale (refer to Table 12.5).

This has the potential to result in soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site.

However, as no sensitive receptors are located within 100 m of the construction site at this location, no significant soiling, PM_{10} or vegetation effects are envisaged.

R407 Sallins Bypass

The construction of the bypass will require significant earthworks and the development of major structures; therefore this construction site would be considered to be of a major scale (refer to Table 12.4). This has the potential to result in soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site.

At Ch. 0+900, a property (R02) is located within approximately 50 m of the proposed bypass and the realigned Osberstown Road. Therefore, there is the potential for soiling effects at this location with standard mitigation measures in place.

The realignment of Osberstown Road is considered to be of moderate scale. This has the potential to result in soiling effects within 50 m, PM_{10} impacts within 15 m and vegetation effects within 15 m of the construction site. R03 is located approximately 10 m from the works. Therefore there is the potential for soiling effects, PM_{10} impacts and vegetation effects at this property with standard mitigation measures in place. At other properties within 50 m of the works, there is the potential for soiling effects.

At the location where the bypass crosses the Grand Canal, major works occur which have the potential for soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site. One property (R04) is located within 100 m of the works at this location. Therefore, there is the potential for soiling effects at this location with standard mitigation measures in place.

Sallins Link Road

The construction of the Sallins Link Road from Ch. 0+000 to Ch. 0+90 0will require significant earthworks and the development of major structures; therefore this construction site would be considered to be of a major scale (refer to Table 12.4). This has the potential to result in soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site.

No properties are located within 25 m of these proposed works. A number of properties in Castlesize Drive are located within 100 m of the works. Therefore, there is the potential for soiling effects at this location with standard mitigation measures in place.

The Sallins Link Road ties into the Millbank Estate at Ch. 0+900. This single carriageway road is considered to be of moderate scale with the potential to result in soiling effects within 50 m, PM_{10} impacts within 15 m and vegetation effects within 15 m of the construction site.

A number of sensitive receptors are located in proximity to the works including the Cocoon crèche and the Milbank Estate. No1. Millbank Estate is located within 15 m of the proposed works.

There is the potential for soiling effects, PM_{10} impacts and vegetation with standard mitigation in place at this location. There is the potential for soiling effects at the crèche and other properties within 50 m of the works following the implementation of standard mitigation measures.

Clane Road Roundabout

The construction of the roundabout will require significant earthworks and the development of major structures; therefore this construction site would be considered to be of a major scale (refer to Table 12.4). This has the potential to result in soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site.

One property, 'Deerpark' is located approximately 60 m from the works. There is the potential for soiling effects this location following the implementation of standard mitigation measures.

Ecologically Sensitive Areas

The proposed R407 Sallins Bypass crosses the Grand Canal which is a proposed Natural Heritage Area (pNHA) (site code no. 2104) and supports otter, listed under Annex II of the EU Habitats Directive and opposite-leaved pondweed (Groenlandia densa), a Flora Protection Order listed species. Refer to Chapter 14, *Ecology* for further information on the pNHA.

The construction of the crossing will require significant earthworks and the development of major structures; therefore this construction site would be considered to be of a major scale (refer to Table 12.5). This has the potential to result in soiling effects within 100 m, PM_{10} impacts within 25 m and vegetation effects within 25 m of the construction site. There is the potential for soiling effects, PM_{10} impacts and vegetation effects to occur at the Grand Canal pNHA following the implementation of standard mitigation measures.

12.4.1.2 Construction Traffic

Construction traffic generated as a result of the M7 Osberstown Interchange and R407 Sallins Bypass will not give rise to an overall significant increase in AADT (>10%, refer to NRA Guidance). Therefore, no further assessment is required as outlined by the DMRB.

Construction traffic data from M7 Naas to Newbridge By-Pass Upgrade Scheme was combined with construction traffic data for the M7 Osberstown Interchange and R07 Sallins Bypass. The emissions from the combined construction vehicles are assessed where construction traffic results in a significant (>10%) increase in AADT flows near sensitive receptors. The assessment was carried out using the DMRB screening model, as recommended by the NRA guidance.

No significant increase (>10%) occurred in AADT flows near sensitive receptors therefore no further assessment is required.

12.4.2 Operation Phase

12.4.2.1 Local Assessment

The impact on air quality is assessed below for the opening year (2015) and design year (2030) under the "Do Minimum" (DM) and "Do Something" (DS) scenarios respectively.

Opening Year (2015)

Predicted concentrations (including background concentrations) for the 'DM', and 'DS' scenarios for the opening year 2015 are presented in Table 12.8.

The receptor showing the **greatest levels** of pollutants (including the background concentrations), as a result of the 'DS' scenario is Receptor 12 (see **Figure 12.1 V3**).

For this receptor, annual average concentrations of NO_2 are predicted to be 18.74µg/m³, which complies with the AQS of 40µg/m³; annual average concentrations of $PM_{2.5}$ are predicted to be 17.48µg/m³, which complies with the proposed limit value of 25µg/m³ and the annual average concentrations of PM_{10} are predicted to be 19.42µg/m³ which complies with the limit value of 40 µg/m³. The number of annual days which PM_{10} levels is predicated to exceed the limit of 50µg/m³ is <2 days. This complies with the limit of 35 days.

From Tables 12.3 and 12.4, the predicted change in concentration of all pollutants can be assessed. The predicated increase in NO_2, $PM_{2.5}$ and PM_{10} is considered negligible. The increase in magnitude of change in PM_{10} daily values is also considered negligible.

Under the 2015 DS scenario, all predicted pollutant concentrations comply with the relevant limit values at all receptors selected.

Table 12.8: Predicted Pollutant Concentrations Including Background Concentrations - Predicted using the DMRB for 2015

Receptor	Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
		Limit Values	***40***	***40***	***25***	***35***
R01	Osberstown House	DM	15.45	17.83	16.05	<2
		DS	16.17	17.94	16.15	<2
		Increase/Decrease DS- DM	0.72	0.11	0.10	
		Increase/Decrease %				
		DS – DM	4.66	0.62	0.56	
R02	Osberstown Road	DM	15.54	17.85	16.07	<2
		DS	16.24	18.06	16.25	<2
		Increase/Decrease DS- DM	0.70	0.21	0.19	
		Increase/Decrease %				
		DS – DM	4.50	1.18	1.06	

Receptor	Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
		Limit Values	***40***	***40***	***25***	***35***
R03	Osberstown Road/Cottages West Of Canal Bank Junction	DM	16.58	18.09	16.28	<2
		DS	16.33	18.03	16.23	<2
		Increase/Decrease DS- DM	-0.25	-0.06	-0.05	
		Increase/Decrease %				
		DS – DM	-1.51	-0.33	0.31	
R04	Canal Road	DM	15.45	17.83	16.05	<2
		DS	18.09	18.26	16.43	<2
		Increase/Decrease DS- DM	2.64	0.43	0.39	
		Increase/Decrease %				
		DS – DM	17.09	2.41	2.17	
R05	Proposed Sallins Link Road	DM	15.45	17.83	16.05	<2
		DS	16.71	18.03	16.23	<2
		Increase/Decrease DS- DM	1.26	0.20	0.18	
		Increase/Decrease %				
		DS – DM	8.16	1.12	1.01	
R06	Proposed Sallins Link Road	DM	15.45	17.83	16.05	<2
		DS	17.18	18.11	16.30	<2
		Increase/Decrease DS- DM	1.73	0.28	0.25	
		Increase/Decrease %				
		DS – DM	11.20	1.57	1.41	
R07	Proposed M7 Osberstown Interchange (West)	DM	16.18	18.17	16.35	<2
		DS	16.3	18.21	16.39	<2
		Increase/Decrease DS- DM	0.12	0.04	0.04	
		Increase/Decrease %				
		DS – DM	0.74	0.22	0.20	
R08	Proposed M7 Osberstown Interchange (Northwest)	DM	15.45	17.83	16.05	<2
		DS	15.95	17.96	16.16	<2
		Increase/Decrease DS- DM	0.50	0.13	0.12	
		Increase/Decrease %				
		DS – DM	3.24	0.73	0.66	
R09	Proposed M7 Osberstown Interchange (South)	DM	16.18	19.62	17.66	<2
		DS	16.28	19.65	17.69	<3
		Increase/Decrease DS- DM	0.10	0.03	0.03	
		Increase/Decrease %				
		DS – DM	0.62	0.15	0.14	

Receptor	Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
		Limit Values	***40***	***40***	***25***	***35***
R10	R407 Sallins Bypass – North Of Clane Road Roundabout	DM	17.21	18.34	16.51	<2
		DS	17.62	18.48	16.63	<2
		Increase/Decrease DS- DM	0.41	0.14	0.13	
		Increase/Decrease %				
		DS – DM	2.38	0.76	0.69	
R12	M7 North East Of Proposed M7 Osberstown Interchange	DM	18.73	19.4	17.46	<2
		DS	18.74	19.42	17.48	<2
		Increase/Decrease DS- DM	0.01	0.02	0.02	
		Increase/Decrease %				
		DS - DM	0.05	0.10	0.09	
R13	M7/N7 West Of Proposed M7 Osberstown Interchange	DM	17.82	18.98	17.08	<2
		DS	17.92	19.03	17.13	<2
		Increase/Decrease DS- DM	0.10	0.05	0.05	
		Increase/Decrease %				
		DS – DM	0.56	0.26	0.24	
R15	R407 Sallins By-Pass – South Of Monread Road Roundabout	DM	17.29	18.5	16.65	<2
		DS	17.5	18.61	16.75	<2
		Increase/Decrease DS- DM	0.21	0.11	0.10	
		Increase/Decrease %				
		DS – DM	1.21	0.59	0.54	
R16	Mill Lane - West Of R407 Sallins Road	DM	16.14	18.01	16.21	<2
		DS	16.17	18.02	16.22	<2
		Increase/Decrease DS- DM	0.03	0.01	0.01	
		Increase/Decrease %				
		DS – DM	0.19	0.06	0.05	
R17	Carragh Road South Of Western Distributor Link Road	DM	16.62	18.21	16.39	
		DS	16.86	18.25	16.43	
		Increase/Decrease DS- DM	0.24	0.04	0.04	
		Increase/Decrease %				
		DS - DM	1.44	0.22	0.20	

Design Year (2030)

Predicted concentrations (including background concentrations) for the 'DM', and the 'DS' scenarios for the design year, 2030 are presented in Table 12.9.

The receptor showing the greatest levels of pollutants (including the background concentrations), as a result of the 'DS' scenario is Receptor 12 (see **Figure 12.1 V3**).

For this receptor, annual average concentrations of NO_2 are predicted to be 11.76µg/m³, which complies with the AQS of 40 µg/m³; annual average concentrations of $PM_{2.5}$ are predicted to be 17.24µg/m³, which complies with the proposed limit value of 25 µg/m³ and the annual average concentrations of PM_{10} are predicted to be 19.15µg/m³ which complies with the limit value of 40 µg/m³. The number of annual days which PM_{10} levels is predicted to exceed the limit of 50µg/m³ is < 1day. This complies with the limit of 35 days.

From Tables 12.2 and 12.3 the increase in concentration of all pollutants can be assessed. The increase in NO_2 is considered negligible. The increase in $PM_{2.5}$ and PM_{10} are both considered small. The subsequent increase in magnitude of change in PM_{10} daily values is also considered negligible.

Under the 2030 DS scenario, all predicted pollutant concentrations comply with the relevant limit values at all receptors selected.

Table 12.9: Predicted Pollutant Concentrations Including Background Concentrations - Predicted using the DMRB for 2030

Receptor	Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
		Limit Values	***40***	***40***	***25***	***35***
R01	Osberstown House	DM	8.55	17.45	15.71	<2
		DS	9.29	17.56	15.80	<2
		Increase/Decrease DS- DM	0.74	0.11	0.10	
		Increase/Decrease %				
		DS – DM	8.65	0.63	0.57	
R02	Osberstown Road	DM	8.67	17.48	15.73	<2
		DS	9.35	17.71	15.94	<2
		Increase/Decrease DS- DM	0.68	0.23	0.21	
		Increase/Decrease %				
		DS – DM	7.84	1.32	1.18	
R03	Osberstown Road/Cottages West Of Canal Bank Junction	DM	10.02	17.79	16.01	<2
		DS	9.73	17.73	15.96	<2
		Increase/Decrease DS- DM	-0.29	-0.06	-0.05	
		Increase/Decrease %				
		DS – DM	-2.89	-0.34	-0.31	
R04	Barrettstown Road	DM	8.55	17.45	15.71	<2
		DS	11.28	17.87	16.08	<2
		Increase/Decrease DS- DM	2.73	0.42	0.38	
		Increase/Decrease %				

Receptor	Location	Scenario	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} (Days > 50 $\mu g/m^3$)
		Limit Values	***40***	***40***	***25***	***35***
		DS – DM	31.93	2.41	2.17	
R05	Proposed Sallins Link Road	DM	8.55	17.45	15.71	<2
		DS	9.77	17.64	15.88	<2
		Increase/Decrease DS- DM	1.22	0.19	0.17	
		Increase/Decrease %				
		DS – DM	14.27	1.09	0.98	
R06	Proposed Sallins Link Road	DM	8.55	17.45	15.71	<2
		DS	9.86	17.65	15.89	<2
		Increase/Decrease DS- DM	1.31	0.2	0.18	
		Increase/Decrease %				
		DS – DM	15.32	1.15	1.03	
R07	Proposed M7 Osberstown Interchange (West)	DM	9.26	18.81	16.93	<2
		DS	9.37	18.85	16.97	<2
		Increase/Decrease DS- DM	0.11	0.04	0.04	
		Increase/Decrease %				
		DS – DM	1.19	0.21	0.19	
R08	Proposed M7 Osberstown Interchange (North)	DM	8.55	17.45	15.71	<2
		DS	9.06	17.6	15.84	<2
		Increase/Decrease DS- DM	0.51	0.15	0.14	
		Increase/Decrease %			0.00	
		DS – DM	5.96	0.86	0.77	
R09	Proposed M7 Osberstown Interchange (South)	DM	9.26	19.26	17.33	<2
		DS	9.35	19.29	17.36	<2
		Increase/Decrease DS- DM	0.09	0.03	0.03	
		Increase/Decrease %				
		DS – DM	0.97	0.16	0.14	
R10	R407 Sallins Bypass (North of Proposed Sallins Bypass Junction)	DM	10.21	17.96	16.16	<2
		DS	10.58	18.1	16.29	<2
		Increase/Decrease DS- DM	0.37	0.14	0.13	
		Increase/Decrease %				
		DS – DM	3.62	0.78	0.70	
R12	M7 North East Of Proposed Osberstown Interchange	DM	11.73	19.11	17.20	<2
		DS	11.76	19.15	17.24	<2
		Increase/Decrease DS- DM	0.03	0.04	0.04	

Receptor	Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
		Limit Values	***40***	***40***	***25***	***35***
		Increase/Decrease %				
		DS – DM	0.26	0.21	0.19	
R13	M7/N7 West Of Proposed Osberstown Interchange	DM	10.86	18.68	16.81	<2
		DS	10.93	18.72	16.85	<2
		Increase/Decrease DS- DM	0.07	0.04	0.04	
		Increase/Decrease %				
		DS – DM	0.64	0.21	0.19	
R15	R407 Sallins Road South Of Monread Road Roundabout	DM	10.44	18.19	16.37	<2
		DS	10.69	18.3	16.47	<2
		Increase/Decrease DS- DM	0.25	0.11	0.10	
		Increase/Decrease %				
		DS – DM	2.39	0.60	0.54	
R17	Carragh Road East Of Western Distributor Link Road	DM	10.1	17.99	16.19	<2
		DS	10.51	18.14	16.33	<2
		Increase/Decrease DS- DM	0.41	0.15	0.14	
		Increase/Decrease %				
		DS – DM	4.06	0.83	0.75	

12.4.2.2 Air Quality Improvements

Table 12.10 outlines locations where air quality will improve, as a result of decreases in AADT. Hatched areas represent scenarios where AADT flow values will decrease by 10% or greater. Non-hatched areas represent scenarios where a 10% reduction in AADT flow does not occur.

The reduction in traffic will result in a localised improvement of air quality in these regions, which will be particularly evident where sensitive receptors are adjacent to roadways and traffic reductions are substantial.

Table 12.10: Locations of Improved Air Quality as a result of reduced AADT flows

Location	Link Number (see Figure 5.5 V3)	Link	2015	2030
			DS - DM	DS - DM
Western Distributor Link Road	1	West of Monread Roundabout		
	2	East of Airside Business Park		
	3	East of Sallins Road (R407) Roundabout		
	4	West of Sallins Road (R407) Roundabout		
	5	East of Proposed M7 Osberstown Interchange Link (Distributor Link Road)		
	6	West of Proposed M7 Osberstown Interchange Link		
	7	North of R409 Carragh Road		
	8	North of R445 Newbridge Road		
M7/N8	17	West of the B&Q Roundabout		
	18	West of the Bundle of Sticks Junction		
R445 Dublin Road	23	East of Monread Road Roundabout		
	24	South of Monread Road Roundabout		
Canal Bank	26	North of Mill Lane (or South of Osberstown Road)		
	27	South of Mill Lane		

Location	Link Number (see Figure 5.5 V3)	Link	2015	2030
			DS - DM	DS - DM
R407 Sallins Road	30	North of Proposed Sallins Link Road Junction		
	31	North of Osberstown Road Junction		
	32	North of Monread Road Roundabout		
Osberstown Road/Cottages	37	West of R407 Sallins Road		
	38	West of Canal Bank Junction		
Kerdiffsown Road	44	Kerdiffsown Road		
Maudlins Interchange (Junction 9)		Westbound Off-Slip (West of Dublin Road)		
		Westbound On-Slip		
		Eastbound Off-Slip		
		Eastbound On-Slip		
		Interchange Link Road		
Johnstown Interchange (Junction 8)		Eastbound On-Slip		
		Interchange Link Road		
		Johnstown Road (West)		

12.4.2.3 Ecologically Sensitive Areas

Table 12.11 presents the results from the air quality modelling at the Grand Canal for 2015 and 2030 for the DM and DS scenarios.

Traffic emissions potentially impacting on NO_x levels at the Grand Canal pNHA was assessed. Modelling was carried out at Osberstown (Ch. 1+600) where the Sallins Bypass crosses the Grand Canal pNHA.

Ambient NO_x concentrations predicted for the opening and design years along a transect of up to 200 m within the Grand Canal pNHA are given in Table 12.11 in accordance with NRA guidance. The contribution of the road to dry deposition is also given and was calculated using the guidance methodology.

The annual average NO_x concentration at the Grand Canal pNHA compiles with the limit value of 30 $\mu g/m^3$ for the Do Minimum scenario in 2015 and 2030, with NO_x concentrations reaching 92% of this limit in 2015 and 44% in 2030. For the Do Something scenario the limit values are exceeded in 2015 at 110% of the limit value and complied with in 2030 with the predicted concentration at 64% of the limit value.

The impact of the proposed scheme results in an increase in NO_x concentrations of a maximum of 6.10$\mu g/m^3$ at the Grand Canal pNHA. The NRA guidelines state in Appendix 9 that where the Scheme is expected to cause an increase of more than 2$\mu g/m^3$ and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_x should be assessed by the project ecologist. Refer to Chapter 14 – *Ecology* for the assessment of NO_x on the Grand Canal pNHA habitat.

The road contribution to the NO_2 dry deposition rate along the 200 m transect within the pNHA at Osberstown is also detailed in Table 12.11. The maximum increase in the NO_2 dry deposition rate is 1.61 Kg(N)/ha/yr. in 2015 and 2.0 Kg(N)/ha/yr. in 2030. This accounts for 40% of the critical load for inland and surface water habitats of 5-10 Kg(N)/ha/yr (NRA 2011).

Table 12.11: Predicted Pollutant Concentrations at The Grand Canal Including Background Concentrations -Predicted using the DMRB for 2015 and 2030

Dist. To Road (m)	NOx Conc. (µg/m^3) - 2015			NOx Conc. (µg/m^3) - 2030			NO_2 Dry Deposition Rate Impact (Kg(N) /ha/yr)	
	Do Minimum	Do Something	Impact	Do Minimum	Do Something	Impact	2015	2030
18.89	27.45	32.98	5.53	13.18	19.28	6.10	1.61	2.00
28.89	27.45	31.68	4.23	13.18	17.85	4.67	1.24	1.55
38.89	27.45	30.74	3.29	13.18	16.81	3.63	0.97	1.22
48.89	27.45	30.03	2.58	13.18	16.03	2.85	0.77	0.97
58.89	27.45	29.49	2.04	13.18	15.43	2.25	0.61	0.77
68.89	27.45	29.05	1.60	13.18	14.95	1.77	0.48	0.61
78.89	27.45	28.71	1.26	13.18	14.57	1.39	0.38	0.48
88.89	27.45	28.44	0.99	13.18	14.27	1.09	0.30	0.38
98.89	27.45	28.22	0.77	13.18	14.03	0.85	0.23	0.30
108.89	27.45	28.19	0.74	13.18	13.99	0.81	0.22	0.28
118.89	27.45	28.02	0.57	13.18	13.81	0.63	0.17	0.22
128.89	27.45	27.90	0.45	13.18	13.67	0.49	0.14	0.17
138.89	27.45	27.80	0.35	13.18	13.57	0.39	0.11	0.14
148.89	27.45	27.74	0.29	13.18	13.50	0.32	0.09	0.11
158.89	27.45	27.69	0.24	13.18	13.45	0.27	0.07	0.10
168.89	27.45	27.67	0.22	13.18	13.43	0.25	0.07	0.09
178.89	27.45	27.66	0.21	13.18	13.41	0.23	0.06	0.08
188.89	27.45	27.62	0.17	13.18	13.37	0.19	0.05	0.07
198.89	27.45	27.59	0.14	13.18	13.33	0.15	0.04	0.05
200	27.45	27.56	0.11	13.18	13.33	0.15	0.04	0.05
Standards	**30 µg/m^3**	**30 µg/m^3**	**-**	**30 µg/m^3**	**30 µg/m^3**	**-**	**5 - 10 Kg(N)/ha/yr**	

12.4.2.4 Regional Assessment

The DMRB regional approach was used to estimate total emissions from the road network. The assessment focuses on the change in emissions of nitrogen oxides in the current (baseline), opening and design years. The impact on carbon dioxide is considered in Chapter 13- *Climate*. Table 12.12 presents the predicated pollutant emissions at regional level.

Table 12.12: Predicted NO_x Emissions at Regional Level - Predicted using the DMRB for 2015 and 2030 (Tonnes per Annum)

	Scenario	NO_x (t/a)
2015	DM	166
	DS	174
	% Increase/Decrease	
	DS - DM	4.9
2030	DM	173
	DS	179
	% Increase/Decrease	
	DS - DM	3.5
	% of change (2030) relative to NEC Directive Limits	0.009

Nitrogen oxides are predicted to increase by 0.009% of the NEC Directive limit for NO_x in 2030. This increase is not considered significant.

12.5 Mitigation Measures

12.5.1 Construction Phase

Emissions to air during earthmoving and construction will occur, although the prevailing weather, the size of the site and its distance from sensitive receptors will assist in facilitating the management of any effects. The focus of the control procedures will therefore be to reduce the generation of airborne material.

The assessment of construction impacts contained in Section 12.4.1 includes for the implementation of 'standard mitigation', as stated in the NRA guidance. This shall include the following measures:

- Spraying of exposed earthwork activities and site haul roads during dry weather.
- Provision of wheel washes at exit points.
- Control of vehicle speeds and speed restrictions.
- Sweeping of hard surface roads.

In addition, the following measures shall be implemented in the areas outlined in Section 12.4 where major works will occur in proximity to sensitive receptors including at the river crossing points:

- Provision of hoarding of 2 m high at a minimum.
- Covering of stockpiles and locating stockpiles away from sensitive receptors.
- Locating plant away from sensitive receptors.

Employee awareness is also a most important way that dust may be controlled on any site. Staff training and the vigilant management of operations ensure that all dust suppression methods are implemented and continuously monitored.

Dust deposition monitoring will be conducted at a number of locations in the vicinity of the proposed road development. These locations will be determined in consultation with the local residents and the roads authority. At a minimum, monitoring will be carried out at the two nearest sensitive receptors at the interchange construction site, at the nearest sensitive receptors to the river bridge crossings and at the crossing of the Grand Canal. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft guidelines. Should an exceedance of the TA Luft limit occur during the construction phase, additional mitigation measures, for example more regular spraying of water, will be implemented.

12.5.2 Operational Phase

As it is predicted that all air quality standards for the protection of human health will be complied with, no specific mitigation measures are required. The assessment of the potential impact of NOx emissions at the Grand Canal pNHA is contained in Chapter 14 - *Ecology*.

12.6 Residual Impacts

The residual impact on air quality as a result of the proposed scheme will not be significant following the implementation of mitigation measures outlined above.

12.7 References

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