Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6A: Legislation, Policy and Guidance

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

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Tables

1 Legislation, Policy and Guidance

1.1.1 Table 1.1 to Table 1.3 summarise the applicable legislation, policy and guidance to Chapter 6: Air Quality.

Table 1.1: Summary of Legislation

Legislation	Summary	Chapter Reference
European Ambient Air Quality Directive (2008/50/EC)	The Directive is the primary driver for managing and improving air quality for each member state of the EU. The Directive sets legally binding limit values for concentrations in ambient (outdoor) air of pollutants that can impact public health, including NO_2 and particulates (PM_{10} & $PM_{2.5}$). EU limit values are set for individual pollutants and comprise a concentration value, an averaging time over which it is to be measured, the number of allowed exceedances per year (if any), and a date by which it must be achieved. Some pollutants (e.g. PM_{10}) have more than one limit value covering different averaging times.	Chapter 6: Air Quality conforms with the Directive by assessing whether sensitive receptors are predicted to experience pollutant concentrations beyond or within the EU limit values for NO_2, PM_{10}, $PM_{2.5}$ and where applicable NO_x. See Section 6.7 and 6.10.
Air Quality Standards Regulations 2010, as amended in 2016	The European Ambient Air Quality Directive was transposed into English law via the Air Quality Standards Regulations 2010, as amended in 2016.	The assessment conforms with the Regulations by assessing whether sensitive receptors are predicted to experience pollutant concentrations beyond or within the objective values for NO_2, PM_{10}, $PM_{2.5}$ and where applicable NO_x as prescribed in the

Legislation	Summary	Chapter Reference
		regulations. See Section 6.7 and 6.10.
The Environmental Protection Act (EPA) 1990	The Environmental Protection Act (EPA) (Section 79, Chapter 43, Part III - Statutory Nuisance and Inspections), contains a definition of what constitutes a 'statutory nuisance' with regard to dust and places a duty on Local Authorities to detect any such nuisances within their area. Dust arising from construction works could lead to statutory nuisance if it is 'prejudicial to health or a nuisance' i.e. affects people's wellbeing, even though it may not be prejudicial to health. A separate Statutory Nuisance Statement is presented as DCO Document 6.10.	The assessment conforms to the Act through the identification of the risk of impacts upon amenity as a result of the construction phase in Section 6.7 and Section 6.8, and through the assessment of changes to concentrations of particulate matter (PM_{10} and $PM_{2.5}$) with the operation of the Scheme as presented in Section 6.8 and Section 6.10. The assessment considers the change in pollutant concentrations at sensitive receptor locations in relation to the annual objective for NO_2, PM_{10} and $PM_{2.5}$ set for the protection of human health.

Table 1.2: Summary of Policy

Policy	Summary	Chapter Reference
National Policy Statement for National Networks (2014)	Paragraph 3.8 of the NPS NN states that *"the impact of road development on aggregate levels of emissions is likely to be very small. Impacts of road development need to be seen against significant projected reductions in carbon emissions and improvements in air quality as a result of current and future policies to meet the Government's legally*	The assessment fulfils the policy by considering the impact of the Scheme upon emissions and modelling the dispersal of the emissions and the resulting concentrations at sensitive receptor locations with and without the Scheme. The Opening Year considered in the assessment represents the worst year in terms of

Policy	Summary	Chapter Reference
	binding carbon budgets and the European Union's air quality limit values". Specifically, regarding air quality, Paragraph 3.8 of the NPS NN also states that *"aggregate air quality impacts from delivering a programme of investment on the Strategic Road Network of the scale envisaged in Investing in Britain's Future are small. Total PM_{10} and NO_x might be expected to increase slightly, but this needs to be seen in the context of projected reductions in emissions over time. PM_{10} and NO_x are expected to decrease over the next decade or so as a result of tighter vehicle emission standards, then flatten, with further falls over time due to greater levels of electric and other ultra-low emission vehicles".* The NPS NN in Paragraph 5.6 states the requirement for ES where *"the impacts of the project (both on and off-scheme) are likely to have significant air quality effects in relation to meeting EIA requirements and / or affect the UKs ability to comply with the Air Quality Directive, the applicant should undertake an assessment of the impacts of the proposed project as part of the environmental statement."*	emissions and Local Air Quality. This is because emissions from the national fleet are predicted to improve in time. See Sections 6.7 and 6.10 (document reference 6.1). A judgement of the risk to the UKs compliance with the EU Ambient Air Quality Directive is given in Appendix 6D and Section 6.10.

Policy	Summary	Chapter Reference
	Paragraph 5.7 states that "The ES should describe: • *Existing air quality levels;* • *Forecasts of air quality at the time of opening, assuming that the scheme is not built (the future baseline) and taking account of the impact of the scheme; and* • *Any significant air quality effects, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of the impact of road traffic generated by the project."* NPS NN Paragraph 5.8 explains that *"The applicant's assessment should be consistent with Defra's published future national projections of air quality based upon evidence of future emissions, traffic and vehicle fleet."* NPS NN Paragraph 5.9 states that *"In addition to information on the likely significant effects of a project in relation to EIA, the Secretary of State must be provided with a*	

Policy	Summary	Chapter Reference
	judgement on the risk as to whether the project would affect the UK's ability to comply with the EU Ambient Air Quality Directive."	
National Policy Statement for Ports (2012)	Paragraph 5.13.8 of the PNPS states that *"The NPS for Ports requires applicants to consider the effects of a project during both the construction and operational phases upon air quality taking into account the existing air quality levels."*	The assessment fulfils the policy by considering the effects of the Scheme during both the construction and operational phases. See Section 6.7 and 6.10 (document reference 6.1).
National Planning Policy Framework (2019)	Paragraph 170.e of the NPPF states that *"…Planning policies and decisions should contribute to and enhance the natural and local environment by: preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."* And that*: "The environmental impact of the Proposed Development will be a*	This assessment fulfils the policy by considering the impact of the Scheme upon compliance with relevant national objectives for pollutants. The Scheme is not situated in a Clean Air Zone or an Air Quality Management Area. See Section 6.10, Section 6.5 (document reference 6.1) and Appendix 6D (document reference 6.2).

Policy	Summary	Chapter Reference
	material consideration during the planning process." Paragraph 181 of the NPPF states that *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*	
National Air Quality Strategy 2007	The UK Government and the devolved administrations are	The assessment considers the pollutants identified in the National Air Quality

Policy	Summary	Chapter Reference
	required under the Environment Act 1995 to produce a national air quality strategy. The National Air Quality Strategy 2007 sets out the UK's air quality objectives, Defra provides tools and guidance on meeting the objectives for local authorities and practitioners through the Local Air Quality Management regime. In England, the Secretary of State for Environment, Food, and Rural Affairs has responsibility for adhering to the limit values, whilst the Department for Environment, Food and Rural Affairs (Defra) co-ordinate the assessment of compliance with limit values and development of Air Quality Plans for the UK (last updated in 2017).	Strategy where roads are considered a dominant source of such pollutants. The assessment includes conclusions as to compliance with the limit values and objectives set out in the National Air Quality Strategy. See Section 6.3 and 6.10 (document reference 6.1).
The Air Quality Strategy for England Scotland and Wales	The strategy sets out air quality objectives and policy options to improve air quality in the UK.	See Section 6.3 and 6.10 (document reference 6.1).
Clean Air Strategy 2019	A new Clean Air Strategy (CAS) was issued in January 2019 outlining ambitions to reduce air pollution, make air healthier to breathe and for nature protection. The Strategy sets out how the UK Government will work towards meeting	The assessment considers the pollutants identified in the Clean Air Strategy where roads are considered a dominant source of such pollutants. See Section 6.3 and 6.10 (document reference 6.1).

Policy	Summary	Chapter Reference
	reductions in England. The CAS, proposes actions to reduce air pollution and its effects. Proposals in the strategy relating to roads include an emphasis on clean growth and innovation such as plans to encourage the development, manufacture and use of zero exhaust emission vehicles. The CAS has an increased focus on particulate matter emissions with a target to reduce the number of people living in locations experiencing $PM_{2.5}$ concentrations above the World Health Organisation guideline level of 10µg/m^3 by 50% by the year 2025 and to aims to reduce emissions of $PM_{2.5}$ against the 2005 baseline by 30% by 2020, and 46% by 2030. The CAS aims to reduce emissions of nitrogen oxides (NO_x) of which NO_2 is a component against the 2005 baseline by 55% by 2020, increasing to 73% by 2030. The Air Quality strategy introduces a future strategy for reducing exhaust emissions from road vehicles called 'Road to Zero' which sets out plans to end the sale of conventional petrol and	

Policy	Summary	Chapter Reference
	diesel vehicles by 2040. The CAS has been considered in this assessment. A detailed National Air Pollution Control Programme is expected to be published in 2019 and the contents of the CAS have been considered in this assessment. Under the 2017 Air Quality Plan, certain local authorities are required to undertake feasibility studies to identify options to deliver compliance with EU limit values. GYBC was not included in the list of authorities required to do this.	
East Inshore Marine Plan	The EIMP Objective 6: To have a healthy, resilient and adaptable marine ecosystem in the East marine plan areas requires applicants to consider collective pressure upon air quality including effects on adjacent coastal communities in view of identified Air Quality Management Areas and the amount of current and potential future shipping traffic in the marine plan areas.	The assessment fulfils the policy by incorporating Defra Air Quality Background Mapping pollutant concentrations in the local air quality assessment methodology that include a prediction of shipping emissions within the relevant grid square. See Table 6.8 and Section 6.5 (document reference 6.1). The adjacent coast communities have not declared Air Quality Management Areas and are beyond the study area defined by changes in traffic related to the

Policy	Summary	Chapter Reference
		scheme. See Section 6.4 for the determination of the extent of the study area.
Great Yarmouth Borough Council Core Strategy Policy CS9 **Encouraging well-designed, distinctive places**	Policy CS9 Encouraging well-designed, distinctive places states that GYBC will through planning policy: *"Seek to protect the amenity of existing and future residents, or people working in, or nearby, a proposed development, from factors such as noise, light and air pollution and ensure that new development does not unduly impact upon public safety".* *"New and existing development should not contribute to, or be put at risk from, pollution or other sources of nuisance or intrusion that could adversely affect amenity. In addition to the potential impacts of development on the amenity of people, there are other potential environmental impacts that also need to be addressed, principally in relation to air quality and light pollution".*	The assessment conforms to the policy by predicting the likely impact of the scheme upon Local Air Quality during both the operational and construction phase. The air quality assessment provides a detailed evaluation of the significance of effects of the Scheme's impact on local air quality receptors within 200 m of affected roads in Section 6.6 (document reference 6.1), where the amenity impacts from the Scheme upon local air quality would be greatest.
Policy CS16 Improving Accessibility and Transport	Policy CS16 Improving accessibility and transport states that GYBC will create a more integrated transport network.	The assessment conforms to the policy by predicting the likely impact of the Scheme upon Local Air Quality during the operational phase and the

Policy	Summary	Chapter Reference
	"A well-connected and integrated transport network supports the sustainable functioning and development of the borough. At present the majority of trips taken within and to the borough are by car, resulting in congestion and increased air pollution, particularly at peak times". *"Easing congestion and improving the transportation network will make the borough more desirable to investors and improve air quality through a reduction in traffic emissions. To help ease congestion, the Council with its partner organisations and the local transport operators are pursuing a range of different options, including: Supporting the development of a Third River Crossing to reduce congestion".*	impact of construction dust within the construction phase. The Scheme is expected to reduce congestion and the assessment within this chapter considers the change in emissions from traffic as broken down into time periods which cover the AM and PM peak periods see Appendix 6C (document reference 6.2).

Table 1.3: Summary of Guidance

Guidance	Summary	Chapter Reference
United Nations Economic Commission for Europe (UN/ECE) Critical Loads	The United Nations Economic Commission for Europe (UN/ECE) Critical Loads provides critical load values for nutrient nitrogen deposition when undertaking assessment of the effects of changes in air quality upon designated ecological	The assessment predicts the likely impact of the Scheme upon designated ecological sites considered sensitive to changes in air quality during the operational phase and the potential impact of construction dust during the construction

Guidance	Summary	Chapter Reference
	sites.	phase. See Section 6.4, Section 6.6, Section 6.8 (document reference 6.1) and Appendix 6G (document reference 6.2).
Design Manual for Roads and Bridges (DMRB) HA207/07 Air Quality	The DMRB technical guidance sets out the circumstances of when an assessment may be required providing details of the information required to undertake such an assessment of the effect of a Scheme upon Local Air Quality upon sensitive receptors and designated ecological sites considered sensitive to NO_x and Nitrogen deposition.	The assessment follows the DMRB technical guidance in the methodology of the Operational Local Air Quality Assessment, see Section 6.4 (document reference 6.1), the methodology of the Ecological Air Quality Assessment, see Section 6.4 (document reference 6.1) and in the methodology of the Operational Regional Air Quality Assessment in Section 6.4 (document reference 6.1).
Institute of Air Quality Management (IAQM) Land Use Planning and Development Control Planning for Air Quality (2017)	The IAQM Land Use Planning and Development Control Planning for Air Quality technical guidance sets out the circumstances of when an assessment may be required providing details of the information required to undertake such an assessment of the effect of a Scheme upon Local Air Quality and the methodology to determine the significance of impacts upon Local Air Quality.	The assessment follows the IAQM technical guidance in the methodology applied to determining the significance of impacts upon Local Air Quality. See Section 6.4, 6.7 and 6.10 (document reference 6.1).
Institute of Air Quality Management (IAQM)	The IAQM Guidance on the Assessment of Dust	The assessment follows the IAQM technical

Guidance	Summary	Chapter Reference
Guidance on the Assessment of Dust from Demolition and Construction (2014)	from Demolition and Construction technical guidance sets out the circumstances of when an assessment may be required providing details of the information required to undertake such an assessment of the effect of dust generated during the construction of a scheme upon receptors considered sensitive to dust impacts.	guidance in the methodology applied to determining the significance of construction dust impacts during the construction phase. See Section 6.4, Section 6.10 (document reference 6.1) and Appendix 6B (document reference 6.2).
Defra Local Air Quality Management Technical Guidance LAQM TG(16)	LAQM TG(16) sets out the methodology for air quality monitoring and the dispersal model verification procedure.	The assessment follows LAQM TG(16) in the method and approach applied to the dispersal model verification procedure given in Appendix 6C (document reference 6.2).
Highways England IAN 175/13 Updated air quality advice on risk assessment related to compliance with the UE Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 'Air Quality'	IAN 175/13 provides advice on conducting risk assessments related to compliance with the EU Directive on ambient air quality. The IAN is withdrawn pending the issue of new guidance. However, the compliance risk assessment for the Scheme has been conducted following the IAN methodology in the absence of updated guidance.	The compliance risk assessment follows the method specified in IAN 175/13 as summarised in Appendix 6D (document reference 6.2).
Highways England IAN 174/13 Updated advice for evaluating significant local air quality effects (2013)	IAN 174/13 provides advice on categorizing the impacts of changes in air quality upon sensitive receptors where the predicted concentrations	The approach to determining significance in guidance produced by the IAQM and within the Highways England IAN guidance differs in the

Guidance	Summary	Chapter Reference
	are within 10% of the relevant Air Quality Standards objective concentrations.	method by which the change between the Do Minimum and Do Something results for the Local Air Quality Assessment are defined as significant. Further information on the determination of significance is given in Section 6.4 (document reference 6.1). The IAN methodology considers only receptors where the concentration of a pollutant falls within 10% of the relevant objective or is in exceedance of the objective in the Do Something scenario whereas the IAQM methodology for determining significance categorises all changes in concentration in relation to the annual mean air quality objective for NO_2 and PM_{10}. The conclusions on significance given in this assessment are based upon the IAQM methodology which was deemed more appropriate as the predicted concentrations in the Opening Year across the study area do not fall within 10% of the relevant air quality objectives.

Great Yarmouth Third River Crossing

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Document 6.2: Environmental Statement Volume II: Technical Appendix 6B: Air Quality Construction Phase Assessment Methodology

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

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Tables

1 Air Quality Construction Phase Assessment Methodology

1.1 Introduction and Scope of the Assessment

1.1.1 Appendix 6B of the Environmental Statement (ES) outlines the guidance provided by the Institute of Air Quality Management (IAQM) for the assessment of air quality impacts arising from demolition and construction activities[1], (herein referred to as 'the Guidance ').

1.2 Step One: Screen the Need for a Detailed Assessment

1.2.1 An assessment of construction phase dust emissions will normally be required where there are:

- 'Human receptors' within 350m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)[1]; and
- 'Ecological receptors' within 50m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

1.2.2 Human and ecological receptors have been considered up to a distance of 500m to incorporate the distances specified in the IAQM guidance.

1.2.3 The Guidance refers to a 'Human receptor', as any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over period relevant to the air quality objectives, as defined in Defra technical air quality guidance (Ref 6.5).

1.2.4 The Guidance refers to an 'Ecological receptor' as any sensitive habitat affected by dust soiling and includes locations with a statutory designation such as a Site of Specific Scientific Interest (SSSI), Special Area of Conservation (SACs), Special Protection Areas (SPAs) and RAMSAR sites, as designated under the RAMSAR convention.

[1] The distance applied is in line with the IAQM Guidance on the assessment of dust from demolition and construction and differs from the land referencing limits in accordance with the discipline specific guidance which captures a more conservative area.

1.2.5 Where the need for a more detailed assessment is screened out, the Guidance concludes that the level of risk is 'negligible' and that any effects are unlikely to be significant.

1.3 Step Two: Assess the Risk of Dust Impacts

1.3.1 The Guidance states that the risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (Step Two (A)); and
- The sensitivity of the area to dust impacts (Step Two (B)) which is defined as low, medium or high sensitivity.

1.3.2 These two factors are combined to determine the risk of dust impacts with no mitigation applied. Depending on the activities undertaken, risk category designations may be required for each of four construction activities defined by the Guidance; namely Demolition, Construction, Earthworks and Trackout.

Step Two (A): Define the Potential Dust Emission Magnitude

1.3.3 The dust emission magnitude has been based on the scale of the anticipated works and is classified as 'Small', 'Medium', or 'Large' as identified for each construction activity from the criteria in Table 1.1.

Table 1.1: Dust Emission Magnitude Criteria

Activity	Description		
	Small	Medium	Large
Demolition	Total building volume less than 20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber) demolition activities less than 10m above ground level; demolition during wetter months	Total building volume between 20,000m^3 – 50,000m^3, potentially dusty construction material; demolition activities between 10m and 20m above ground level	Total building volume more than 50,000m^3, potentially dusty construction material (e.g. concrete); on-site crushing and screening; demolition activities more than 20m above ground level
Earthworks	Total site area less than	Total site area between 2,500m^2	Total site area more than

Activity	Description		
	Small	Medium	Large
	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	to 10,000m^2; moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m - 8m in height, total material moved 20,000 tonnes – 100,000 tonnes	10,000m^2; potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds more than 8m in height, total material moved more than 100,000 tonnes
Construction	Total building volume less than 25,000m^3; construction material with low potential for dust release (e.g. metal cladding or timber).	Total building volume between 25,000 m^3 and 100,000m^3; potentially dusty construction material (e.g. concrete), on- site concrete batching;	Total building volume more than 100,000m^3; on-site concrete batching, sandblasting;
Trackout	Less than 10 HDV outward movements in any one day; surface material with low potential for dust release; unpaved road length less than 50m	Between 10 to 50 HDV outward movements in any one day; moderately dusty surface material (e.g. high clay content); unpaved road length between 50 and 100m	More than 50 HDV outward movements in any one day; potentially dusty surface material (e.g. high clay content); unpaved road length more than 100m

1.3.4 Table 1.11 details the risk of impacts for potential dust nuisance, health and ecosystem effects from demolition; earthworks; general construction activities and trackout, respectively. For the purposes of the Step Two (A) assessment, in accordance with the Guidance, it is assumed that no mitigation measures are applied, the dust emission magnitude is dependent

on the available information on the construction phase and professional judgement.

1.3.5 A summary of the dust emission magnitude assigned to each construction activity as part of this assessment is outlined in Table 1.2.

Table 1.2: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Description
Demolition	Large	The construction demolition involves the removal of a foot bridge constructed of concrete, 22 two storey brick residential buildings, one two storey brick building and eight large sheds with corrugated roofs mounted on concrete pillars and associated hardstanding. A worst-case assumption that asbestos may be present within structures has been taken.
Earthworks	Large	The exact extent of Earthworks is unknown at this ES stage. However, due to the size of the Scheme and taking a worst-case approach to the assessment, it is judged that Earthworks could produce high levels of dust and it has accordingly been included within the assessment.
Construction	Large	Extensive onsite works will be required during construction of the Scheme therefore a worst-case assumption that works have the potential to generate high levels of dust was taken.
Trackout	Large	At the ES stage, the exact number of construction vehicles utilised throughout the construction phasing is unknown, nor the amount and length of unpaved roads that will be used. As a worst case estimate it is assumed that the scheme will generate up to a peak of 140 two-way HDV vehicle movements, and 290 LDV movements per day (see 6.4 of the (ES Document Reference

Activity	Dust Emission Magnitude	Description
		6.1)) and it is likely that there will be sections of unpaved road during construction. The approach routes to the construction compounds will be the trunk road network and vehicles accessing the construction compound situated on the east side of the Principal Application Site will use Fish Wharf for access. Vehicles accessing the construction compound situated on the west side of the Principal Application Site will use Williams Adams Way, Suffolk Road and Queen Anne's Road.

Step Two (B): Define the Sensitivity of the Area

1.3.6 The sensitivity of the area takes into account a number of factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

1.3.7 The significance of dust effects associated with the construction phase was defined using the criteria detailed in Table 1.3,

1.3.8 Table 1.4 and Table 1.5.

Table 1.3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<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

[a] The sensitivity of the area is derived for each of the four activities: demolition, construction, earthworks and trackout.

[b] Estimate the total number of receptors within the stated distance. Only the **highest level** of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total number of receptors <50 m is 102. The sensitivity of the area in this case would be high.

[c] For trackout, the distances are measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500m from large sites as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road where sensitivity would be high when the number of receptors is over 100.

Table 1.4: Sensitivity of the Area to Human Health Impacts[ab]

Receptor Sensitivity	Annual mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)[c] <20	<50	<100	<200	<350
High	>32 µg.m^3	>100	High	High	Medium	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg.m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg.m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg.m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg.m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg.m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg.m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual mean PM_{10} concentration	Distance from the Source (m)[c]					
		Number of Receptors	<20	<50	<100	<200	<350
	<24 µg.m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

[a] The sensitivity of the area is derived for each of the four activities: demolition, construction, earthworks and trackout.

[b] Estimate the total number of receptors within the stated distance, (e.g. the total within 350 m and not the number between 200 and 350m), noting that only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total number of receptors <50 m is 102. If the annual mean PM_{10} concentration is 29 µg/m^3, the sensitivity of the area would be high.

[c] Most straightforwardly taken from the national background maps, but should also take account of local sources. The values are based on 32 µg/m^3 being the annual mean concentration at which an exceedance of the 24hr objective is likely in England, Wales and Northern Ireland.

[d] In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

[e] For trackout, the distances are measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50m from the edge of the road where sensitivity would be high when the number of receptors is over 100.

Table 1.5: Sensitivity of the Area to Ecological Impacts[ab]

Receptor Sensitivity	Distance from the Source (m)[c]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

[a] The sensitivity of the area is derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site.

[b] Only the highest level of area sensitivity from the table needs to be considered.

[c] For trackout, the distances are measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, as measured from the site exit. The impact declines with distance from the site.

1.3.9 Table 1.6 provides the method of defining the sensitivity of the area.

Table 1.6: Outcome of Defining the Sensitivity of the Area

Receptor Sensitivity	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	High	High	High	High
Ecological	High	High	High	High

Step Two (C): Define Risk of Impacts

1.3.10 The dust emission magnitude determined using the criteria in Table 1.1 Table 1.1: Dust Emission Magnitude Criteriaand justified in Table 1.2 has been combined with the sensitivity of the area determined through the implementation of Table 1.3,

1.3.11 Table 1.4 and Table 1.5 to determine the risk of impacts without mitigation.

1.3.12 The matrices in

1.3.13 Table 1.7 provide a method of assigning the level of risk for each activity. This has been used in determining the level of mitigation that must be applied and discussed in Step Three. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation are required.

Table 1.7: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Small	Medium	Large
Demolition			
Low	Negligible	Low Risk	Medium Risk
Medium	Low Risk	Medium Risk	High Risk
High	Medium Risk	Medium Risk	High Risk
Earthworks			
Low	Negligible	Low Risk	Low Risk
Medium	Low Risk	Medium Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk
Construction			
Low	Negligible	Low Risk	Low Risk
Medium	Low Risk	Medium Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk
Trackout			
Low	Negligible	Low Risk	Low Risk
Medium	Negligible	Low Risk	Medium Risk
High	Low Risk	Medium Risk	High Risk

1.3.14 Table 1.8 provides a summary of the risk of dust impacts for the four activities and allows for site-specific mitigation measures to be specified for inclusion in this assessment (see Step Three).

Table 1.8: Summary of Risk for Definition of Mitigation Measures

Sensitivity of Area	Summary of Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	High Risk	High Risk
Human Health	High Risk	High Risk	High Risk	High Risk
Ecological	High Risk	High Risk	High Risk	High Risk

1.4 Step Three: Site-specific Mitigation

1.4.1 The dust risk categories for each of the four activities determined in Step Two have been used to define the appropriate, site-specific, mitigation measures to be adopted and reflected in the OCoCP (document 6.16).

1.4.2 The mitigation measures are divided into general measures applicable to all site and measures applicable specifically to demolition, earthworks, construction and trackout, for consistency with the assessment methodology. More information on the site-specific mitigation identified as part of this air quality assessment can be found in the Sections 6.7 and 6.8 of Chapter 6 of the ES (document reference 6.1).

1.5 Step Four: Determine Significant Effects

1.5.1 Once the risk of dust impacts has been determined in Step Two and the appropriate dust mitigation measures identified in Step Three, the final step has been to determine whether there are significant effects arising from the construction phase of the Scheme. This assessment is based on professional judgement and takes account of the significance of the effect of each of the four construction activities.

1.5.2 For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. The Guidance states that this is normally possible. Hence the residual effect will normally be 'not significant'.

1.6 Step Five: Dust Assessment Report

1.6.1 The findings of the construction phase dust assessment are reported in Section 6.8 of Chapter 6 of the ES (document reference 6.1). This assessment includes:

- A summary of dust emission magnitude and sensitivity of the study area;
- The potential risk of impacts associated with the construction phase, without mitigation; and
- Details of appropriate mitigation measures commensurate to the scale and nature of construction activities and locations; this will be applied via the OCoCP.

1.7 Mitigation Measures

1.7.1 Following assessment of the potential risk for construction dust impacts from the Application Sites, where practicable the following mitigation measures recommended by IAQM should be implemented where high risk activities are

identified. A site-specific list of recommended measures is included in Chapter 6 Section 6.8 and included within the Outline CoCP (document reference: 6.16).

1.7.2 Dust and PM_{10} monitoring is also included within the Outline CoCP (document reference 6.16) as embedded mitigation for medium to high risk sites, as defined by IAQM. The monitoring locations should be agreed with the county planning authority in consultation with GYBC, with baseline monitoring taking place at least three months before construction works commence.

1.7.3 The following additional mitigation will be applied through the OCoCP with further measures as practicable to be applied to demolition, trackout, and construction activities through the relevant phases of the construction programme.

1.7.4 For mitigation measures specific to **demolition** it is highly recommended to:

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

1.7.5 For mitigation measures specific to **trackout** it is highly recommended to:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.

- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10m from receptors where reasonably practicable.

1.7.6 For mitigation measures specific the **earthworks** it is highly recommended to:

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

1.7.7 For mitigation measures specific to **construction**:

- Regular monitoring will be undertaken including regular onsite and offsite inspection where receptors are nearby and are accessible, to monitor dust, record inspection results, and make the log available to the local authority when requested. The frequency of site inspections by the person accountable for air quality and dust issues on site will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions;
- Site management will be applied to - record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken; make the complaints log available to the local authority when asked; record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book; hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
- Regarding preparing and maintaining the site – the site layout will be optimized so that machinery and dust causing activities are located away from receptors, as far as is possible; solid screens or barriers will be

erected around dusty activities or the site boundary that are at least as high as any stockpiles on site; where applicable for specific operations where there is a high potential for dust production and the site is actives for an extensive period full enclosure may be required; Measures will be taken to avoid site runoff of water or mud; Site fencing, barriers and scaffolding will be kept clean using wet methods; Materials that have a potential to produce dust will be removed from site as soon as possible, unless being re-used on site. Stockpiles will be covered to prevent wind whipping.

- Dust generating activities (e.g. cutting, grinding and sawing) will be minimised and weather conditions considered prior to conducting potentially dust emitting activities. Cutting, grinding or sawing equipment will be fitted or used in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems where practicable;
- Fine material will not be stockpiled to an excessive height in order to prevent exposure to wind and dust nuisance;
- Scabbling (roughening of concrete surfaces) will be avoided if possible.
- Sand and other aggregates will be stored in bunded areas and not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Bulk cement and other fine powder materials are to be delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
- Roads and accesses will be kept clean;
- Where reasonably practicable, plant will be located away from site boundaries that are close to residential areas;
- Water will be used as a dust suppressant, where applicable;
- Drop heights from excavators to crushing plant will be kept to a minimum;
- Distances from crushing plant to stockpiles will be kept to the minimum practicable to control dust generation associated with the fall of materials. Use enclosed chutes and conveyors and covered skips; Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Skips will be securely covered;

- Soiling, seeding, planting or sealing of completed earthworks will be completed as soon as reasonably practicable following completion of earthworks;
- Dust suppression and the maintenance of the surface of access routes will be appropriate to avoid dust as far as practicable, taking into account the intended level of trafficking;
- Wheel wash facilities to minimise trackout of dust;
- Material will not be burnt on site; and
- Engines will be switched off when not in operation. A Framework Construction Traffic Management Plan is given in Appendix A to the OCoCP to minimise any adverse effects related to construction traffic.

1.7.8 The Outline CoCP (document reference 6.16) requires that the full CoCP stipulates the following to ensure the aforementioned mitigation is implemented effectively, continually monitored and updated accordingly:

- Identification of a responsible environmental manager; and
- Method statements for the control of dust in such locations.

Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6C: Local Air Quality Modelling and Model Verification

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

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1 Local Air Quality Modelling and Model Verification

1.1 Atmospheric Dispersion Model

1.1.1 The predicted impacts on local air quality associated with changes to vehicle emissions as a result of the operation of the Scheme were assessed using the Cambridge Environmental Research Consultants (CERC) atmospheric dispersion modelling system for roads (ADMS-Roads v4.1.1).

1.1.2 ADMS-Roads applies advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations within the given model domain. It can predict long-term and short-term concentrations, as well as calculations of percentile concentrations.

1.1.3 ADMS-Roads is a validated model, developed in the UK by CERC. The model validation process includes comparisons with data from the UK's Automatic Urban Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC web site at http://www.cerc.co.uk/environmental-software/model-validation.html.

1.1.4 The procedures involved in undertaking the dispersion modelling assessment are outlined below:

- Collation of input data – traffic data (flows, speeds, percentage of Heavy Duty Vehicles (HDVs), road network mapping, sensitive receptor coordinates and meteorological data;
- Input of data in to the ADMS-Roads model for the scenarios to be modelled (see Table 1.1);
- Development of emissions inventories for each pollutant to be assessed, using Defra's emission factor toolkit (EFT v8.0.1);
- Running the ADMS-Roads model for each considered scenario;
- Conversion of modelled NO_X concentrations to NO_2 concentrations using Defra's NO_x-NO_2 calculator v6.1;
- Addition of Defra background concentrations to the modelled concentrations with the background road sector contribution removed to avoid double counting of the road source component;

- Verification and adjustment of modelled road-NO_x contributions from the assessed road network through analysing the ADMS-Roads modelled road-NO_x outputs versus scheme-specific monitored road-NO_x for the base year scenario (2017);
- Comparison of predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors to the relevant air quality objectives in each scenario; and
- Analysis of changes in pollutant concentrations between the Do Minimum and Do Something scenarios to assess the significance of impacts associated with the Scheme on local air quality.

1.1.5 The key model inputs used in the air quality assessment are summarised in Table 1.1.

Table 1.1: Data Inputs to the ADMS Roads Dispersal Model

Input Data Set	Description
One year of meteorological data	Hourly sequential meteorological data set of 12-month period (2017) from the closest representative coastal meteorological station, situated at Weybourne.
Sensitive receptor locations	Ordnance Survey (OS) grid coordinates for each sensitive receptor within 200m of an affected road identified through applying the DMRB local air quality screening criteria. Sensitive receptor locations were identified using the OS Address Plus data set, which specifies each property classification.
Network of road sources	To include all the road sources within the traffic data set provided that may influence pollutant concentrations at identified sensitive receptors, receptors within 200m of each 'affected road' meeting the affected roads criteria detailed in ES Chapter 6, Section 6.4 were selected. The coverage of the network of modelled road sources has been determined by selecting all roads with traffic data that fall within or intersect an area of 200m around a sensitive receptor location.
Road traffic emissions	Vehicle emissions inventories for the modelled road network were calculated using the Defra emission factors toolkit (EFT v8.0.1). The road source emissions rates (g/km/s) were entered into the model for each respective road source link.
Minimum Monin-Obukhov length	The Minimum Monin-Obukhov length represents the stability of the atmosphere and the model takes the setting as the minimum height above which vertical turbulent motion is significantly inhibited by stable stratification. A Minimum

Input Data Set	Description
	Monin-Obukhov length of 10m was selected to reflect the low building height in the Study Area and the spatial characteristics of the town of Great Yarmouth which is coastal with low buildings.
Surface Roughness	The model was run with the option to take the surface roughness[1] from the dispersal site[2] within the model (the modelled road network), which was 0.5 (considered relevant to open suburbia).

1.1.6 Model validation undertaken by the software developer Cambridge Environmental Research Consultants (CERC). To evaluate the performance of the model within the context of the Scheme Study Area a verification procedure is followed according to Defra guidance LAQM TG(16).

1.2 Traffic Data

1.1.7 Traffic flow data from the SATURN traffic model was provided by Transport Planning specialists comprising of Period Traffic flows for the AM Peak (3hrs, 7am to 10am), Inter-peak (5.5hrs 10am to 3.30pm), PM Peak (2.5hrs, 3.30pm to 6pm) and Off-peak (12hrs, 7pm to 7am). It should be noted that these periods differ from those presented in the Transport Assessment as the traffic data informing the environmental assessments is from the strategic SATURN traffic model, whereas the data presented in the Traffic Assessment is related to the local Paramics model thus has different time periods. Traffic composition (percentage HDVs) and average link speeds (km/h) were used in the modelling as provided for the assessed road network.

1.1.8 Traffic flow data were provided for the following scenarios:

- 2017 Base Year (model verification year);
- 2023 Opening Year Do Minimum (without Scheme); and
- 2023 Opening Year Do Something (with Scheme).

[1] The surface roughness is related to the land use and characteristics in the are being modelled.

[2] The dispersal site is the location from which the pollutants are dispersing as a source in the air quality dispersal model, dispersal in the model in this assessment is from the modelled road network.

1.1.9 The Study Area for the modelling assessment focused on the new road layout that would be introduced by the Scheme, in addition to existing roads affected by the Scheme. The modelled road network consists of the local affected road network determined by screening as explained in Section 6.4 of the Environmental Statement (document reference 6.1) and the addition of all roads for which traffic data is available within 200m of the sensitive receptors that are located within 200m of an affected road. The model road network is given in Figure 6.2 and includes but is not limited to the following roads on the approach to the existing bridges and close to the Scheme:

- A1243 South Denes Road
- Lowestoft Road
- High Road
- A47
- A143
- South Quay
- Pasteur Road
- Bridge Road
- North Quay

1.1.10 The model road network includes the LARN and additional roads included in the traffic model which are located within 200m of the sensitive receptors. The LARN and MRN are shown in Figure 6.2.

1.1.11 The Defra EFT v8.0.1 was used to calculate vehicle emissions of NOx, PM10 and PM2.5 for each scenario, which were used as an input to the dispersion model. Road traffic emissions were calculated from period traffic data covering the AM peak period from 7 to 10 a.m., the inter-peak (IP) period from 10 a.m. to 3.30p.m., the PM peak period from 3.30 to 7p.m. and the off-peak (OP) period from 7p.m. to 7a.m.

1.1.12 The network speed (combination of link and junction delays) was extracted for AM, IP and PM peak hours. This was assumed to represent the peak period. Off peak speed was assumed to be free flow. A flow weighted average speed was then calculated.

1.3 Meteorological Data

1.1.13 ADMS-Roads utilises hourly sequential meteorological data; including wind direction, wind speed, temperature, precipitation and cloud cover, to facilitate the prediction of pollution dispersion between source and receptor.

1.1.14 Meteorological data input to the model were obtained from the closest meteorological station in Weybourne for the year 2017. The 2017 data were used to be consistent with the base/verification traffic year and were applied to the remaining scenarios for the local air quality assessment. The 2017 wind rose is presented in Appendix 6F.

1.4 Conversion of NO_x to NO_2

1.1.15 Oxides of nitrogen (NO_x) concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NO_x at the modelled receptor locations was then converted to NO_2 using the NO_x to NO_2 calculator[3], in accordance with Defra guidance.

1.5 Model Validation

1.1.16 The ADMS-Roads dispersion model has been validated for road traffic assessments and is considered to be fit for purpose. Model validation undertaken by the software developer (CERC) is unlikely to have included validation in the vicinity of the Scheme considered in this assessment. It is therefore necessary to perform a comparison of model results with local monitoring data at relevant locations.

1.6 Model Verification

1.1.17 The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. A combination of the Scheme-specific 2017 NO_2 diffusion tube monitoring data, and NO_2 diffusion tube monitoring data from GYBC was used in the model verification process. The following are examples of potential sources of uncertainty in air quality dispersal modelling;

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties and emission factor uncertainties;

[3] Version 6.1.

- Model input parameters such as roughness length and minimum Monin-Obukhov length;
- Overall limitations of the dispersion model.

1.1.18 Model verification is a process that facilitates these uncertainties to be investigated and, through appropriate adjustment of the modelled road-NO_x contribution, minimised to improve the consistency of modelling results versus available monitored data. Model adjustment factors for road-NO_x, derived through this process, were applied to all subsequent model scenario outputs.

1.7 Model Precision

1.1.19 Residual uncertainty may remain after systematic error or 'model accuracy' has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the 'precision' of the model predictions, for example how wide the scatter or residual variability of the predicted values compare with the monitored concentration of an air pollutant at a given location, once systematic error has been allowed for. The quantification of model precision provides an estimate of how the final predictions may deviate from monitored pollutant concentrations at the same location over the same period.

1.1.20 A combination of Local Authority air quality monitoring and Scheme-specific air quality monitoring was used for the verification process as presented in Table 1.3 and Appendix 6F.

1.8 Model Performance

1.1.21 An evaluation of model performance has been undertaken to establish confidence in the model results. Defra guidance LAQM.TG (16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty, as summarised in *Table 1.2*.

Table 1.2: Model Performance Statistics

Statistical Parameter	Comments	Ideal Value
Root Mean Square Error (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective for the pollutant being assessed, it is recommended that	0.00

Statistical Parameter	Comments	Ideal Value
	the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40 µg/m^3, if an RMSE of 10 µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification.	
Fractional Bias (FB)	Fractional bias is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00
Correlation Coefficient (CC)	Correlation coefficient is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of one means an absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.	1.00

1.9 Assessment Verification Approach

1.1.22 The verification process involves a review of the modelled pollutant concentrations against corresponding monitoring data to determine how well the air quality model has performed. Depending on the outcome it may be considered that the model has performed adequately and that there is no need to adjust any of the modelled results LAQM.TG (16).

1.1.23 Alternatively, the model may perform outside of the ideal performance limits as stated by LAQM.TG16 (i.e. model agrees within +/-25% of monitored equivalent, but ideally within +/- 10%). There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

1.1.24 Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered as reasonable, then the modelled results require adjustment to best align with the monitoring data. This may either be a single verification adjustment factor to be applied to the modelled concentrations across the Study Area, or a range of different

adjustment factors to account for different zones in the Study Area e.g. major roads, local roads.

1.1.25 The adjustment was applied to the NO_x road source contribution (road-NO_x) and not total NO_2, given that ADMS-Roads was used to predict road-NO_x only. This ensured that any adjustment was applied to road-NO_x prior to being used in the NO_x to NO_2 conversion process.

1.10 Monitoring Data for Verification

1.1.26 The 2017 Scheme-specific NO_2 diffusion tube monitoring results were annualised to the modelled Base Year of 2017 for verification purposes. Annualisation was applied following the method given in Defra LAQM TG(16) guidance and Appendix 6D. The monitoring results used in the verification process are presented in Table 1.6. The GYBC NO_2 diffusion tube monitoring results were a 12-month dataset for 2017 therefore did not require annualisation.

1.1.27 Considering the location of the monitoring sites, roadside and background site status, traffic data network coverage, and data capture 28 Scheme-specific monitoring locations were selected for model verification. Selection of monitoring sites for verification purposes was undertaken by review of each location. There were multiple sites that were not used for verification due to the presence of on street parking which is not resolved in the traffic data, other sites were not used due to the presence of bus stops or construction traffic and roadworks during the monitoring period.

1.11 Initial Model Performance Analysis

1.1.28 An initial comparison of the unadjusted annual mean road NO_x and total annual mean NO_2 concentrations at each suitable monitoring location was undertaken versus the measured equivalent in 2017. A total of 28 monitoring sites with reported annual mean NO_2 data for 2017 were identified within the air quality domain area and were included in the initial comparison. The comparison of unadjusted modelled road-NO_x and total NO_2 with the monitored equivalents is presented in Table 1.3, giving poor model performance. The statistical analysis of the air quality model outputs for annual mean NO_2, before adjustment, is summarised in Table 1.4.

Table 1.3: Summary of Modelled versus Monitored Road-NO_x and Total NO_2 before Model Adjustment – Initial Single Zone

Modelled vs Monitored Criteria (Annual Mean)	No. of locations (Road NO_x)	No. of locations (Total NO_2)
Total Number of Monitoring Locations Included in Model	28	28
Model Under Predicts	28	28
Model Over Predicts	0	0
Model within +/- 10% of Monitored Value	0	0
Model within +/- 25% of Monitored Value	5	0
Model Under Predicts Monitored Value By >25%	23	28
Model Over Predicts Monitored Value By >25%	0	0

Table 1.4: Statistical Analysis of Modelled versus Monitored Total NO_2 before Model adjustment – Initial Single Zone

Area	Root Mean Square Error RMSE Value ($\mu g/m^3$)	As a % of limit value	Fractional Bias (reported to 2 d.p.)	Correlation Coefficient
Whole Domain no adjustment	8.4	21.%	0.33	0.75
Ideal Value	4.0	10%	0.00	1.0

1.1.29 From a review of the unadjusted air quality model outputs, there is an overall tendency for the model to underestimate the monitored road-NO_x and total NO_2 equivalent. The model is shown to under predict, with 28 out of the 28 sites underpredicting monitored road-NO_x and 23 sites underpredicting monitored total NO_2 by less than -25%.

1.1.30 The statistical analysis presented in Table 1.4 was completed for the whole model domain with respect to total annual mean NO_2. The RMSE value for the whole domain is 8.4 $\mu g/m^3$, indicating that the average uncertainty across the whole model is high.

1.1.31 The fractional bias confirms that the model has a systematic tendency to under predict. Use of the correlation coefficient is most appropriate when considering a high number of data points, therefore the whole domain correlation coefficient is the most representative value of the linear

relationship between the modelled and monitored values. The coefficient is 0.75, which indicates that the relationship between the unadjusted model and the monitored data is not linear.

1.1.32 To improve the model performance and reduce uncertainty across the whole domain, adjustment of the model with respect to predicted road NO_x was undertaken with an approach consisting of two zones reflecting different conditions across the model domain.

1.12 Zonal Model Verification and Adjustment

1.1.33 From the outcomes of the statistical analysis of the unadjusted model, as reported in Table 1.4, it was identified that further model adjustment was required to improve performance relative to the monitoring data.

1.1.34 Two model verification adjustment zones (VAZs) were identified based generally on conditions within the Scheme traffic reliability area (TRA) as shown on Figure 6.2, as described in Table 1.5.

Table 1.5: Verification Adjustment Zones

Zone	Description
Zone 1: Junctions	Areas within the urbanised town of Great Yarmouth considered to be influenced by a junction within 50 metres.
Zone 2: Non- Junctions	Areas where receptors do not fall into the category given above. There are areas with minor junctions, for example where traffic data are not provided that have been categorised in the non-junction verification zone using professional judgement based on knowledge of similar schemes, reflecting the conditions of the air quality modelling as determined by the traffic data provided for the assessment.

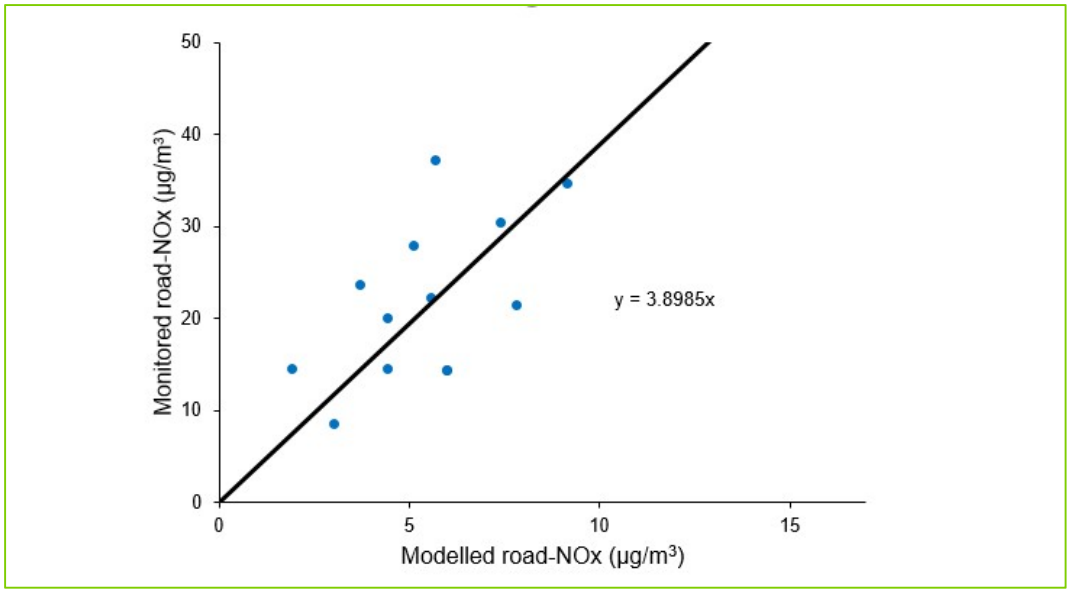
1.1.35 The application of the junction or non-junction status for verification to a specific location/modelled receptor was conducted using geographical information systems (GIS) spatial analysis and the application of professional judgement to reflect the conditions in Great Yarmouth where there are areas of slow moving traffic and short road links close to junctions, and areas of freer flowing traffic (non-junctions). The verification adjustment zones are described in Table 1.5.

1.1.36 The modelled road-NO_x adjustment factors derived from the zonal analyses will be applied to all base and future year modelled road-NO_x values at receptors and/or grid points located within the respective zone.

1.13 Zone 1: Junctions

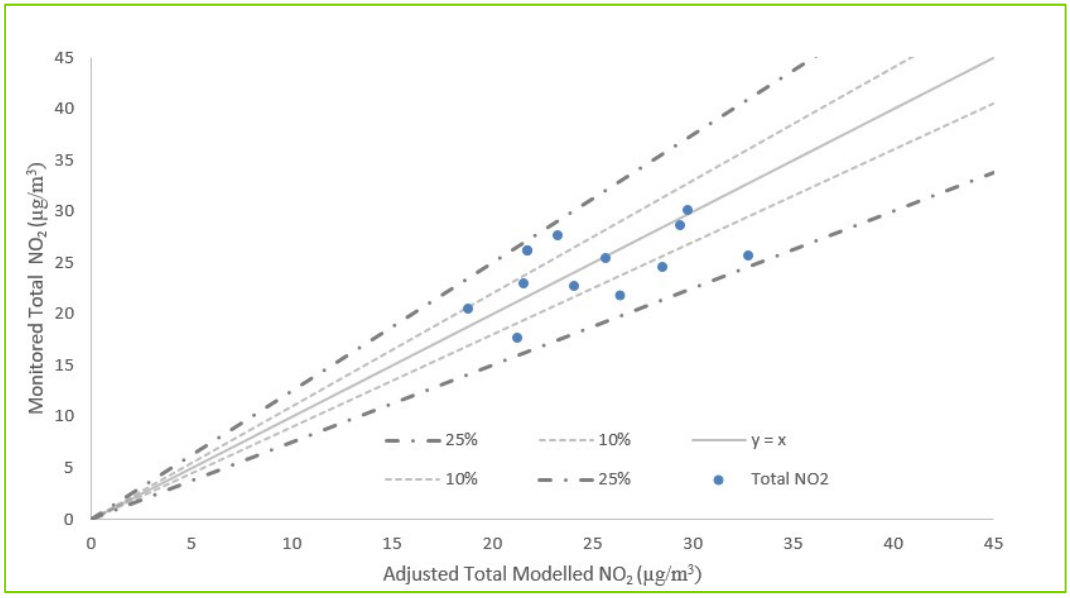
1.1.37 The modelled versus monitored NO_x concentrations are presented in Plate 1.1 and Table 1.6. Data were collected from 13 suitable diffusion monitoring sites in the areas considered to be influenced by junctions. The initial comparison between the predicted concentrations and monitoring data illustrates that the model tends to under predict NO_2 concentrations across the modelled area.

Plate 1.1: Unadjusted Modelled Road NO_x versus Monitored Road NO_x for the Junction VAZ



1.1.38 With the 3.8985 adjustment factor applied to the road-NO_x values, the total adjusted annual mean NO_2 at each location is within +/- 25% of the total monitored equivalent as depicted in Plate 1.4.

Plate 1.2: Total Annual Mean NO_2 (Adjusted) versus Total Annual Mean NO_2 (Unadjusted) Junction VAZ



1.14 Zone 2: Non-Junctions

1.14.1 The modelled versus monitored NO_2 concentrations are presented Plate 1.3 and Table 1.6. The initial comparison between the predicted concentrations and monitoring data illustrates that the model tends to under predict NO_2 concentrations across the modelled area. Data were collected from 15 suitable diffusion monitoring sites in the areas considered to be not influenced by junctions.

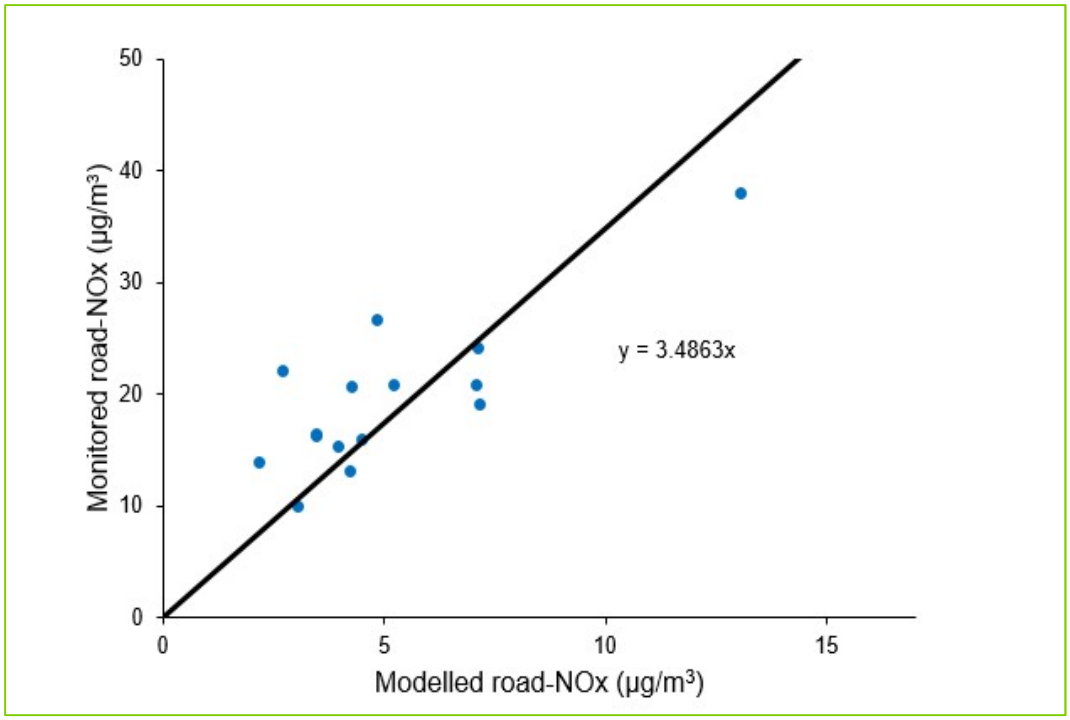


Plate 1.3: Modelled versus Monitored Road NO_x Non-Junction VAZ

1.1.39 With the 3.4863 adjustment factor applied to the road-NOx values, the total adjusted annual mean NO_2 at each location is within +/- 25% of the total monitored equivalent as depicted in Plate 1.4.

Plate 1.4: Total Annual Mean NO_2 (Adjusted) versus Total Annual Mean NO_2 (Unadjusted) Non- Junction VAZ

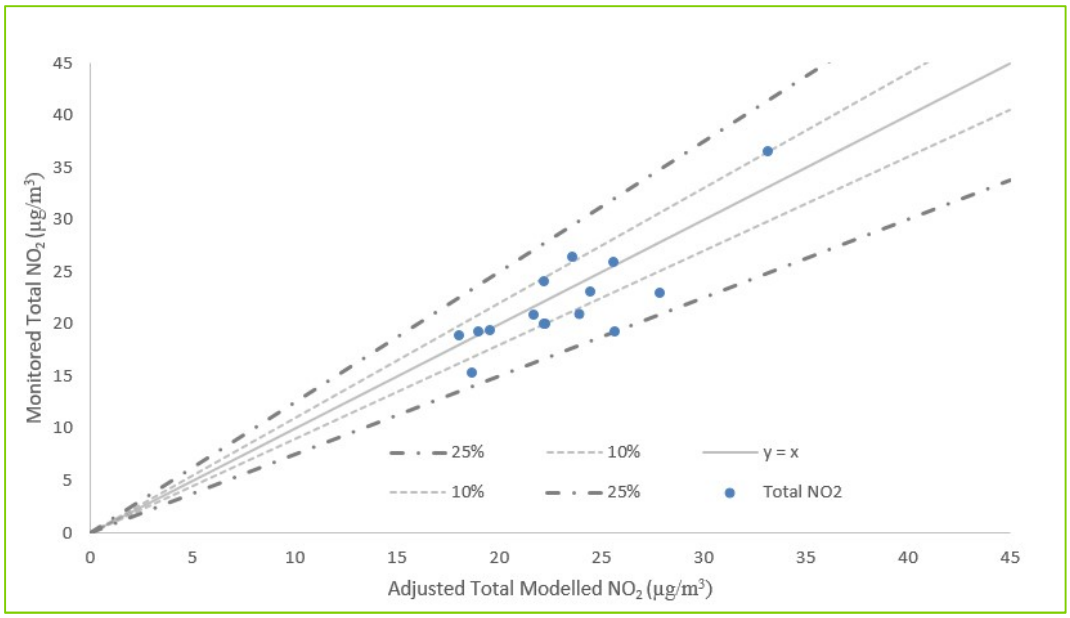


Table 1.6: Summary: Modelled vs Monitored Annual Mean Road NO_x and Total Annual Mean NO_2

Monitoring Sites	Verification Zone	X(m)	Y(m)	Background NO_2	Monitored NO_2	Monitored NO_x (Roads)*	Modelled NO_x (Roads) (no adjustment)	Modelled Total NO_2 (no adjustment)	Road-NO_x Adjustment Factor	Adjusted Modelled NO_x (Road)	Adjusted Total NO_2	Total NO_2 % Change Adj. vs Mon. NO_2
WSP3	Non-Junction	652337.81	308077.09	13.1	23.9	20.7	4.3	15.4	3.4863	14.9	21.0	-12
WSP5	Non-Junction	652840	307991	14.3	25.7	22.2	2.7	15.7		9.4	19.3	-25
WSP11	Non-Junction	652608.81	306228.62	13.7	22.2	16.3	3.5	15.5		12.1	20.0	-10
WSP15	Non-Junction	652368.19	307419	14.3	27.9	26.8	4.8	16.8		16.8	23.0	-18
WSP17	Non-Junction	651529.56	306309.03	11.3	22.2	20.8	7.1	15.1		24.6	24.1	8
WSP22	Non-Junction	651864.06	306967.66	11.3	18.7	13.9	2.2	12.5		7.5	15.4	-18
WSP23	Non-Junction	652227.56	306854.94	13.7	23.6	19.1	7.1	17.5		24.9	26.5	12

Monitoring Sites	Verification Zone	X(m)	Y(m)	Background NO_2	Monitored NO_2	Monitored NO_x (Roads)*	Modelled NO_x (Roads) (no adjustment)	Modelled Total NO_2 (no adjustment)	Road-NO_x Adjustment Factor	Adjusted Modelled NO_x (Road)	Adjusted Total NO_2	Total NO_2 % Change Adj. vs Mon. NO_2
WSP25	Non-Junction	652385.31	306035.97	13.7	24.5	21.0	5.2	16.4		18.1	23.1	-6
WSP34	Non-Junction	651514.25	304698.75	11.1	18.1	13.2	4.2	13.4		14.6	18.9	4
WSP35	Non-Junction	651225.62	304382.84	11.1	19.6	16.1	4.5	13.5		15.6	19.3	-1
GYDT1	Non-Junction	652053	308188	13.1	25.6	24.2	7.1	16.9		24.8	25.9	1
GYDT5	Non-Junction	652520	306862	13.7	21.7	15.3	3.9	15.8		13.7	20.9	-4
GYDT6	Non-Junction	652569	306537	13.7	22.3	16.5	3.4	15.5		12.0	20.0	-10
GYDT7	Non-Junction	652611	306223	13.7	19.0	10.1	3.0	15.3		10.5	19.2	1
GYDT10	Non-Junction	652326	307376	14.3	33.2	38.1	13.0	21.1		45.5	36.5	10

Monitoring Sites	Verification Zone	X(m)	Y(m)	Background NO_2	Monitored NO_2	Monitored NO_x (Roads)*	Modelled NO_x (Roads) (no adjustment)	Modelled Total NO_2 (no adjustment)	Road-NO_x Adjustment Factor	Adjusted Modelled NO_x (Road)	Adjusted Total NO_2	Total NO_2 % Change Adj. vs Mon. NO_2
WSP6	Junction	652847.69	307378.09	14.3	26.4	23.7	3.7	16.3	3.8985	14.4	21.8	-17
WSP9	Junction	652766.94	306046.5	13.7	21.3	14.6	1.9	14.7		7.4	17.6	-17
WSP12	Junction	652468.19	307087.25	14.3	32.8	37.2	5.7	17.3		22.1	25.6	-22
WSP13	Junction	652459	307304	14.3	28.5	28.0	5.1	17		19.9	24.6	-14
WSP14	Junction	652176.69	307613.88	14.3	25.7	22.2	5.5	17.2		21.6	25.4	-1
WSP24	Junction	652373.56	306227.66	13.7	24.1	20.1	4.4	16.0		17.2	22.7	-6
WSP28	Junction	652406	305817.78	14.0	29.4	30.5	7.4	17.9		28.8	28.6	-3
WSP30	Junction	652309.25	305187.97	14.0	21.6	14.6	4.4	16.3		17.3	23.0	6
WSP32	Junction	652071.69	304946.81	12.2	29.8	34.8	9.1	17.1		35.5	30.2	1
GYDT3a	Junction	652104	307665	14.3	21.8	14.4	6.0	17.5		23.3	26.2	20
GYDT3b	Junction	652104	307665	14.3	21.8	14.4	6.0	17.5		23.3	26.2	20
GYDT9	Junction	652066	307874	14.3	18.8	8.6	3	15.9		11.8	20.5	9
GYDT12	Junction	651993	307370	12.1	23.3	21.5	7.8	16.		30.5	27.7	19

* Diffusion Tube monitored road-NO_x derived using NO_2-NO_x calculator.

1.15 Summary

1.1.40 The summary results and model performance statistics, as defined LAQM TG(16), are provided in Table 1.7.

1.1.41 A comparison of the performance of the modelled concentrations from the air quality model against the monitoring data was undertaken. The results show that the verification performance for each individual VAZ is satisfactory. The model performance statistics show that the uncertainty in the predictions of adjusted total NO_2 was acceptable for the Non-Junction Zone as the RMSE is less than 4µg/m^3. The Junction Zone has an RMSE below 4µg/m^3, however 1 of the 13 locations is above +/- 25% of the monitoring equivalent. The adjusted model is considered to be performing suitably with respect to NO_2 levels in proximity to junctions.

1.1.42 The fractional bias values derived for each zone are very close to the ideal value of zero, indicating that the adjusted model does not tend to over or under predict when compared to the monitored equivalents.

1.1.43 In terms of the model domain correlation coefficient, based on comparing all adjusted total NO_2 values with the monitored equivalents, a CC of 0.83 for the non-junction VAZ indicates a strong positive linear relationship within the context of the geographical extent of the domain, the spread of monitoring locations with respect to distances from the modelled road sources, and model input variables. The junction zone with a CC of 0.54 shows a moderate positive relationship.

1.1.44 The statistical analysis of the adjusted model performance and uncertainty demonstrates that the atmospheric dispersion model is robust and representative for the prediction of annual mean road-NO_x concentrations at identified receptor locations throughout the domain.

1.1.45 The road-NO_x adjustment factors derived through the model verification process were applied to each subsequent model scenario outputs to calculate the respective road-NO_x at each identified sensitive receptor location.

1.1.46 The road-NO_x model adjustment factors were applied to derive the road-PM_{10} and road-$PM_{2.5}$ concentrations at each receptor in the absence of local and Scheme-specific PM_{10} and $PM_{2.5}$ monitoring data.

Table 1.7: Summary of Modelled versus Monitored road-NO_x and Total NO_2 after Model Adjustment –Two Verification Adjustment Zones

Modelled vs Monitored Criteria (Annual Mean)	No. of locations (Unadjusted Road NO_x)*	No. of locations (Total NO_2)
Total number of monitoring locations included in model	28	28
Model UNDER PREDICTS	28	16
Model OVER PREDICTS	0	12
Model within +/- 10% of monitored value	0	0
Model within +/- 25% of monitored value	5	27
Model UNDER PREDICTS monitored value by >25%	23	1
Model OVER PREDICTS monitored value by >25%	0	0

** unadjusted.*

Table 1.8: VAZ Model Performance Statistics

VAZ	No. of Monitoring Sites	No. sites within +/- 25%	Root Mean Square Error*		Fractional Bias	Correl. Coeff.
			µg/m^3	% of Objective		
Non-Junction	15	14	2.9	7.1	0.04	0.83
Junction	13	13	3.6	9.0	0.02	0.54

**LAQM TG(16) state that "…Ideally and RMSE within 10% of the air quality Objective would be derived, which equates to 4µg/m^3 for the annual average NO_2 objective."*

Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6D: Compliance Risk Assessment

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

APFP regulation Number: 5(2)(a)

Planning Inspectorate Reference Number: TR010043

Author: Norfolk County Council

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Tables

1 Compliance Risk Assessment

1.1 DEFRA Pollution Climate Mapping

1.1.1 The Scheme Study Area for the traffic related air quality assessment incorporates road links included in Defra's Pollution Climate Mapping (PCM) model, which is a national-scale model designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of particular pollutants in the atmosphere, including annual mean NO_2.

1.1.2 The EU Directive on ambient air quality (2008/50/EC) sets out a range of mandatory Limit Values (LVs) for different pollutants including nitrogen dioxide (NO_2) and particulate matter less than 10 microns in aerodynamic diameter (PM_{10}).

Table 1.1 Limit Values for NO_2 and PM_{10}

Pollutant	Air Quality Limit Value	Measured As
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a calendar year	1-hour mean
	40 µg/m^3	Annual mean
Particles (PM_{10}) (gravimetric)	50 µg/m^3 not to be exceeded more than 35 times a calendar year	Daily mean
	40 µg/m^3	Annual mean

1.1.3 Defra assesses and reports the status of UK air quality on an annual basis to the European Commission. For the assessment, the UK is split up into 43 zones. Of the 43 zones, only six zones were compliant with the NO_2 annual mean LV in 2017 (Ref 6.12).

1.1.4 To assess the status of UK air quality, Defra run a Pollution Climate Mapping (PCM) model for each pollutant within the EU Air Quality Directive for the base year and future projections. The PCM provides outputs at 1 x 1 km grid of the UK for background concentrations and at approximately 9,000 roadside locations.

1.1.5 Following a High Court ruling in November 2016 on Defra's national air quality plan – targeted at reducing concentrations of NO_2 within towns and cities – the proceedings concluded that the PCM model produced by Defra was over optimistic, requiring a revision to both the model and the timetable for achieving compliance with the EU annual mean limit value for NO_2. The latest updated PCM projections for concentrations of NO_2 and NO_x across

the UK in the years 2017 – 2030 were published by Defra in September 2017 (Ref 6.13).

1.2 The Compliance Risk Assessment

1.2.1 The compliance risk assessment has been completed in accordance with Interim Advice Note (IAN) 175/13 (Ref 6.6) as an update to DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07). The IAN is used to undertake and report the risk of a scheme being non-compliant with the EU Air Quality Directive (2008/50/EC). A new version of IAN 175/13 is pending from Highways England, in the absence of updated guidance the original 2013 guidance has been applied.

1.2.2 The compliance risk assessment looks at the maximum measured concentration along a section of road as well as the maximum change in concentration as a result of the Scheme, and compares these values with the PCM model.

Data Requirements

1.2.3 To complete the assessment the following data was required:

- Defra's modelled road network from their EU Directive submission, including PCM modelled links and concentrations for the latest reported year and reference years;
- Defra's zone maps; and
- Outputs from the Local Air Quality Assessment for the Scheme.

Identifying the Compliance Risk Road Network

1.2.4 The road network used was defined by overlaying the affected road network as defined by DMRB HA207/07, as explained in Section 6.4 with the road network from the PCM model. Where the two road networks intersect throughout the Study Area, this subset of links becomes the Study Area for the Compliance Risk Road Network (CRRN). If no links intersect, then the assessment can be screened out.

1.2.5 The roads that comprise the CRRN were overlaid on a map of the 43 UK zones as defined by Defra. The zone reference and current status (compliant or non-compliant) of the zone were established for each link.

Calculating the Opening Year Total No_2 Concentrations from DEFRA's PCM Model

1.2.6 Defra provides an update of the UK's air quality status on an annual basis. Defra also provides projections for a number of reference years. The total predicted NO_2 concentration is available for each PCM road link.

1.2.7 Where the Scheme opening year coincides with a reference year, then the NO_2 concentration from the PCM model can be used directly. Where the Scheme opening year falls outside a reference year, then the equivalent opening year concentrations need to be calculated, for this Scheme the reference years provided by Defra have been used, calculation of an equivalent opening year was not required.

Calculating the Equivalent Scheme NO_2 Concentration Consistent with the PCM Model

1.2.8 As the CRRN intersects the DMRB affected road network, sensitive receptors within 200m of each link have been identified in the Local Air Quality Assessment. Modelled results will therefore be available which show the impact of the Scheme, i.e. the changes in annual mean NO_2 concentrations at each receptor between the Do-Minimum and the Do-Something scenarios in the opening year.

1.2.9 Receptors with the largest change in annual mean NO_2 concentration as a result of the Scheme (both positive and negative) located within 200m of each of the road links in the CRRN were selected. The equivalent Scheme NO_2 was then calculated by taking the equivalent PCM opening year concentration (as calculated above) and adding the largest change in modelled concentrations.

1.2.10 Steps 1-3 below outline the approach followed for each CRRN link identified to calculate the equivalent Scheme NO_2 concentration;

- **Step One**: Calculate the equivalent Scheme PCM NO_2 concentration for each of the links in the CRRN.
- **Step Two**: For those road links where the equivalent opening year PCM or the equivalent Scheme PCM modelled total NO_2 concentrations are greater than the LV (40 $\mu g/m^3$), then for each road link record the change in concentrations.
- For those road links where NO_2 concentrations are less than 40 $\mu g/m^3$, but the outcomes of the local air quality assessment predict increases in NO_2 concentrations, also record these road links where the there is a risk of creating a new exceedance of the LV. For example, where the air

quality assessment indicates a change of +3µg/m^3, but the PCM model concentration is 25µg/m^3 then this link does not need to be included.

- **Step Three**: If the change in NO_2 concentrations is less than 0.4µg/m^3, then those roads can be scoped out of the compliance risk assessment, as the changes are considered to be imperceptible.

Determining the Scheme's Compliance Risk Rating

1.2.11 To determine whether the Scheme is at risk of causing non-compliance, for each road within the CRRN, it was determined whether the change in NO_2 concentrations would result in:

- A compliant zone becoming non-compliant; and / or
- Delay Defra's date for achieving compliance for that zone; and / or
- An increase in the length of roads in exceedance in the zone which would be greater than 1% when compared with the previous total length; and / or
- An overall increase, decrease or no change in NO_2 concentrations Compliance Risk Assessment Output.

Compliance Risk Road Network

1.2.12 There is a total of 41 PCM road links that intersect the DMRB local air quality affected road network. They comprise sections of five major and trunk A-Roads as detailed in Table 1.2.

1.2.13 Base 2017 data obtained from Defra's PCM model indicated that none of the 41 PCM links are currently non-compliant with the European Commissions' Limit Value for annual mean NO_2. The highest recorded concentration of 33.4 µg/m^3 is recorded for PCM link 38421, incorporating the existing crossing over the River Yare at the Breydon Bridge to the North of the Scheme. Details of all Base 2017 concentrations can be found in Table 1.2.

1.2.14 A map showing the CRRN transposed on top of the DMRB local affected road network is presented in Figure 6.20.

Table 1.2 Detail of PCM Links within the Identified Compliance Risk Road Network

Road Name	Defra Census ID	Zone Name	Zone ID	Base 2017 Road NO2 (µg/m^3)*
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5

Road Name	Defra Census ID	Zone Name	Zone ID	Base 2017 Road NO2 (µg/m^3)*
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A143	16669	Eastern	UK0029	15.5
A12	29011	Eastern	UK0029	31.8
A12	29011	Eastern	UK0029	31.8
A12	29011	Eastern	UK0029	31.8
A12	29011	Eastern	UK0029	31.8
A12	29011	Eastern	UK0029	31.8
A12	29011	Eastern	UK0029	31.8
A12	38421	Eastern	UK0029	33.4
A12	38421	Eastern	UK0029	33.4
A12	38421	Eastern	UK0029	33.4
A12	38421	Eastern	UK0029	33.4
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A149	48266	Eastern	UK0029	26.6
A1243	57026	Eastern	UK0029	19.3
A1243	57026	Eastern	UK0029	19.3
A1243	57026	Eastern	UK0029	19.3
A1243	57026	Eastern	UK0029	19.3
A1243	57026	Eastern	UK0029	19.3

Road Name	Defra Census ID	Zone Name	Zone ID	Base 2017 Road NO2 (µg/m^3)*
A1243	57026	Eastern	UK0029	19.3
A143	77159	Eastern	UK0029	18.7
A143	77159	Eastern	UK0029	18.7
A143	77159	Eastern	UK0029	18.7
A143	77159	Eastern	UK0029	18.7
A143	77159	Eastern	UK0029	18.7
A143	77159	Eastern	UK0029	18.7
*Values rounded to 1 d.p.				

Equivalent Scheme NO_2 Concentrations

1.2.15 Equivalent opening year (2023) NO_2 concentrations for each PCM link within the CRRN and are detailed in Table 1.3. The concentrations show that all links are compliant with the European Commission's LV for annual mean NO_2, with a highest predicted concentration of 25.5 µg/m^3.

1.2.16 Sensitive receptors within 200m of each CRRN link were identified and in each instance the worst-case receptor was selected. The change in NO_2 concentrations at the worst-case receptor has been added to the relative PCM Equivalent Opening Year concentration in order to calculate the PCM Equivalent Scheme concentration. Details of the calculations can be found in Table 1.3.

1.2.17 Of the 41 PCM links identified which intersect the local model, 30 have a sensitive receptor within the local air quality model upon which the compliance assessment can be made. None of the 30 PCM Equivalent Scheme NO_2 concentrations are in exceedance of the annual mean LV. Furthermore, the largest predicted increase in annual mean NO_2 concentrations as a result of the Scheme coming into operation is 1.1 µg/m^3. Even when applying this concentration to each Equivalent Opening Year concentration, no link in the CRRN will become non-compliant as a result of the Scheme coming into operation.

1.2.18 As such, the Scheme is considered to be at Low Risk of causing noncompliance.

1.2.19 A summary of the compliance risk assessment outputs is provided in Table 1.4.

Table 1.3 Compliance Risk Assessment Equivalent Opening Year and Equivalent Scheme PCM Concentrations

Inputs				Defra PCM Model and Compliance Information					Receptor Result				
Scheme	Defra's PCM Data			Total NO_2 ($\mu g/m^3$)			Compliance Info		Annual Mean NO_2 Concentration ($\mu g/m^3$)				
				Proceeding Year	Following Year	Opening Year							
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	NO_2 (2022)	NO_2 (2023)	NO_2 (2023)	Max Zone NO_2 Concentrations	Projected Compliance Year	Receptor ID	DM	DS	Change (DS-DM)	Equivalent Scheme PCM
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	25161	17.2	18.3	1.1	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	41131	16.8	17.7	0.9	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	11119	15.7	16.5	0.8	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	10578	18.1	19.1	1.0	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	1783	24.4	25	0.6	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	34298	18.4	19	0.6	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	35893	16.6	17.1	0.5	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	23925	14.2	14.5	0.3	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	2104	13.4	13.8	0.4	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	718	12.4	12.6	0.2	<40
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	20265	12.9	13.3	0.4	<40

Inputs				Defra PCM Model and Compliance Information					Receptor Result				
Scheme	Defra's PCM Data			Total NO_2 ($\mu g/m^3$)			Compliance Info		Annual Mean NO_2 Concentration ($\mu g/m^3$)				
				Proceeding Year	Following Year	Opening Year							
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	NO_2 (2022)	NO_2 (2023)	NO_2 (2023)	Max Zone NO_2 Concentrations	Projected Compliance Year	Receptor ID	DM	DS	Change (DS-DM)	Equivalent Scheme PCM
A143	16669	UK0029	Yes	13.2	12.7	12.7	57.4	2023	18917	13.3	13.7	0.4	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	33734	15.5	14.6	-0.9	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	40648	21.8	22.2	0.4	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	31124	21.4	21.7	0.3	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	34298	18.4	19	0.6	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	34298	18.4	19	0.6	<40
A12	29011	UK0029	Yes	25.6	24.5	24.5	57.4	2023	34298	18.4	19	0.6	<40
A12	38421	UK0029	Yes	25.6	25.5	25.5	57.4	2023	372	13.7	13.4	-0.3	<40
A12	38421	UK0029	Yes	25.6	25.5	25.5	57.4	2023	33711	18.6	17.8	-0.8	<40
A12	38421	UK0029	Yes	25.6	25.5	25.5	57.4	2023	27205	12.3	12	-0.3	<40
A149	48266	UK0029	Yes	22.1	21.1	21.1	57.4	2023	4210	18.8	17.5	-1.3	<40
A149	48266	UK0029	Yes	22.1	21.1	21.1	57.4	2023	20023	21	20.6	-0.4	<40

Inputs				Defra PCM Model and Compliance Information					Receptor Result				
Scheme	Defra's PCM Data			Total NO_2 ($\mu g/m^3$)			Compliance Info		Annual Mean NO_2 Concentration ($\mu g/m^3$)				
				Proceeding Year	Following Year	Opening Year							
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	NO_2 (2022)	NO_2 (2023)	NO_2 (2023)	Max Zone NO_2 Concentrations	Projected Compliance Year	Receptor ID	DM	DS	Change (DS-DM)	Equivalent Scheme PCM
A149	48266	UK0029	Yes	22.1	21.1	21.1	57.4	2023	20023	21	20.6	-0.4	<40
A149	48266	UK0029	Yes	22.1	21.1	21.1	57.4	2023	20657	21.2	19.5	-1.7	<40
A1243	57026	UK0029	Yes	15.9	15.2	15.2	57.4	2023	32519	13.5	12.5	-1.0	<40
A1243	57026	UK0029	Yes	15.9	15.2	15.2	57.4	2023	27370	16.9	15.4	-1.5	<40
A143	77159	UK0029	Yes	14.6	13.9	13.9	57.4	2023	19953	12.9	13.2	0.3	<40
A143	77159	UK0029	Yes	14.6	13.9	13.9	57.4	2023	31372	15.5	15.9	0.4	<40
A143	77159	UK0029	Yes	14.6	13.9	13.9	57.4	2023	8752	15.2	15.5	0.3	<40

Table 1.4 Compliance Risk Assessment Outcome

Inputs Scheme	Defra PCM Data			Compliance Descriptors					Outcome
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	Change >1% of LV (0.4 µg/m^3)	Will Compliant Zone Become Non-compliant?	Delay Defra Compliance?	Change in Road Length that Currently Exceeds LV?	Does the Scheme Worsen Air Quality Overall?	Compliance Risk Rating (Low/Neutral/High)
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low
A143	16669	UK0029	Yes	No	No	No	No	Yes	Low

Inputs Scheme	Defra PCM Data			Compliance Descriptors					Outcome
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	Change >1% of LV (0.4 µg/m^3)	Will Compliant Zone Become Non-compliant?	Delay Defra Compliance?	Change in Road Length that Currently Exceeds LV?	Does the Scheme Worsen Air Quality Overall?	Compliance Risk Rating (Low/Neutral/High)
A12	29011	UK0029	Yes	No	No	No	No	No	Low
A12	29011	UK0029	Yes	No	No	No	No	Yes	Low
A12	29011	UK0029	Yes	No	No	No	No	Yes	Low
A12	29011	UK0029	Yes	No	No	No	No	Yes	Low
A12	29011	UK0029	Yes	No	No	No	No	Yes	Low
A12	29011	UK0029	Yes	No	No	No	No	Yes	Low
A12	38421	UK0029	Yes	No	No	No	No	No	Low
A12	38421	UK0029	Yes	No	No	No	No	No	Low
A12	38421	UK0029	Yes	No	No	No	No	No	Low
A149	48266	UK0029	Yes	No	No	No	No	No	Low
A149	48266	UK0029	Yes	No	No	No	No	No	Low
A149	48266	UK0029	Yes	No	No	No	No	No	Low
A149	48266	UK0029	Yes	No	No	No	No	No	Low

Inputs Scheme	Defra PCM Data			Compliance Descriptors					Outcome
Road Name	Defra Link Census ID	Zone Ref No.	Is it a Compliant Zone?	Change >1% of LV (0.4 µg/m^3)	Will Compliant Zone Become Non-compliant?	Delay Defra Compliance?	Change in Road Length that Currently Exceeds LV?	Does the Scheme Worsen Air Quality Overall?	Compliance Risk Rating (Low/Neutral/High)
A1243	57026	UK0029	Yes	No	No	No	No	No	Low
A1243	57026	UK0029	Yes	No	No	No	No	No	Low
A143	77159	UK0029	Yes	No	No	No	No	Yes	Low
A143	77159	UK0029	Yes	No	No	No	No	Yes	Low
A143	77159	UK0029	Yes	No	No	No	No	Yes	Low

Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6E: Scheme-Specific Air Quality Monitoring

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

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Planning Inspectorate Reference Number: TR010043

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1 Scheme-Specific Air Quality Monitoring

1.1 Introduction

1.1.1 A Scheme-specific programme of NO_2 diffusion tube monitoring was undertaken for five months to establish the baseline condition and for model verification purposes. The monitoring started in August 2017 and ended in January 2018.

1.2 Monitoring Locations

1.2.1 A total of 40 sites were selected for diffusion tube monitoring. Details of the site locations are provided in Table 1.1 and the monitoring results are presented in Table 1.2.

1.3 Bias Adjustment

1.3.1 Monitoring of NO_2 using diffusion tubes is demonstrated to have a degree of uncertainty of +/- 25% when compared to automatic ambient monitoring data (Ref 6.9), known as systematic bias. However, diffusion tubes are a low-cost method of monitoring suitable to give an indication of average NO_2 concentrations and can be deployed at many locations over a wide area.

1.3.2 A bias adjustment factor, which can be derived using local or national data, is applied to the diffusion tube results to adjust for any systematic bias. Detailed guidance on bias correction for NO_2 diffusion tubes is given in LAQM TG(16) (Ref 6.5).

1.3.3 To facilitate local bias adjustment, the guidance recommends that co-located diffusion tubes are sited at the inlet of a continuous analyser for each month of the monitoring programme. The closest continuous analyser to the monitoring area is the Norwich Lakenfields urban background continuous analyser, which is managed by Defra as part of the Automatic Urban and Rural Network (AURN). The AURN is the main network of air quality monitoring stations used by Defra for compliance reporting against the Ambient Air Quality Directives (Ref 6.10).

1.3.4 The Bias Adjustment Factor obtained from the colocation of diffusion tubes with the Norwich Lakenfields continuous analyser was 0.77 as calculated in the AEA precisions and accuracy spreadsheet downloaded from the Defra website.

1.3.5 Annualisation was undertaken following the procedure given in TG(16) Box 7.9. AURN sites situated within 50 miles of the diffusion tube NO_2 monitoring

locations are considered ideal where the data capture is at least 85% for the appropriate year of measurement. The locations given below represent the most suitable continuous analyser locations within 50 miles with adequate data capture. A factor of 1.04 was calculated using 2017 data from the following continuous analysers;

- Cambridge Roadside AURN
- Norwich Lakenfields AURN
- Wicken Fen AURN

1.4 Monitoring Results

1.4.1 The bias adjusted and annualised results show that 2017 NO_2 annual mean concentrations ranged from 10.7 µg/m^3 to 32.8 µg/m^3. The monitoring has not identified an exceedance of the annual mean NO_2 objective of 40 µg/m^3 at any of the monitoring locations, all of which included triplicate tube sampling. The highest annual mean concentration of NO_2 was identified at location WSP12 on South Quay Great Yarmouth.

Table 1.1: Scheme-Specific NO_2 Diffusion Tube Monitoring Location Site Details

Site ID	Description	X	Y	Height (m)	Type
WSP1	Runham Rd	651935	308536	2.4	Roadside
WSP2	School Rd	651964	308314	2.4	Roadside
WSP3	Northgate Street	652340	308077	2.6	Roadside
WSP4	Priory Gardens	652491	307941	2.6	Urban Background
WSP5	Nelson Rd N Jury St	652842	307991	2.8	Urban Background
WSP6	Nelson Rd N Trafalgar St	652850	307378	2.7	Roadside
WSP7	Nelson Rd N St Peters Rd	652873	307074	2.5	Roadside
WSP8	Queens Rd	652756	306572	2.5	Roadside
WSP9	Admiralty Rd	652769	306047	2.6	Roadside
WSP10	Sutton Rd	652658	306040	2.5	Roadside
WSP11	Southgates Rd	652611	306229	2.6	Roadside
WSP12	S Quay Nottingham Way	652468	307090	2.5	Roadside
WSP13	Yarmouth Way	652459	307304	2.5	Roadside

Site ID	Description	X	Y	Height (m)	Type
WSP14	Stonecutters Way	652178	307619	2.5	Roadside
WSP15	Greyfriars Way	652371	307422	2.6	Urban Background
WSP16	Trafalgar College Thamesfield Way	651732	306714	2.5	Roadside
WSP17	Gapton Hall Rd	651531	306309	2.5	Roadside
WSP18	Vincent Close	651517	307179	2.6	Urban Background
WSP19	Mill Rd	651627	307643	2.5	Urban Background
WSP20	Mill Rd jnc. Bridge Rd	652016	307412	2.6	Roadside
WSP21	Southtown Rd	652042	307298	2.6	Roadside
WSP22	Station Rd	651865	306968	2.8	Roadside
WSP23	Southtown Rd 2	652231	306856	2.5	Roadside
WSP24	Boundary Rd	652373	306231	2.6	Roadside
WSP25	Cromwell Rd	652386	306036	2.5	Roadside
WSP26	Queen Anne's Rd	652360	305868	2.8	Roadside
WSP27	Queen Anne's Rd 2	652166	305970	2.8	Roadside
WSP28	Southtown Rd 3	652408	305818	2.7	Roadside
WSP29	Manby Rd	652404	305357	2.8	Roadside
WSP30	Burgh Rd	652309	305188	2.7	Roadside
WSP31	Alpha Rd	652396	305674	2.8	Roadside
WSP32	A143	652071	304949	2.8	Roadside
WSP33	Plane Rd	651959	304891	2.8	Roadside
WSP34	Lynn Grove	651514	304700	2.6	Roadside
WSP35	Beccles Rd	651224	304384	2.7	Roadside
WSP36	Baliol Rd	652306	304368	2.6	Roadside
WSP37	Middleton Rd	652270	303862	2.8	Roadside
WSP38	Brasnose Avenue	652278	302742	2.8	Roadside
WSP39	Horsley Drive	651967	301967	2.3	Roadside
WSP40	Cormorant Way	650866	305188	2.8	Roadside

Table 1.2: Monitored Annual Mean NO_2 Concentrations

Site ID	P1 (µg/m^3)	P2 (µg/m^3)	P3 (µg/m^3)	P4 (µg/m^3)	P5 (µg/m^3)	Bias Adjusted* Period Average Concentration (µg/m^3)	2017 Annualised** Concentration (µg/m^3)
WSP1	34.0	24.7	37.1	36.5	33.6	25.6	26.6
WSP2	24.7	25.4	29.6	38.4	30.6	22.9	23.8
WSP3	27.7	25.9	27.2	36.5	31.8	23.0	23.9
WSP4	21.7	20.9	26.2	32.7	25.2	19.5	20.3
WSP5	28.9	29.0	32.4	40.1	30.1	24.7	25.7
WSP6	26.4	27.0	31.5	43.6	35.9	25.3	26.4
WSP7	32.6	34.2	36.2	47.3	41.8	29.6	30.8
WSP8	23.0	19.2	27.7	40.0	29.0	21.4	22.3
WSP9	22.1	23.5	27.9	34.1	25.3	20.5	21.3
WSP10	23.6	26.1	No data	37.2	No Data	22.3	23.2
WSP11	25.5	26.1	27.6	33.8	25.3	21.3	22.2
WSP12	34.1	38.9	45.2	47.3	38.7	31.5	32.8
WSP13	30.0	33.1	33.8	43.6	37.2	27.4	28.5
WSP14	32.1	29.9	31.6	34.9	31.7	24.7	25.7

Site ID	P1 (µg/m^3)	P2 (µg/m^3)	P3 (µg/m^3)	P4 (µg/m^3)	P5 (µg/m^3)	Bias Adjusted* Period Average Concentration (µg/m^3)	2017 Annualised** Concentration (µg/m^3)
WSP15	27.4	30.0	35.4	43.3	37.6	26.8	27.9
WSP16	28.3	No Data	32.0	42.3	28.0	25.1	26.2
WSP17	26.3	25.5	24.7	32.5	29.2	21.3	22.2
WSP18	23.6	23.8	No Data	35.9	32.3	22.3	23.2
WSP19	15.9	14.7	17.7	22.6	19.6	13.9	14.5
WSP20	35.2	32.8	35.4	36.0	No data	21.5	22.4
WSP21	30.7	28.7	No Data	No data	32.5	17.7	18.4
WSP22	19.1	18.3	23.2	28.3	27.7	17.9	18.7
WSP23	25.4	27.4	28.3	36.3	29.6	22.7	23.6
WSP24	27.3	27.0	29.9	32.1	33.7	23.1	24.1
WSP25	29.6	23.4	30.0	36.7	33.1	23.5	24.5
WSP26	20.3	24.7	22.5	30.0	No Data	18.8	19.6
WSP27	18.6	25.0	30.0	38.2	No Data	21.5	22.4
WSP28	34.0	34.1	34.0	43.3	38.0	28.2	29.4
WSP29	23.4	No Data	26.8	32.4	26.3	21.0	21.8

Site ID	P1 (µg/m^3)	P2 (µg/m^3)	P3 (µg/m^3)	P4 (µg/m^3)	P5 (µg/m^3)	Bias Adjusted* Period Average Concentration (µg/m^3)	2017 Annualised** Concentration (µg/m^3)
WSP30	24.5	26.2	27.4	30.9	25.9	20.8	21.6
WSP31	23.0	20.3	21.3	29.0	22.8	17.9	18.7
WSP32	32.9	35.9	33.7	47.5	36.1	28.6	29.8
WSP33	16.7	18.6	19.0	24.4	22.2	15.5	16.2
WSP34	0.0	23.2	25.8	34.9	29.1	17.4	18.1
WSP35	20.5	21.1	23.7	28.5	28.1	18.8	19.6
WSP36	16.4	19.3	20.9	0.0	19.1	11.7	12.1
WSP37	19.5	19.6	20.9	25.8	27.9	17.5	18.2
WSP38	27.8	26.0	31.6	33.7	16.0	20.8	21.7
WSP39	16.3	15.0	15.0	20.3	0.0	10.3	10.7
WSP40	16.2	15.3	18.4	23.9	21.9	14.8	15.4

*Bias Adjustment Factor 0.77.
** Annualisation Factor 1.04.

Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6F: Wind Rose

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The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ("APFP")

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1 Wind Rose

1.1 Wind Rose 2017 Weybourne Meteorological Data

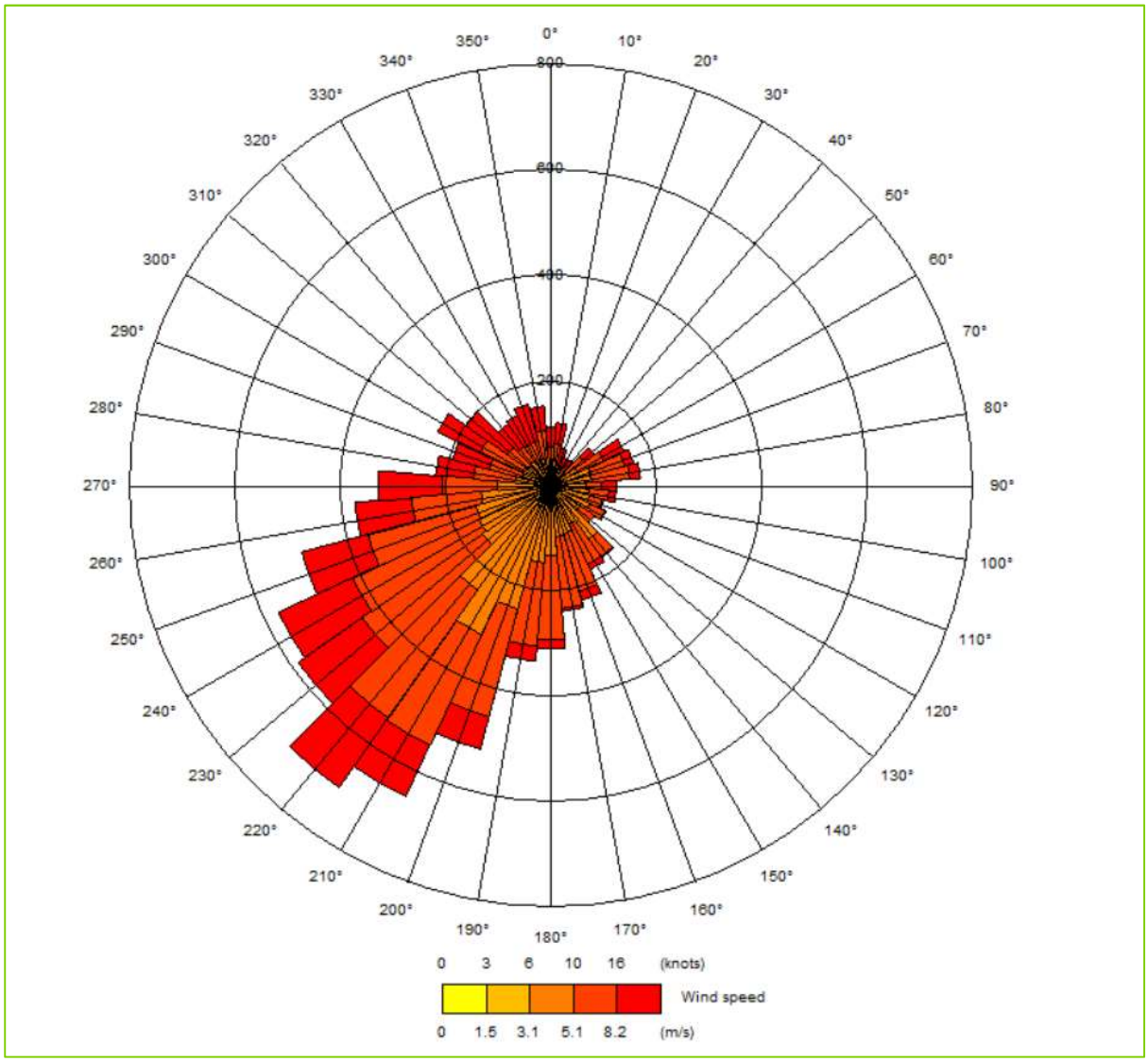

Plate 1.1: 2017 Weybourne Wind Rose

Great Yarmouth Third River Crossing

Application for Development Consent Order

Document 6.2: Environmental Statement Volume II: Technical Appendix 6G: Ecological Assessment Detailed Results and Impacts

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1 Ecological Assessment Detailed Results and Impacts

1.1 Breydon Water SSSI/SPA/Ramsar

Assessment of Ambient NO_x Concentrations

1.1.1 The NO_x concentrations for transect points modelled at 10m intervals from the nearest modelled road (the A47) and across the Breydon Water Site of Special Scientific Interest (SSSI)/Special Protection Area (SPA)/Ramsar are presented in Table 1.1. Air quality dispersal modelling for NO_x showed no change in NO_x concentrations between the Do Minimum and Do Something scenarios up to a distance of 155m from the nearest modelled road.

1.1.2 Modelling does not indicate an increase in NO_x concentrations at the Breydon Water SSSI/SPA/Ramsar as a result of the Scheme. The annual mean objective for NO_x (30µg/m^3), established for the protection of vegetation and ecosystems, is not exceeded. Therefore, as specified in the DMRB guidance, no further assessment of ecological impacts at the Breydon Water SSSI/SPA/Ramsar as a result of changes in NO_x concentrations is required.

1.1.3 The location of the modelled transects for Breydon Water SSSI/SPA/ Ramsar is presented in Plate 1.1. The coverage of the traffic model Traffic Reliability Area which is based upon the area over which changes in traffic should be considered where the changes in traffic are potentially in exceedance of the criteria set out in the DMRB as given in Chapter 6 Section 6.4, and therefore qualify as part of the LARN, did not extend for the entirety of the perimeter of Breydon Water, however coverage was sufficient to make an assessment for the NO_x and nitrogen sensitive neutral grassland habitat in SSSI Unit 10.

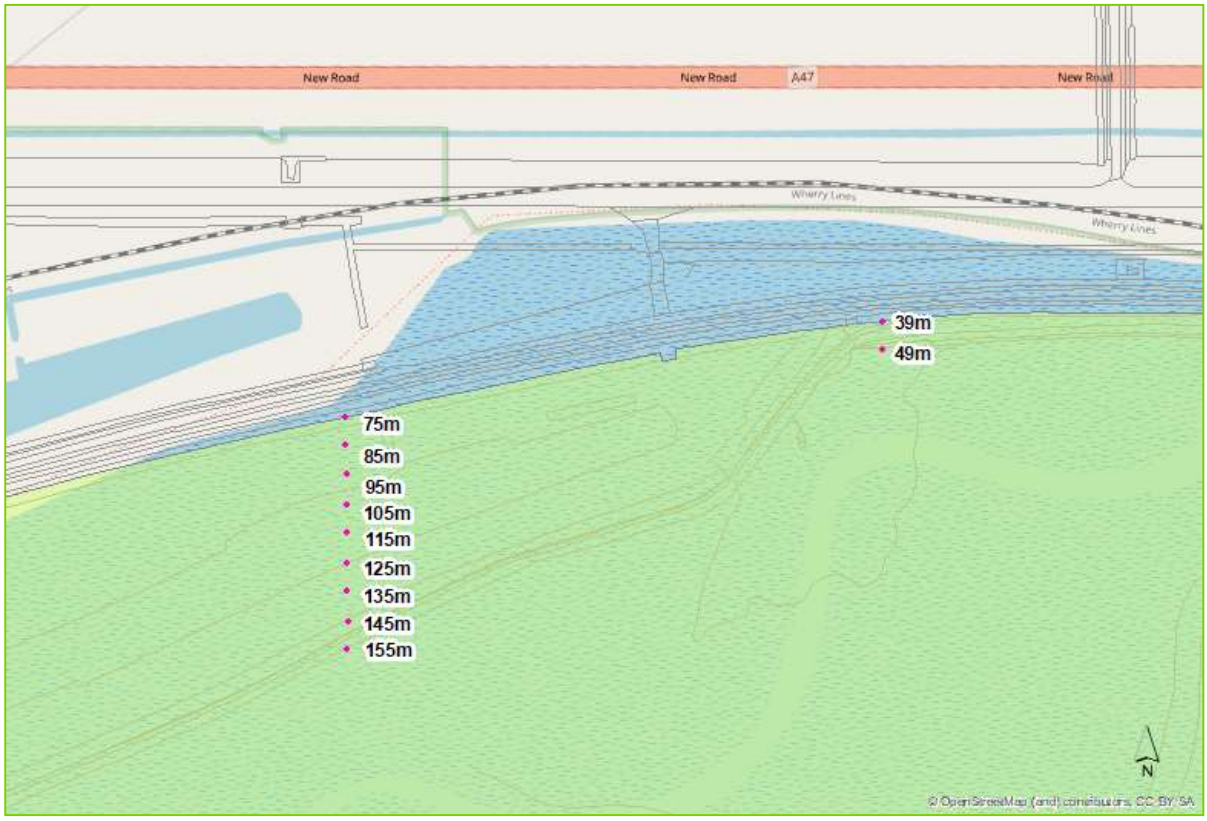

Plate 1.1: Location of the Modelled Transects for Breydon Water SSSI/SPA/Ramsar

Table 1.1: Annual Mean NO_x Concentration at Breydon Water SSSI

Distance from Edge of Nearest Modelled Road Link A47 New Road (m)	Annual Mean NO_x Concentrations (µg/m^3)			
	2017 BY	2023 DM	2023 DS	2023 DS-DM
39	19.0	14.8	14.8	0.0
49	18.1	14.3	14.3	0.0
75	16.3	13.3	13.3	0.0
85	16.0	13.2	13.2	0.0
95	15.8	13.0	13.0	0.0
105	15.6	12.9	12.9	0.0
115	15.4	12.9	12.9	0.0
125	15.3	12.8	12.8	0.0
135	15.2	12.8	12.7	0.0

Distance from Edge of Nearest Modelled Road Link A47 New Road (m)	Annual Mean NO_x Concentrations (µg/m^3)			
	2017 BY	2023 DM	2023 DS	2023 DS-DM
145	15.1	12.7	12.7	0.0
155	15.1	12.7	12.7	0.0

Assessment of Nitrogen Deposition

1.1.4 The results for predicted Nitrogen deposition rates (N-deposition) across the Breydon Water SSSI/SPA/Ramsar modelled transects are presented in Table 1.2. There is no change in N-deposition between the DM and DS scenario. As such, further assessment of the impacts of the Scheme upon ecology at Breydon Water SSSI/SPA/Ramsar due to changes in air quality is not required.

Table 1.2: Annual Mean N Deposition Rates Concentration at Breydon Water SSSI

Distance from Edge of Nearest Modelled Road Link A47 New Road (m)	Total N Deposition Rate (kg N ha^{-1} yr^{-1})			
	2017 BY	2023 DM	2023 DS	2023 DS-DM
39	12.0	10.4	10.4	0.0
49	11.9	10.3	10.3	0.0
75	11.9	10.3	10.3	0.0
85	11.8	10.3	10.3	0.0
95	11.8	10.3	10.3	0.0
105	11.8	10.3	10.3	0.0
115	11.8	10.3	10.3	0.0
125	11.8	10.3	10.3	0.0
135	11.8	10.3	10.3	0.0
145	11.8	10.3	10.3	0.0
155	11.8	10.3	10.3	0.0