A46 Newark Bypass

Scheme Number: TR010065

6.1 Environmental Statement

Chapter 5 Air Quality

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Rules 2009

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Infrastructure Planning

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The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Rules 2009

The A46 Newark Bypass

Development Consent Order 202[#]

6.1 Environmental Statement
Chapter 5 Air Quality

Regulation Number:	**APFP Regulation 5(2)(a)**
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Contents

5 Air quality

5.1 Introduction

5.1.1 This Chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (as amended) to be provided in the Environmental Statement (ES) to enable the identification and assessment of likely significant effects on air quality.

5.1.2 The Scheme has the potential to cause both adverse and beneficial effects. This Chapter includes:

- A description of the assessment methodology and identification of the study area.
- A review of air quality baseline conditions within the study area.
- Assessment of the potential impacts associated with construction dust and traffic management measures on sensitive human health receptors and designated habitats within the study area.
- Assessment of the potential air quality impacts of the Scheme on sensitive human health receptors and designated habitats within the study area.
- Assessment of the risk to affecting the UK's reported ability to comply with the Air Quality Directive[1] in the shortest timescales possible.
- Inclusion of mitigation measures, where relevant, and summary of overall significance of effects.

5.1.3 This assessment considers both construction and operational phase effects and has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality.[2]

5.1.4 This Chapter has been undertaken in compliance with the Planning Inspectorate's Scoping Opinion received for this Scheme [APP-189]. Appendix 4.1 (Scoping Opinion Schedule of Comments and Responses) of the ES Appendices [APP-125] contains further information on how each of the matters raised in the Scoping Opinion have been addressed.

5.1.5 In line with the Planning Inspectorate's Scoping Opinion construction plant emissions have been scoped out of the assessment. This is because effects of plant emissions on local air quality are considered of negligible significance relative to the surrounding road traffic contributions on the local road network, given the nature of the site plant. Further to this, guidance from the Institute of Air Quality Management (IAQM) notes that effects from on-site plant exhausts

[1] Air Quality Directive (2008) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe'.
[2] National Highways (2019) DMRB LA 105 – Air Quality, Revision 0 [online]. Available at: 10191621-07df-44a3-892e-c1d5c7a28d90 (standardsforhighways.co.uk) (last accessed December 2023).

would likely not be significant. Construction plant emissions have therefore been scoped out as the impacts would be minimal and not significant.

5.1.6 Chapter 2 (The Scheme) of this ES contains a detailed description of the Scheme. The drawings referenced in this Chapter can be found in the ES Figures [contained within Volume 6.2 of the ES], and the technical appendices referred to in this Chapter are presented in the ES Appendices [contained within Volume 6.3 of the ES].

5.1.7 This Chapter should be read in parallel with Chapter 8 (Biodiversity), Chapter 12 (Population and Human Health) and Chapter 15 (Combined and Cumulative Effects) of this ES.

5.2 Competent expert evidence

5.2.1 The competent expert has a master's level degree in Environmental Science and is a full member of the Institute of Environmental Sciences (IES) and the IAQM. The competent expert has 15 years of professional experience in the field of air quality including the preparation of ES Chapters and has acted as an Expert Witness in the examination of Development Consent Order (DCO) applications for other roads schemes.

5.3 Legislative and policy framework

5.3.1 The principal legislative and planning context for the assessment of the environmental effects of the Scheme on air quality is presented below. The relevant legislation and policies listed below have been taken into account in the assessment.

National legislation

Air Quality Standards Regulations

5.3.2 The Air Quality Standards Regulations 2010,[3] Air Quality Standards (amendment) Regulations 2016,[4] Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019,[5] and Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[6] implement Directive 2008/50/EC on ambient air quality.[7]

5.3.3 These pieces of legislation define limit values and timescales within which they are to be achieved for the purpose of protecting human

[3] Statutory Instrument. (2010) The Air Quality Standards Regulations, No. 1001.
[4] Statutory Instrument. (2016) The Air Quality Standards (Amendment) Regulations, No. 1184.
[5] Statutory Instrument. (2019) Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations.
[6] Statutory Instrument. (2020) Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, No. 1313.
[7] European Union. (April 2008) Directive on ambient air quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044.

health and the environment by avoiding, reducing, or preventing harmful concentrations of air pollutants.

5.3.4 The limit values are presented in Table 5-1 and apply everywhere, with the exception of:

- Any locations situated within areas where members of the public do not have access and there is no fixed habitation.
- In accordance with Article 2(1) of the Air Quality Directive 2008/50/EC, on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply.
- On the carriageway of roads.
- On the central reservations of roads except where there is normally pedestrian access to the central reservation.

5.3.5 The Department for Environment Food and Rural Affairs (Defra) assesses and reports on compliance with the limit values for each of the 43 zones and agglomerations across the UK. Zones and/or agglomerations achieve compliance when everywhere within the zone and/or agglomeration (except locations provided in the Directive) does not exceed the relevant limit value. The Scheme is located within the East Midlands Zone. In July 2017, Defra published the 'Air Quality Plan for tackling roadside nitrogen dioxide concentrations in East Midlands (UK0032)'[8]. The plan presents general information regarding this zone, as well as details of NO_2 exceedances within the zone and details of local air quality measures that have been or will be implemented, or are being considered for implementation.

5.3.6 The assessment undertaken for the East Midlands Zone indicates that the annual limit value was predicted to be exceeded in 2015 but was expected to be achieved by 2020 through the implementation of measures across the zone, combined with other measures implemented across the UK. However, in the most recent Pollution Climate Mapping (PCM) model published by Defra in 2020, the expected date of compliance for the East Midlands Zone has been revised to 2021. This is supported by the findings in Defra's Compliance Assessment Summary[9]. This document presents a summary of the UK's compliance with the Air Quality Directive in 2021, based on measurements from national air pollution monitoring networks and supplementary assessment (which includes air pollution modelling). The results of the air quality assessment for NO_2 in 2021 shows that the hourly and annual mean NO_2 limit values were met in the East Midlands Zone.

[8] Defra (2017) Air Quality Plan for tackling roadside nitrogen dioxide concentrations in East Midlands (UK0032). Available at: https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0032.pdf (Last accessed December 2023).
[9] Defra (2022) Air Pollution in the UK 2021 – Compliance Assessment Summary. Available at: air_pollution_uk_2021_Compliance_Assessment_Summary_Issue1.pdf (defra.gov.uk) (Last accessed December 2023)

Part IV of the Environment Act 1995

5.3.7 Part IV of the Environment Act 1995[10] (as amended by Schedule 11 of the Environment Act 2021)[11] requires that every local authority shall periodically carry out a review of air quality within its area, including predictions of likely future air quality. The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in the Air Quality (England) Regulations 2000[12] and the Air Quality (England) (Amendment) Regulations 2002.[13] In most cases, the air quality objectives are set at the same pollutant concentrations as the limit values transposed in UK law, although compliance dates differ.

5.3.8 As part of the review of air quality, the relevant local authority must assess whether air quality objectives are being achieved, or are likely to be achieved within the relevant periods, and identify the key sources of emissions responsible for the failure to achieve the objectives. Any parts of a local authority's area where the objectives are not being achieved, or are not likely to be achieved within the relevant period, must be identified and declared as an Air Quality Management Area (AQMA). Once such a declaration has been made, the relevant local authority is under a duty to prepare an Action Plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.

5.3.9 The Environment Act 1995[10] (as amended by Schedule 11 of the Environment Act 2021)[11] requires the UK Government to produce a national Air Quality Strategy (AQS). The AQS establishes the UK framework for air quality improvements. The previous 2007 AQS[14] was superseded as of 14 January 2019 with the Clean Air Strategy 2019 (CAS).[15]

5.3.10 The CAS does not set legally binding objectives, the CAS instead has targets for reducing total UK emissions of nitrogen oxides (NOx) and fine particulate matter ($PM_{2.5}$) from sectors such as road transport, domestic sources and construction plant (non-road mobile machinery (NRMM)).

5.3.11 Further to this, the UK Government has produced a revised AQS that replaces the 2007 strategy and compliments the CAS. The revised AQS sets out the actions the Government expects local authorities in England to take in support of achieving the Government's long-term air

[10] Department for Environment Food and Rural Affairs. (2003) Part IV of the Environment Act 1995 Local Air Quality Management
[11] Statutory Instrument. (2021) Chapter 30, Schedule 11 Local Air Quality Management Framework of Environment Act 2021.
[12] Statutory Instrument. (2000) Air Quality (England) Regulations, No. 928.
[13] Statutory Instrument. (2002) Air Quality (England) (Amendment) Regulations, No. 3043.
[14] Department for Environment Food and Rural Affairs. (July 2007), 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland', Cm 7169, Department for Environment Food and Rural Affairs. [online] available at: Air Quality Strategy Vol 1 (publishing.service.gov.uk) (last accessed July 2024).
[15] Department for Environment Food and Rural Affairs. (January 2019), 'The Clean Air Strategy'.

quality goals, including the two new $PM_{2.5}$ targets, which are as follows:

- an annual mean concentration target for $PM_{2.5}$ of 10 µg/m^3 at any monitoring station by 2040.
- a population exposure reduction target of 35% by 2040 compared to a 2018 baseline.

5.3.12 As well as this, the Environmental Improvement Plan 2023[16] for England, which is discussed further in Section 5.3.39, records the legal targets and sets interim targets to be met by the end of January 2028. These targets are not legal thresholds but have been included for reference. They are:

- The highest annual mean concentration in the most recent full calendar year must not exceed 12 µg/m^3 of $PM_{2.5}$.
- Compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.

5.3.13 Air quality objectives and limit values relevant to the Scheme are summarised in Table 5-1 and Table 5-2. The new long-term $PM_{2.5}$ air quality target described above in paragraph 5.3.11 as set out in The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[17] sets a target date of 2040, which is after the Scheme opening year of 2028. The targets are to be met at air quality monitoring stations. In the absence of air quality monitoring stations in the vicinity of the Scheme, the date by which the target is to be achieved and the factors noted at paragraph 5.5.21 of this Chapter, it is not relevant to include this target in Table 5-1. Likewise, the interim $PM_{2.5}$ air quality target mentioned above in paragraph 5.3.12 has also not been included in Table 5-1 either.

[16] Defra (2023) Environment Improvement Plan 2023. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1168372/environmental-improvement-plan-2023.pdf (Last accessed December 2023)
[17] Statutory Instrument (2023) The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023.

Table 5-1: Relevant air quality objectives and limit values for human health receptors

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air quality objectives	Limit values
Nitrogen dioxide (NO_2)	Annual	40 µg/m^3	-	31 December 2005[(a)]	1 January 2010[(b)(c)]
	1 Hour	200 µg/m^3	18	31 December 2005[(a)]	1 January 2010[(b)(c)]
Particulates (PM_{10})	Annual	40 µg/m^3	-	31 December 2004[(a)(c)]	1 January 2005[(b)]
	24 Hour	50 µg/m^3	35	31 December 2004[(a)(c)]	1 January 2005[(b)]
Fine particulates ($PM_{2.5}$)	Annual	20 µg/m^3	-	-	1 January 2020[(b)(c)]

Notes:[(a)] Air Quality (England) Regulations 2000 as amended.
[(b)] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe, as transposed into UK Law.
[(c)] Air Quality Strategy 2023

Table 5-2: Relevant air quality objectives and limit values for ecological receptors

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air quality objectives	Limit values
Oxides of nitrogen (NOx)[(c)]	Annual	30 µg/m^3	-	31 December 2000[(a)]	19 July 2001[(b)]

Notes:[(a)] Air Quality (England) Regulations 2000 as amended.
[(b)] Air Quality Strategy 2007.
[(b)] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe, as transposed into UK Law.
[(c)] Designated for the protection of vegetation and ecosystems and also referred to as the 'critical level' for NOx. The policy of the UK statutory nature conservation agencies is to apply the annual mean NOx criterion in internationally designated conservation sites and Site of Special Scientific Interest (SSSI) on a precautionary basis, as the limit value applies only to locations more than 20 kilometres from towns with more than 250,000 inhabitants or more than 5 kilometres from other built-up areas, industrial installations or motorways.

5.3.14 Table 5-3 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment of air quality.

Table 5-3: Locations where the air quality objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes, etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24-Hour	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be shorter than either the 24- or 8-hour relevant mean.
1-Hour	All locations where the annual mean and 24-hour and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations, etc, which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: Defra Local Air Quality Management Technical Guidance (LAQM TG22)[18].

Environmental Protection Act 1990

5.3.15 Section 79(1)(d) of the Environmental Protection Act (EPA) 1990[19] defines one type of 'statutory nuisance' as "*any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*". Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. Best practicable means (that the best practicable means were used to prevent, or counteract the effects of, the nuisance) is a widely used defense by operators to ensure that they comply with the EPA 1990.

5.3.16 This legislation is of relevance to the Scheme as dust generating activities, such as earth moving, would be carried out during the construction phase. Details of whether dust effects as a result of the Scheme would give rise to a statutory nuisance as defined under the

[18] Defra (2022), Local Air Quality Management – Technical Guidance (22) [online]. Available at: LAQM-TG22-August-22-v1.0.pdf (defra.gov.uk). (Last accessed December 2023).
[19] Parliament of the United Kingdom (1990) Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents. (Last accessed July 2024).

EPA 1990 can be found in the Statement Relating to Statutory Nuisances [APP-186].

National Policy

National Policy Statement for National Networks

5.3.17 The National Policy Statement for National Networks (NPSNN) sets out the policy which the Scheme should comply with. It is also the basis for informing a judgement on the impacts of the Scheme, for example whether the Scheme is consistent with the requirements of the NPSNN. Compliance of the Scheme with the 2015 NPSNN is detailed within the NPSNN (2015) Accordance Tables [REP6-016].

5.3.18 At the time of the DCO application submission in April 2024, a Draft NPSNN (2024) Accordance Table [APP-192] was submitted with the application which summarised compliance of the Scheme with the draft NPSNN. This was because, even though the NPSNN 2024 was still in draft at that time (having been published for consultation in March 2023), it was still capable of constituting a material consideration in the Secretary of State's decision on the Application. As the 2024 NPSNN was designated on 24 May 2024, the Draft NPSNN (2024) Accordance Table [APP-192] has been superseded by the NPSNN (2024) Accordance Table [REP5-032], which assesses the Scheme against the designated 2024 NPSNN. The application for development consent for the Scheme was accepted for examination on 23 May 2024. As set out in the transitional provisions of the 2024 NPSNN (paragraphs 1.16 and 1.17), the 2015 NPSNN has effect for any application for development consent accepted for examination prior to 24 May 2024 and will inform decisions made by the Secretary of State in relation to those applications. However, it is noted that the 2024 NPSNN may still be an important consideration for the Secretary of State for Transport when determining whether to consent the DCO for this Scheme. Therefore, the NPSNN (2024) Accordance Tables [REP5-032] summarised compliance of the Scheme with the 2024 NPSNN.

5.3.19 The policies of relevance to air quality within the 2015 NPSNN and detail on how they have been addressed in the assessment are provided below.

5.3.20 Paragraph 5.7 of the 2015 NPSNN notes *“that the applicant should undertake an assessment of the impacts of the proposed project as part of the ES and 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
- 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 Scheme

5.3.21 This 2015 NPSNN requirement has been addressed in this assessment; baseline air quality concentrations are described in Section 5.8 of this Chapter, whilst modelled air quality concentrations have been predicted for the Do-Minimum (DM) (without Scheme) and Do-Something (DS) (with Scheme) scenarios in the Scheme opening year. Concentrations are presented and discussed in Section 5.11 of this Chapter. Further to this, any significant air quality effects, their mitigation and any residual effects during the construction and operational phases are presented and discussed in Sections 5.9, 5.10 and 5.11 of this Chapter.

5.3.22 Paragraph 5.3 of the 2015 NPSNN notes *"the impact of increases in emissions of pollutants during the construction and operation phases of a project on human health and protected species and habitats".* This point has been addressed in this Chapter in Section 5.9, where the assessment of the impacts of the Scheme during the construction and operational phases has been presented.

5.3.23 Paragraph 5.4 of the 2015 NPSNN notes that UK legislation sets out ambient air quality objectives. It also refers to the fact that the European Union has established common, health-based and eco-system based ambient concentration limit values for the main pollutants in the Ambient Air Quality Directive (2008/50/EU) ('the Air Quality Directive'), which are required to be met by various dates. Relevant air quality standards and objectives are outlined in Section 5.3 of this Chapter.

5.3.24 Further to this, paragraph 5.6 of the 2015 NPSNN notes that where the impacts of the Scheme (both on- and off-Scheme) are likely to have significant air quality effects in relation to meeting EIA requirements and/or affect the UK's ability to comply with the Air Quality Directive, the applicant should undertake an assessment of the impacts of the Scheme as part of the ES. This requirement has been addressed in this Chapter in Sections 5.9 and 5.11, where the assessment of the impacts of the Scheme has been presented. This is in line with DMRB LA105, which meets the requirements of the 2015 NPSNN.

5.3.25 It is stated in paragraph 5.8 of the 2015 NPSNN that *"Defra publishes future national projections of air quality based on evidence of future emissions, traffic and vehicle fleet. Projections are updated as the evidence base changes. Applicant's assessment should be consistent with this but may include more detailed modelling to demonstrate local impacts".* This requirement has been addressed in this assessment as emission factors derived from Defra's Emission Factors Toolkit EFT (v11.0) have been used, which contain projections up to the year 2050. Predicted background pollutant concentrations published by Defra have also been used, which have been adjusted based on monitored background concentrations, to ensure they are representative of local background conditions. Adding to this, long-term trend gap analysis factors have been applied to uplift opening

year concentrations in order to address the uncertainty relating to predictions of future emissions.

5.3.26 Paragraphs 5.9 and 5.12- 5.14 of the 2015 NPSNN provide advice for decision makers:

5.3.27 Paragraph 5.9 of the 2015 NPSNN states *"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 judgement on the risk as to whether the project would affect the UK's ability to comply with the Air Quality Directive."* This requirement is addressed in Section 5.5 of this Chapter in accordance with DMRB LA 105, therefore meeting the requirements of the 2015 NPSNN.

5.3.28 Paragraph 5.12 of the 2015 NPSNN states *"The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and/or where they lead to a deterioration in air quality in a zone/agglomeration."* Relevant detail on this requirement is provided in Section 5.13 of this Chapter.

5.3.29 Paragraph 5.13 of the 2015 NPSNN states "*The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will:*

- *result in a zone/agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant.*
- *affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision."* Relevant detail on this requirement is provided in Section 5.13 of this Chapter.

5.3.30 Paragraphs 5.14 and 5.15 of the 2015 NPSNN state "*The Secretary of State should consider whether mitigation measures put forward by the applicant are acceptable. A management plan may help codify mitigation at this stage. The proposed mitigation measures should ensure that the net impact of a project does not delay the point at which a zone will meet compliance timescales. Mitigation measures may affect the project design, layout, construction, operation and/or may comprise measures to improve air quality in pollution hotspots beyond the immediate locality of the scheme. Measures could include, but are not limited to, changes to the route of the new scheme, changes to the proximity of vehicles to local receptors in the existing route, physical means including barriers to trap or better disperse emissions, and speed control. The implementation of mitigation measures may require working with partners to support their delivery."* Detail on mitigation measures is provided in Section 5.10 of this Chapter and in the Table 3-2 Register of Environmental Actions and Commitments (REAC) as part of the First Iteration Environmental Management Plan (EMP) [REP6-012].

National Planning Policy Framework

5.3.31 The National Planning Policy Framework (NPPF) (December 2024)[20] sets out the Government's planning policy framework for the whole of England, including the Government's expectation for content and quality of planning applications and local plan policy. The overall strategic aims of the NPSNN and NPPF are consistent. The NPPF may be an important and relevant matter but does not form the basis for a decision on an NSIP.

5.3.32 With regard to air quality, the NPPF states that:

- Paragraph 187 *"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... quality…"*. This policy has been considered in this Chapter in Section 5.9 and 5.11, where the assessment of the impacts of the Scheme has been presented.
- Paragraph 199 *"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*.

5.3.33 Detail on mitigation measures is provided in Section 5.10 of this Chapter and in the Table 3-2 REAC as part of the First Iteration EMP [REP6-012]. Detail on compliance with relevant limit values and national objectives for pollutants with the Scheme in place is provided in Section 5.11. Committed developments with potential to generate traffic have been incorporated into the traffic model developed for this Scheme. As such, the cumulative effect of the Scheme with other committed developments included within the traffic model has been accounted for within Section 5.11.

[20] Ministry of Housing, Communities and Local Government (December 2024) National Planning Policy Framework [online] available at: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf (last accessed March 2025.

National Planning Practice Guidance

5.3.34 On 6 March 2014, the Department for Communities and Local Government published a national planning practice guidance web-based resource[21] which was last updated on 24 June 2021.

5.3.35 The National Planning Practice Guidance includes a dedicated section on air quality (last updated 1 November 2019). It notes that, for new planning applications, the local planning authority may require information on:

- *"the 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality".*

5.3.36 The baseline air quality conditions are presented in Section 5.8, whilst the baseline conditions at human health receptors and designated habitats in the opening year of the development, without the Scheme in place (DM scenario), is presented in Table 5-12 and Table 5-13. The assessment of likely significant effects is presented in Section 5.11.

5.3.37 The National Planning Practice Guidance also states the following in relation to determining whether air quality is relevant to a planning decision:

- *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity".*[22]

5.3.38 The baseline air quality conditions are presented in Section 5.8, whilst the assessment of likely significant effects is presented in Section 5.11 of this Chapter.

[21] National Planning Practice Guidance web-based resource. Accessible at: https://www.gov.uk/Government/collections/planning-practice-guidance (Last accessed December 2023).
[22] National Planning Practice Guidance 'Air Quality Section'. Accessible at: https://www.gov.uk/guidance/air-quality--3 (Last accessed December 2023).

25 Year Environment Plan

5.3.39 The Defra "A Green Future: Our 25 Year Plan to Improve the Environment" (25 Year Environment Plan) (2018)[23] is a policy paper published on 11 January 2018 setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. The first revision of the 25 Year Environment Plan 'Environmental Improvement Plan 2023' was published on 31 January 2023 and sets the two interim targets presented in paragraph 5.3.12 of this Chapter for $PM_{2.5}$ annual mean concentrations and population exposure.

5.3.40 The 25 Year Environment Plan sets out aims to achieve clean air by:

- *"Meeting legally binding targets to reduce emissions of five damaging air pollutants; this should halve the effects of air pollution on health by 2030".*
- *"Ending the sale of new conventional petrol and diesel cars and vans by [2035]"* (The original deadline of 2040 has been brought forward).
- *"Maintaining the continuous improvement in industrial emissions by building on existing good practice and the successful regulatory framework".*

5.3.41 The assessment has considered the targets set out for $PM_{2.5}$ within the assessment as set out in paragraph 5.5.21 of this Chapter.

Local policy

5.3.42 The Newark & Sherwood Amended Core Strategy Development Plan[24] was adopted in 2019, this sets out policy up until 2033 and presents the objectives for development in the area.

5.3.43 Core Policy 12, Biodiversity and Green Infrastructure, relates to air quality. This policy states that the council will:

> *"work with partners to develop a strategic approach to managing air quality in the Sherwood Area, including through the development of a Supplementary Planning Document"*.

5.3.44 The air quality supplementary planning document (SPD) is currently under review by Planning Policy and yet to be adopted as either policy or guidance. As such the SPD is not currently available and has not been considered in this assessment.

[23] HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online]. Available at: https://www.gov.uk/government/publications/25-year-environment-plan - GOV.UK (www.gov.uk) (Last accessed July 2024).
[24] Amended Core Strategy Development Plan (2019) Newark & Sherwood District Council [online]. Available at: https://www.newark-sherwooddc.gov.uk/media/nsdc-redesign/documents-and-images/your-council/planning-policy/local-development-framework/amended-core-strategy-dpd/amended-core-strategy-DPD.pdf (Last accessed December 2023).

National Highways policy

5.3.45 National Highways (the Applicant) supports the delivery of the Government's National Air Quality Plan[25], including the delivery of measures to achieve compliance with legal air quality thresholds in the shortest timescales possible alongside the Strategic Road Network. In addition, air quality is one of the environmental topic areas where the six strategic levers of the National Highways' Environment Strategy[26] will be applied. The strategic levers will make a contribution towards the organisation's environment vision. The six strategic levers are as follows:

- Leadership and Culture
- Health, Safety and Wellbeing
- Engaging Stakeholders
- Design Quality
- Asset Knowledge
- Appraisal, Evaluation and Performance

5.4 Consultation

5.4.1 Consultation with local authority Environmental Health Officers (EHOs) has been progressed through the key stakeholder engagement exercises as part of the ES. A meeting with the Newark & Sherwood District Council EHOs, including the air quality officer, was held on the 14 September 2022 where air quality was discussed and an overview of the Scheme-specific air quality monitoring survey was provided. Newark & Sherwood District Council was in agreement with the points raised in the meeting and had no further comments or queries.

5.4.2 Further consultation was undertaken on 21 June 2023 to provide the EHOs from Newark & Sherwood District Council with an overview of the assessment findings and proposed mitigation for air quality. This was part of a wider environmental meeting where the assessment findings and proposed mitigation for noise and contaminated land were also presented to the relevant EHOs. The EHO for air quality at Newark & Sherwood District Council was in agreement with the assessment findings for air quality and asked to review the proposed mitigation for construction dust in further detail. The EHO for air quality at Newark & Sherwood District Council was notified that this mitigation would be detailed in the First Iteration EMP [REP6-012] which would

[25] Department for Environment Food and Rural Affairs and Department for Transport (2017) UK plan for tackling roadside nitrogen dioxide concentrations [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf (Last accessed December 2023).
[26] National Highways (2017) Environment Strategy Our approach [online'. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy__21___.pdf (Last accessed December 2023).

be submitted as part of the DCO application and subsequently made available to the EHOs.

5.4.3 Further to this, an email was received from the EHO for air quality on 22 June 2023 with regard to the implementation of construction dust mitigation measures on site and the type of monitoring undertaken for the Scheme-specific survey. A response was subsequently provided on 11 July 2023 that included a list of the proposed construction dust mitigation measures for air quality and an explanation of why the Scheme-specific survey had been undertaken using diffusion tubes rather than automatic monitoring. A response was received from Newark & Sherwood District Council on 12 July 2023 that acknowledged receipt of the information provided. No comments or further queries were received from Newark & Sherwood District Council.

5.5 Assessment methodology

5.5.1 This section describes the methodology which has been used for the assessment of air quality, which may be affected by the construction and operation of the Scheme.

5.5.2 The scope of the air quality assessment was presented in Chapter 6 Air Quality of the Environmental Impact Assessment (EIA) Scoping Report submitted to the Planning Inspectorate in September 2022.[27] A schedule of responses detailing how each of the Scoping Opinion comments have been considered as part of this Chapter is contained within Appendix 4.1 (Scoping Opinion Schedule of Comments and Responses) of the ES Appendices [APP-125].

5.5.3 The methodology presented in this Chapter has since been updated in line with the new recommendation from the IAQM[28] and Chartered Institute of Ecology and Environmental Management[29] (CIEEM) to include the ammonia (NH_3) contribution to nitrogen deposition from road traffic emissions. This is the only change from the approach outlined within the Scoping Report.

5.5.4 The assessment has been undertaken in accordance with the principles set out in Chapter 4 (Environmental Assessment Methodology) of this ES. Potential air quality effects have been assessed in accordance with the DMRB LA 105.

5.5.5 The assessment comprises:

- Assessment of the potential impacts associated with the construction phase including consideration of construction dust and traffic management

[27] National Highways (2022) A46 Newark Bypass EIA Scoping Report [online] available at: TR010065-000002-A46N - Scoping Report.pdf (planninginspectorate.gov.uk) (Last accessed December 2023).
[28] Holman et al (2020). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1, Institute of Air Quality Management, London.
[29] CIEEM (2021) Advice on Ecological Assessment of Air Quality Impacts. Chartered Institute of Ecology and Environmental Management. Winchester, UK.

measures on sensitive human health receptors and designated habitats within the study area.

- Assessment of the potential impacts associated with the operation phase, including
    - assessment of the potential air quality impacts of the Scheme on sensitive human health receptors and designated habitats within the study area
    - assessment of the risk to affecting the UK's reported ability to comply with the Air Quality Directive[30] in the shortest timescales possible.

Construction phase

Construction dust

5.5.6 A qualitative assessment of potential dust effects has been undertaken, based on a review of likely dust raising activities, and identification of any sensitive receptors listed in Table 5-3 within 50 metres, 100 metres and 200 metres of these activities, in accordance with DMRB LA 105. The results from the qualitative assessment are presented in Section 5.9 of this Chapter and have been used to inform the best practice mitigation measures presented in Section 5.10 of this Chapter and in the First Iteration EMP [REP6-012]. Details of whether dust effects as a result of the Scheme would give rise to a statutory nuisance as defined under the EPA 1990 can be found in the Statement Relating to Statutory Nuisance [APP-186].

Construction traffic

5.5.7 During the construction phase, the Scheme would introduce new emission sources in the form of site plant, traffic from construction vehicles and the implementation of traffic management measures.

5.5.8 The construction period will be approximately three years. Therefore, as DMRB LA 105 advises that the impact of construction activities on vehicle movements shall be assessed where construction activities are programmed to last more than two years, and in accordance with the Scoping Opinion, the construction traffic flows have been screened against the criteria described in paragraph 5.5.9 below, to determine the level of assessment required.

5.5.9 The criteria are:

- Annual average daily traffic (AADT) >=1,000; or
- Heavy duty vehicle (HDV) AADT >=200; or
- a change in speed band; or
- a change in carriageway alignment by >=5 metres

[30] Air Quality Directive (2008) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe'.

5.5.10 Notwithstanding the above criteria, as stated in DMRB LA 105, the assessment of construction traffic impacts on sensitive receptors shall be proportionate and limited to the areas of key risk of exceeding air quality thresholds.

5.5.11 Table 8-2 in the Transport Assessment [REP5-034] shows the peak construction year daily construction vehicle volumes for a working day with a total two-way heavy goods vehicle (HGV)[31] value of 1,484 vehicles. This value is the combined total of HGVs entering/exiting all of the construction sites and is therefore not representative of a maximum flow on any one road. This value is also not used to calculate the HDV AADT flows, in accordance with DMRB LA 105. Further information on how the HDV AADT flows have been calculated is detailed below in paragraph 5.5.12.

5.5.12 Construction vehicle movements discussed in paragraphs 5.5.13 to 5.5.15 below are provided on an AADT basis, as per the DMRB LA 105 criteria above, and are an aggregate of construction vehicles using different routes to and from works access areas. The construction vehicle movements are based on assumptions made with regard to the size of the workforce, modes of travel, number of journeys made and vehicles used. The AADT values are representative of the average 7-day period (Monday to Sunday) across the year, in accordance with DMRB LA 105. Therefore, construction traffic flows are calculated on the basis of annual average figures rather than variable daily figures.

5.5.13 It is estimated that there would be a maximum construction vehicle flow across the study area on any existing road of 510 two-way AADT movements in 2025 which is below the AADT screening criteria.

5.5.14 It is estimated that there would be 402 two-way HDV AADT construction vehicle movements in 2025 on the A46 between Farndon Roundabout and Cattle Market Roundabout. This exceeds the HDV screening criteria of 200 HDVs AADT in 2025. In the remaining years of construction this figure reduces to less than 100 two-way HDV AADT movements which is below the relevant screening criteria.

5.5.15 It is estimated that there would be 324 two-way HDV AADT movements in 2025 and 246 two-way HDV AADT movements in 2026 on the section of the A46 south of Farndon Roundabout. This is the longest duration (two years) during the construction phase where HDV movements are estimated to be above the screening criteria of 200 HDV AADT.

5.5.16 In summary:

- There are no areas within the study area at risk of exceeding air quality thresholds, based on a review of the baseline air quality conditions undertaken in Section 5.8 of this Chapter.

[31] Note that the air quality assessment uses values expressed as HDVs which is a combination of HGVs and buses. For this Scheme HDVs and HGVs are identical as buses are not explicitly modelled and are captured in the HGV values.

- Furthermore, modelled base year (2022) concentrations presented in Table 1-1 of Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128] show that modelled pollutant concentrations are well below the air quality threshold.
- Whilst there are sections of the A46 where additional two-way HDV construction traffic exceeds the screening criteria of 200 HDV AADT, these changes are temporary and are not programmed to last more than two years.
- Considering the predicted construction traffic flows and the duration they will occur for, there is no risk of these causing an exceedance during the construction phase. As such, traffic flows associated with the construction phase have not been considered further and the need to assess construction traffic associated with the Scheme has been scoped out of this assessment in accordance with DMRB LA 105, as the potential effects are not considered to be significant.

5.5.17 The implementation of traffic management measures during the construction phase has the potential to affect air quality at properties and designated sites within 200 metres of these locations where they are implemented, as a result of road closures, diversions, and speed limit reductions. Therefore, the impact of the traffic management measures on sensitive receptors have been considered qualitatively in Section 5.11 of this Chapter.

Operation phase

Overview

5.5.18 The air quality assessment has considered:

- changes in pollutant concentrations at sensitive receptors to assess against air quality objectives
- changes in concentrations at qualifying features to assess limit value compliance
- changes in concentrations and nitrogen deposition at designated sites.

Pollutants

5.5.19 The air quality assessment has considered emissions of NOx and NH_3.

5.5.20 In accordance with DMRB LA 105, PM_{10} has not been considered further within the air quality assessment. This is because:

- DMRB LA 105 states that it is only necessary to model PM_{10} for the base year (2022) to demonstrate that there is no impact on achievement of the PM_{10} air quality thresholds as a result of the Scheme. Paragraph 5.5.51 provides further detail on the base year.
- The results of the base year PM_{10} modelling presented in Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128] show that the highest concentration is 28.9 µg/m^3, which is predicted at human health receptor R105 and well below the air quality objective of 40 µg/m^3.

- As the air quality modelling does not show any exceedances of the PM_{10} air quality objective in the base year, PM_{10} has not been included in the air quality model in the DM and DS scenarios and has not been assessed further.

5.5.21 Furthermore, in accordance with DMRB LA 105, $PM_{2.5}$ has not been considered further within the air quality assessment. This is because:

- DMRB LA 105 states that there should be no need to model $PM_{2.5}$ as the UK currently meets its legal requirements for the achievement of the $PM_{2.5}$ air quality thresholds and the modelling of PM_{10} can be used to demonstrate that the Scheme does not impact on the $PM_{2.5}$ air quality threshold, as explained below.
- The results of the PM_{10} modelling show that the maximum PM_{10} roads contribution across the modelled human health receptors in the base year of 2022 is predicted to be 4.5 µg/m^3. When this is combined with the maximum raw $PM_{2.5}$ background concentration across the modelled human health receptors for 2022, which is 9.7 µg/m^3, the $PM_{2.5}$ threshold of 20 µg/m^3 is not exceeded. $PM_{2.5}$ is also a constituent part of PM_{10}, which means vehicles emission factors, and therefore the existing roads contributions, for $PM_{2.5}$ are even lower than those for PM_{10}.
- Further to this, the greatest change in annual mean NO_2 concentrations at modelled receptors in the opening year of the Scheme is predicted to be 3.9 µg/m^3 between the with and without Scheme scenarios. Changes in $PM_{2.5}$ would therefore be even lower in the opening year of the Scheme, as $PM_{2.5}$ is a constituent part of PM_{10} and PM_{10} emissions are an order of magnitude lower than NOx emissions.
- Further to this, $PM_{2.5}$ background concentrations are expected to continue falling in the future, due to existing and future measures set out within the 25 Year Environment Plan which will reduce $PM_{2.5}$ emissions with the aim of meeting future targets at relevant monitoring stations in 2040. For example, the maximum $PM_{2.5}$ background concentration from Defra's background maps across the human health receptors assessed is 9.7 µg/m^3 in the base year of 2022, compared to 9.3 µg/m^3 in the opening year of 2028.
- Therefore, it can be concluded that the current and future $PM_{2.5}$ concentrations are lower than the target value of 20 µg/m^3 and the Scheme will not impact on the $PM_{2.5}$ air quality threshold at any of the human health receptors considered.
- In addition to this, the proposed annual mean $PM_{2.5}$ target at air quality monitoring stations of 10 µg/m^3 by 2040 does not need to be met until 2040, which is after the Scheme opening year of 2028, whilst the interim annual mean $PM_{2.5}$ target of 12 µg/m^3 by 2028 is not a legal threshold. The targets are also required to be met at air quality monitoring stations, as identified within the Environment Act 2021, however there are no air quality monitoring stations in the vicinity of the Scheme in respect of which measurements could be made. Therefore, the targets are not applicable to this assessment and have not been considered further. Nonetheless, changes in $PM_{2.5}$ contributions from changes in road traffic will be very

small. As mentioned above, this is because PM_{10} emissions are an order of magnitude lower than NOx emissions and as because $PM_{2.5}$ is a constituent part of PM_{10}, these changes would be even smaller. Therefore, the Scheme would not have a significant effect on the ability to meet the future $PM_{2.5}$ target of 10 µg/m^3 given that $PM_{2.5}$ concentrations are mainly influenced by existing background concentrations and these are currently below the future target. In addition, as indicated by the modelled results for NO_2 the Scheme has a beneficial effect within Newark-on-Trent by reducing traffic where pollutant concentrations and population density are highest. Therefore, the Scheme would help contribute to exposure reduction.

5.5.22 Therefore, it can be concluded that there would be no significant effects for $PM_{2.5}$ and it is not considered further. This conclusion was also agreed as part of the Scoping Opinion.

Screening criteria

5.5.23 In accordance with DMRB LA 105, the following traffic scoping criteria have been used to determine the extent of the study area, which are based on the changes between the DS traffic compared to the DM traffic in the opening year of 2028.

5.5.24 The criteria are:

- AADT >=1,000; or
- HDV AADT >=200; or
- a change in speed band; or
- a change in carriageway alignment by >=5 metres

5.5.25 The criteria have been triggered on many roads within and surrounding the Scheme. The roads which trigger these criteria make up the affected road network (ARN), which make up the study area of the operational phase of the Scheme. Further detail on the ARN is provided in Section 5.7 of this Chapter.

Operational traffic data

5.5.26 Outputs from the SATURN traffic model developed for the Scheme, have been used for this assessment. Data on vehicle flows, speed and percent of HDVs are available for the following periods in the base, DM and DS scenarios for the Scheme:

- AM peak period (07:00 to 10:00)
- Inter-peak period (10:00 to 16:00)
- PM peak period (16:00 to 19:00)
- Off-peak period (19:00 to 07:00)

5.5.27 The diurnal traffic flow characteristics, and therefore emissions, are represented in the dispersion model using time varying emission

factors. The same profile used for weekdays has been applied to the weekend as a worst-case.

5.5.28 Speed data has also been derived from the SATURN traffic model. Appendix 5.2 (SATURN Traffic Data Report) of the ES Appendices [APP-129] provides a summary of traffic data for the study area.

5.5.29 Committed developments with potential to generate traffic have been incorporated into the traffic model developed for this Scheme. Discussion of committed developments included within the traffic model is presented within Appendix A of the Transport Assessment [REP5-034]. The cumulative effect of the Scheme with other committed developments included within the traffic model has therefore been accounted for within this Chapter for operational effects.

Assessment scenarios

5.5.30 This assessment has considered the following scenarios:

- Base year 2022 – for model verification (see paragraph 5.5.51)
- Projected base year 2028 – to account for uncertainty in future pollutant projections (see paragraphs 5.5.52 to 5.5.54).
- DM scenario 2028 (opening year)
- DS scenario 2028

5.5.31 The air quality assessment has compared predicted concentrations against the air quality objectives and assessed compliance with the Air Quality Directive for the opening year of the Scheme only. The opening year of the Scheme is expected to be a worst-case in terms of air quality impacts, as noted in paragraph 2.89 of DMRB LA 105, due to background concentrations improving in future years. Air quality is predicted to improve in future years in response to the uptake of vehicles which meet more stringent emissions standards.[32] This is described further in the context of the assumptions used in the assessment in paragraphs 5.5.52 to 5.5.54 of this Chapter and is consistent with the approach outlined within DMRB LA 105.

Model selection

5.5.32 This assessment has used a dispersion model called ADMS-Roads (version 5.0.1.3), a PC-based model of dispersion in the atmosphere of pollutants released from road traffic sources, produced and validated by Cambridge Environmental Research Consultants (CERC).

5.5.33 The dispersion model was built by digitising traffic model links and assigning road widths based on Ordnance Survey (OS) mapping. The highway design associated with the DS scenario was digitised based

[32] Defra (2017) UK plan for tackling roadside nitrogen dioxide concentrations [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf [last accessed December 2023).

on a geo-referenced CAD drawing of the Scheme. Road widths and alignments were adjusted to represent the Scheme design.

Model parameters and inputs

Vehicle emission factors

5.5.34 Road traffic emission factors for NOx have been derived from an update to the speed band emission factors published in DMRB LA 105. The speed band emission factors used in this assessment, v4.3, take account of Defra's Emission Factor Toolkit (EFT) v11.0 released in November 2021. Emissions have been defined according to the speed band category of the traffic link or road.

5.5.35 Although DMRB LA 105 provides predictions of future emissions, there remains some uncertainty over these forecasts. This uncertainty has been addressed through applying long-term trend (LTT) gap analysis factors to uplift opening year concentrations, as described in paragraph 5.5.54.

5.5.36 A time varying emission file has been used to represent vehicle emissions for each of the traffic periods discussed in paragraph 5.5.26. The same emissions profile was used for weekdays and weekends in order to assess a worst-case.

Meteorological data

5.5.37 The most important meteorological parameters governing the atmospheric dispersion of emissions are wind direction, wind speed and atmospheric stability as described below:

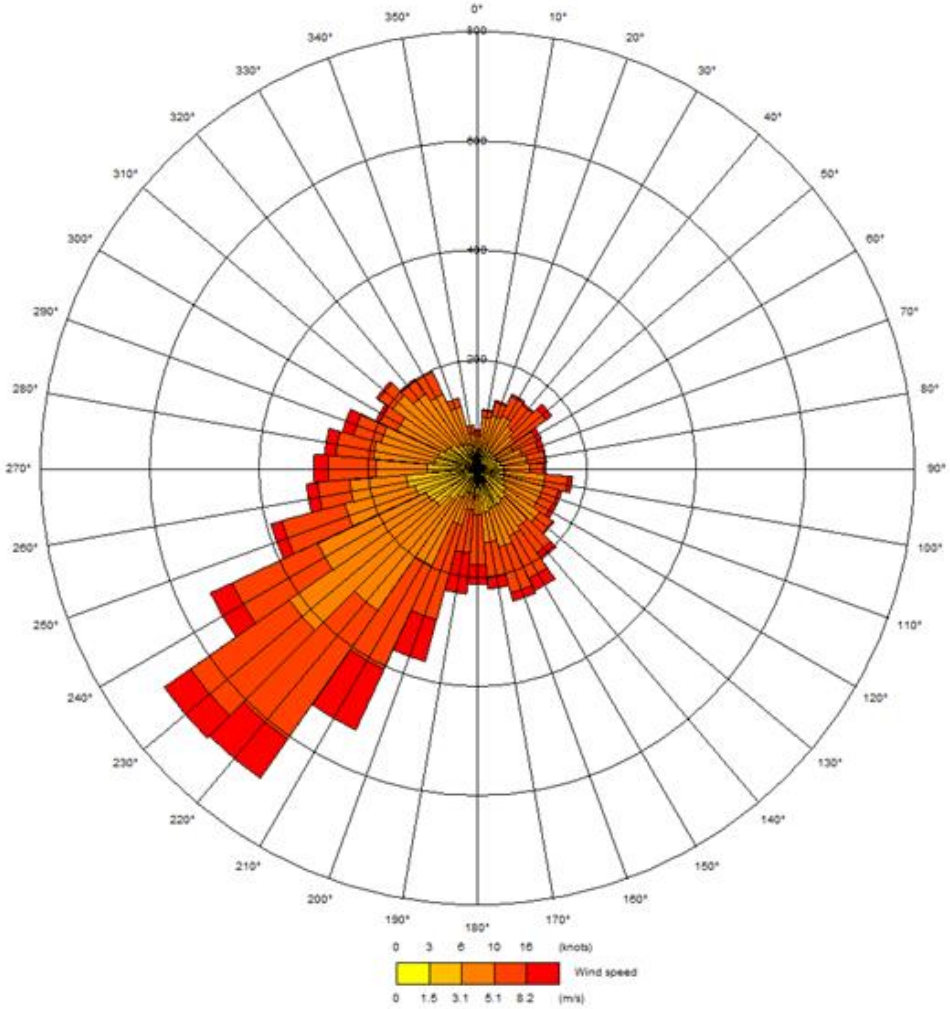
- Wind direction determines the sector of the compass into which emissions are dispersed.
- Wind speed affects the distance which emissions travel over time and can affect dispersion by increasing the initial dilution of pollutants.
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. ADMS uses a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

5.5.38 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. There are only a limited number of sites across the UK where the required meteorological measurements are made.

5.5.39 Data for 2022 from Waddington meteorological station was used within the assessment, which is the closest station to the Scheme, approximately 17 kilometres away to the north-east. The meteorological station is considered representative of the modelled area due to its close proximity to the Scheme and being located on flat terrain. A wind rose is presented in Figure 5.1 below and highlights

predominant wind directions from the south-west, which are associated with the highest wind speeds. There are lower occurrences of wind from other directions and these tend to be associated with lower wind speeds.

Figure 5.1: Wind rose for Waddington (2022)



Source: Generated from data sourced from Air Pollution Services (APS) (2023).

Human health receptors

5.5.40 The air quality objectives only apply in locations of relevant exposure. Therefore, receptors have been chosen following the advice from Defra TG22 set out in Table 5-3. A total of 118 worst-case receptors were selected for the assessment, consisting of residential properties, a school and a hospital, as shown in Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128] and Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028]. Using professional judgement, receptors were selected at locations likely to have the highest pollutant concentrations (such as closest to the road or junction) or anticipated to experience highest level of change (next to roads within the ARN with the largest change in the traffic screening criteria). The human health receptors were modelled at a height of 1.5 metres, which is considered to be the representative of head height in

accordance with best practice. Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028] shows the location of these receptors in relation to the ARN.

5.5.41 A total of 30 human health receptors were selected from the 118 human health receptors which were modelled, as these were the receptors predicted to experience the highest NO_2 concentrations and greatest change in NO_2. Table 5-4 shows the locations of these 30 receptors.

Table 5-4: Air quality assessment human health receptors

Receptor ID	Receptor name	Receptor type	British National Grid Coordinates		
			X	Y	Z
R19	Main Street	Residential	478854	357007	1.5
R22	Latham Farms	Residential	475127	355483	1.5
R24	Main Road, East of Broadgate Lane	Residential	477252	355723	1.5
R25	Main Road, East of Blacksmith Lane	Residential	477496	355678	1.5
R26	Great North Road, North of A46	Residential	478794	356089	1.5
R30	A1 Northbound	Residential	481032	356231	1.5
R33	Alexander Avenue	Residential	480509	355936	1.5
R36	Wheatsheaf Avenue	Residential	481020	355893	1.5
R37	West of Friendly Farmer Roundabout 1	Residential	481456	355909	1.5
R38	West of Friendly Farmer Roundabout 2	Residential	481469	355871	1.5
R39	Lincoln Road	Residential	481126	355761	1.5
R49	North Gate, South of Currie Road	Residential	480197	354544	1.5
R51	Manners Road	Residential	479519	354296	1.5
R52	North Gate, East of Water Lane	Residential	479935	354283	1.5
R53	Great North Road, South of A46	Residential	479614	354162	1.5
R55	Bar Gate	Residential	479762	354063	1.5
R57	Lombard Street, East of Mill Gate	Residential	479578	353829	1.5
R58	Mill Gate, East of Pelham Street	Residential	479504	353788	1.5
R59	Mill Gate, North of Pelham Street	Residential	479416	353706	1.5
R60	Mill Gate, West of Pelham Street	Residential	479306	353577	1.5
R61	Pelham Street	Residential	479554	353617	1.5
R64	Farndon Road	Residential	479092	353283	1.5
R65	Lombard Street, North of Carter Gate	Residential	479828	353720	1.5
R66	London Road East	Residential	479853	353679	1.5
R80	Newark Road	Residential	482361	354332	1.5

Receptor ID	Receptor name	Receptor type	British National Grid Coordinates		
			X	Y	Z
R91	The Ivies	Residential	478153	352837	1.5
R92	A46, South of Farndon Roundabout	Residential	478028	352627	1.5
R95	A46, South of Farndon Roundabout	Residential	478197	352326	1.5
R105	Coddington Road	Residential	482812	351986	1.5
R113	Fosse Way, South of Lodge Lane	Residential	472148	344691	1.5

Ecological receptors

5.5.42 Sensitive ecological designations located within 200 metres of roads affected by operational traffic have been considered in this assessment, in accordance with DMRB LA 105. Ecological receptors have been placed within the designated habitats at 10 metres intervals along transects, up to 200 metres of the road. The receptors have been modelled at a height of 0 metres, to represent worst-case exposure.

5.5.43 As per DMRB LA 105, designated sites considered in the assessment include Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), local nature reserves (LNRs), local wildlife sites (LWS), nature improvement areas, ancient woodlands and veteran trees.

5.5.44 There are 43 sensitive designated sites within 200 metres of the ARN of the Scheme, consisting of one LNR, one ancient woodland (which is also a LWS), eight veteran trees and 33 LWS:

- Devon Park Pastures Local Nature Reserve
- Spring Wood, Kelham Ancient Woodland and LWS
- Veteran tree close to Beaconsfield Drive
- Veteran tree close to The Grange
- Veteran tree close to St Nicholas's Church
- Veteran tree close to the east of Gainsborough Road
- Veteran tree close to Winthorpe Service Area
- Three veteran trees close to of Great North Road
- South Scaffold Lane, Collingham LWS
- Flintham Park LWS
- Potter Hill Plantation LWS
- Valley Farm Grassland LWS
- Kelham Road Grassland II LWS
- Lowfield Grassland, Balderton LWS
- Balderton Dismantled Railway South LWS
- Great North Road Grasslands LWS
- Beacon Hill Gypsum Workings LWS

- Coneygre Wood LWS
- Newark Golf Course LWS
- Langford Moor Area LWS
- Newark Grassland LWS
- The Fleet, South Muskham LWS
- Dairy Farm Railway Strip, Newark LWS
- Devon Park, Newark LWS
- Kelham Road Grassland LWS
- Queen's Sconce, Newark LWS
- Kelham Road Redoubt LWS
- Newark Dismantled Railway LWS
- Newark (Beet Factory) Dismantled Railway LWS
- Newark Trent Grassland LWS
- Kelham Road Redoubt Grassland LWS
- Hill Holt LWS
- Balderton Ballast Pit LWS
- Moorhouse Lane Drain LWS
- Moor Brats Drain, Coddington LWS
- The Beck, Caunton LWS
- Old Trent Dyke LWS
- Trent Banks/Wharves, Newark LWS
- River Devon (North of Cotham) LWS
- River Trent - Kelham LWS

5.5.45 However, following consultation with the competent expert for Biodiversity, it was confirmed that the final eight LWS listed above (from Balderton Ballast Pit LWS to River Trent-Kelham LWS) do not have any qualifying features sensitive to nitrogen deposition. As such, they have not been considered in this assessment.

5.5.46 Therefore, overall, 35 sensitive designated sites have been considered in the assessment, consisting of one LNR, one ancient woodland (which is also a LWS), eight veteran trees and 25 LWS.

5.5.47 Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028] presents the location of the sensitive ecological receptors in relation to the ARN.

Model outputs

5.5.48 The outputs from the dispersion modelling are the annual mean NO_x and PM_{10} roads contribution (in $\mu g/m^3$) at the selected sensitive human health and ecological receptor locations.

Post-processing of results

NOx to NO_2 relationship

5.5.49 Emission rates used within dispersion modelling are based on NOx to represent all nitrogen-oxygen species emitted in exhaust gases. The

proportion of NO_2 is needed for comparison with the air quality objectives presented in Table 5-1.

5.5.50 In accordance with Defra guidance[18], modelled road-traffic NOx has been converted to annual mean NO_2 using the Defra 'NOx to NO_2' calculator,[33] assuming traffic mix 'all other urban UK traffic'.

Model verification

5.5.51 Base year air quality predictions have been used to verify the model against air quality monitoring data. A model verification year of 2022 has been used, based on Scheme specific monitoring undertaken by the Applicant between May 2022 and November 2022 and local authority monitoring undertaken by Newark & Sherwood District Council, using the 2022 traffic data. Further detail on the Scheme specific monitoring survey is presented in Appendix 5.3 (Air Quality Monitoring Report) of the ES Appendices [APP-130], whilst further detail on the model verification is presented in Appendix 5.4 (Air Quality Model Verification Report) of the ES Appendices [APP-131].

Gap analysis

5.5.52 To ensure that the modelled roadside NO_2 concentrations are not too optimistic, and to account for uncertainties in predicted future roadside NO_2 concentrations, an additional scenario called the projected base year, has been included in the air quality modelling, to enable a gap analysis to be completed. This is in line with DMRB LA 105.

5.5.53 The gap analysis is the application of adjustment factors which take into consideration the assumed roadside rates of reduction in NOx and NO_2 by Defra's modelling tools compared to observed roadside monitoring trend ie the gap between the predicted reductions and those observed.

5.5.54 The projected base year scenario (using the base year traffic data) has been modelled using the opening year vehicle emission factors and opening year background concentrations. The final results for the opening year have then been adjusted accordingly, from the gap factors produced, to reflect the long-term trend profile. The Interim Highways Agency Long-Term Gap Analysis Calculator v1.1 (LTTE6) has been used to produce the gap factor and adjust the opening year results.

Background concentrations

5.5.55 Total air pollutant concentrations comprise a background and local component; both of which have to be independently considered for the air quality assessment. The background component is determined by regional, national and international emissions, and often represents a significant proportion of the total pollutant concentration. The local

[33] Defra (2020) NOx to NO_2 Calculator, Version 8.1 [online] available at: NOx to NO_2 Calculator | LAQM (defra.gov.uk) (Last accessed December 2023). Available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/. (Last accessed July 2024).

component is affected by emissions from sources such as roads and chimney stacks, which are less well mixed locally, and add to the background concentration.

5.5.56 Only road traffic emission sources have been explicitly included within the dispersion model. Non-road traffic related emission sources, such as industrial and domestic emissions, are included in Defra's background concentration maps and have been accounted for within the assessment by assigning appropriate 'background' concentrations to modelled receptor locations in accordance with Defra LAQM TG22 guidance.

5.5.57 A comparison between Defra backgrounds and monitored NOx concentrations has been undertaken for the two Newark & Sherwood District Council and nine Scheme-specific sites considered to be in background locations. The results from this comparison are presented below in Table 5-5. These sites are representative of air quality conditions across the study area and are therefore appropriate for the comparison.

5.5.58 In 2022, Defra background concentrations are lower than the monitored background concentrations across the 11 monitoring sites. Small differences in absolute concentrations between the Defra backgrounds and the monitored data can result in concentrations being underpredicted at modelled receptors. Therefore, the Defra NOx, NO_2 and PM_{10} background concentrations applied to this assessment have been uplifted by an average factor of 1.46 recorded for NOx, to improve the agreement with measured concentrations at the monitoring sites and ensure that concentrations are not underpredicted. This factor is greater than the factor recorded for NO_2 and was applied to the NOx, NO_2 and PM_{10} background concentrations as a conservative approach.

5.5.59 Further to this, where the study area modelled road links cover the majority of a background one kilometre grid square, 'in-grid' road sector emissions (i.e. 'motorway', 'trunk', 'primary' and/or 'minor' roads) have been removed from the background annual mean NOx and NO_2 concentration estimates using the Defra Sector Removal Tool Version v8.0.[34] This process has been undertaken to avoid double counting of road traffic emissions, which have already been predicted from the detailed dispersion modelling undertaken for the Scheme. Where traffic data is available only for a limited number of road links (eg at the edge of the study area, or where 'minor' roads are not available), road emissions have not been removed from background concentrations as a conservative measure.

[34] Defra (2020) NO_2 Adjustment for NOx Sector Removal Tool v8.0 [online] available at: NO2 Adjustment for NOx Sector Removal Tool | LAQM (defra.gov.uk) (last accessed December 2023).

Table 5-5: Comparison of 2022 monitored background NO_2 and NO_x concentrations and Defra background pollutant map data

Site ID	NOx concentration (µg/m^3)					NO_2 concentration (µg/m^3)				
	Monitored (Estimated)	Raw Defra background	Adjustment factor	Adjusted Defra background	Adjusted and sector removed Defra background	Monitored	Raw Defra background	Adjustment factor	Adjusted Defra background	Adjusted and sector removed Defra background
4N*	14.7	12.0	1.23	17.5	14.5	10.4	9.2	1.13	13.5	11.2
10N	24.8	15.5	1.61	22.6	19.7	16.0	11.6	1.38	17.0	14.9
A46_003	22.0	14.5	1.51	21.2	17.9	14.4	11.0	1.32	16.1	13.7
A46_004	23.5	14.5	1.62	21.2	17.9	15.3	11.0	1.39	16.1	13.7
A46_009	25.2	16.1	1.56	23.6	21.0	16.2	12.0	1.35	17.6	15.8
A46_016	21.7	15.5	1.40	22.6	19.7	14.3	11.6	1.23	17.0	14.9
A46_018	18.8	15.5	1.22	22.6	19.7	12.7	11.6	1.09	17.0	14.9
A46_023	22.2	12.9	1.71	18.9	16.4	14.6	9.9	1.47	14.4	12.6
A46_026	16.2	12.0	1.36	17.5	14.5	11.3	9.2	1.23	13.5	11.2
A46_027	14.6	12.0	1.22	17.5	14.5	10.4	9.2	1.13	13.5	11.2
Average factor			1.46					1.29		

Note: Annual data capture for all monitoring sites is 100%.
* 4N is noted as a 'Suburban' site, but was considered suitable for background adjustment due to its environmental setting.

Assessment of 1-hour NO_2 concentrations

5.5.60 For all sensitive human health receptors assessed, annual mean concentrations of NO_2 have been presented. Defra's Technical Guidance TG22[18] indicates that the hourly NO_2 air quality objective of 200 µg/m^3 (not to be exceeded more than 18 times per year) is unlikely to be exceeded at roadside locations where the annual mean concentration is less than 60 µg/m^3. Following this guideline, the hourly objective is not considered further within this assessment if the annual modelled mean NO_2 concentrations are found to be less than 60 µg/m^3.

Assessment of daily PM_{10} concentrations

5.5.61 The prediction of daily mean concentrations of PM_{10} is available as an output option within the ADMS-roads dispersion model for comparison against the short-term air quality objective. However, as the model output for annual mean concentrations is considered more accurate than the modelling of the daily mean, an empirical relationship has been used to determine daily mean PM_{10} concentrations. In accordance with TG22[18] the following formula has been used:

- No. of 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206 / annual mean)

5.5.62 Based on this formula, an annual mean PM_{10} concentration of 32 µg/m^3 equates to 35 days at or above 50 µg/m^3.

Assessment criteria for human health receptors

5.5.63 DMRB LA 105 provides advice for evaluating significant air quality effects at receptors. Receptors that have a reasonable risk of exceeding an air quality threshold have been assessed in both a DM and DS scenario.

5.5.64 In accordance with DMRB LA 105, a conclusion of no likely significant air quality effect for human health shall be recorded where the:

- outcomes of the air quality modelling for human health indicate that all concentrations are less than the air quality thresholds; and/or
- difference in concentrations is imperceptible ie less than 1% of the air quality threshold (e.g. 0.4 µg/m^3 or less for annual mean NO_2)

5.5.65 Where changes in concentrations are greater than 1% of the air quality threshold at qualifying receptors, then each receptor shall be assigned to one of the six boxes in Table 2.91 of DMRB LA 105, presented below in Table 5-6.

Table 5-6: Information for judgement of significant air quality effects of a scheme

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4 µg/m^3)	1 to 10	1 to 10
Medium (>2 µg/m^3 to 4 µg/m^3)	10 to 30	10 to 30
Small (>0.4 µg/m^3 to 2 µg/m^3)	30 to 60	30 to 60

5.5.66 Table 5-6 presents guideline bands, setting an upper level of likely significance and the lower level of likely non-significance, for the number of receptors affected by the Scheme. Between these two levels are the ranges where likely significance is more uncertain, therefore professional judgement would be required.

5.5.67 Where the total number of receptors is less than the lower guideline band for all of the magnitude of change categories, the Scheme is unlikely to trigger a significant air quality effect for human health. Where the total number of receptors is greater than the upper guideline band in any of the magnitude categories the Scheme shall trigger a significant air quality effect.

5.5.68 If the Scheme results in effects where the number of receptors falls between the lower and upper guideline bands for any of the magnitude of change criteria, the information in Table 5-6 will then be used along with the following key criteria to determine the overall evaluation of air quality significance:

- The absolute concentration at each receptor, for example is the modelled concentration 40 µg/m^3.
- How many receptors are there in each of the magnitude of change criteria, for example does the Scheme create more worsening than improvements.
- The magnitude of change in concentration at each receptor, for example 0.6 µg/m^3 vs 1.8 µg/m^3.

Assessment criteria for ecologically designated sites

Nitrogen deposition

5.5.69 There is a relatively new recommendation from the IAQM[35] and CIEEM[36] to consider the NH_3 contribution to nitrogen deposition from road traffic emissions. Whilst this is a relatively new area of

[35] Holman et al (2020). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1, Institute of Air Quality Management, London. Available at: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf. (Last accessed July 2024).
[36] CIEEM (2021) Advice on Ecological Assessment of Air Quality Impacts. Chartered Institute of Ecology and Environmental Management. Winchester, UK.[online] available at: Air-Quality-advice-note.pdf (cieem.net) (last accessed July 2024).

assessment, and the tools and methodology are being developed, this assessment has considered the contribution of NH_3 at ecological designations to nitrogen deposition from road vehicle emissions.

5.5.70 Deposition rates were calculated using empirical methods within Habitats Directive Guidance (AQTAG.06)[37] and the National Highways 'Ammonia Nitrogen Deposition Tool (v3)'. The calculation steps are as follows:

- Assign relevant dry deposition velocity to pollutant and habitat (m/s)
- NO_2: 0.0015 m/s for grassland, 0.003 m/s for forest
- NH_3: 0.02 m/s for grassland, 0.03 m/s for forest
- Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)
- Convert units from µg/m^2/s to units of kg/ha/yr by multiplying the dry deposition flux by standard conversion factors (95.9 for NO_2 and 260 for NH_3)
- Use 'Ammonia Nitrogen Deposition Tool (v3)' to calculate ammonia concentration and nitrogen deposition from road NOx
- Add predicted dry nitrogen deposition from NO_2 and NH_3 to get total nitrogen deposition process contribution (kg/ha/yr)

5.5.71 In accordance with DMRB LA 105, wet deposition for nitrogen does not need to be considered for the assessment of road schemes as it is not significant for short range emissions such as those emitted from vehicles. Therefore for the purposes of this assessment, wet deposition has not been considered.

5.5.72 Predicted contributions to nitrogen deposition were compared with the relevant critical load function for each habitat type associated with each designated site. The background nitrogen deposition rate at each designated site has been obtained from Air Pollution Information System (APIS), whilst the habitat type and critical load have been obtained from APIS where available or in consultation with a competent expert for Biodiversity.

5.5.73 For nitrogen deposition, the Scheme's contribution is assessed as a percentage change of the lower critical load for the habitat.

Assessment of significant effects

5.5.74 For ecologically designated sites, the determination of significant effects for nitrogen deposition has been undertaken in line with the flow chart at paragraph 2.98 of DMRB LA 105.

5.5.75 In accordance with DMRB LA 105, where the change in nitrogen deposition was greater than 0.4kg N/ha/yr for the Scheme, the competent expert for Biodiversity reviewed the air quality attribute

[37] Air Quality Advisory Group (2014) AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air. Available at: https://ukwin.org.uk/files/ea-disclosures/AQTAG06_Mar2014%20.pdf. (Last accessed July 2024).

target for the site to confirm whether it is 'restore' or 'maintain' and updated the assessment as necessary.

5.5.76 The competent expert for Biodiversity has then concluded whether the changes in nitrogen deposition are likely to trigger a significant air quality effect, considering Table 21 in the published nitrogen deposition dose response report by Natural England[38] in their assessment of significant air quality effects.

5.5.77 For designated habitats not included in this Natural England report, the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species (excluding nutrient impoverished sand dunes) has been used to inform the judgement of significant air quality effects.

5.5.78 This process has been followed by the competent expert for Biodiversity, as shown in Section 8.11 of Chapter 8 (Biodiversity) of this ES.

Compliance with the Ambient Air Quality Directive

Assessment of compliance risk

5.5.79 DMRB LA 105 provides guidance in relation to the assessment of the risk of the Scheme affecting reported compliance with the Air Quality Directive. The approach is set out in Figure 2.79 of DMRB LA 105 and has been followed in this assessment. To undertake the compliance risk assessment the following information is required:

- Air quality modelled results
- Defra's Pollution Climate Mapping (PCM) model outputs for the compliance road network
- Defra's zones and agglomeration maps

5.5.80 Defra uses the PCM model to report compliance with the Air Quality Directive (EU Directive 2008/50/EC). PCM projections are available for all years from 2018 to 2030 from the base year of 2018. In general, NO_2 concentrations decline into the future, mainly in response to cleaner vehicles and technologies, and actions in Defra's Air Quality Action Plan. The most recent PCM model was published in 2020.

5.5.81 To determine the study area for the compliance risk assessment, the air quality study area was compared to the compliance risk road network in the PCM model. A compliance risk assessment is then required where the two networks intersect, which then forms the basis for the assessment of compliance risk for an individual scheme.

5.5.82 There are road links from the PCM model within the study area for the Scheme but none that intersect the ARN (see Figure 5.2 (Air Quality Constraints) of the ES [AS-029]). The predicted concentrations

[38] Natural England Commissioned Report NECR210. 'Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance.' Available at: https://publications.naturalengland.org.uk/publication/5354697970941952. (Last accessed July 2024).

for the closest PCM model link to the ARN are 16.1 µg/m^3 for 2022 (the assessment base year) and 12.0 µg/m^3 for 2028 (the assessment opening year), which are both below the annual mean limit value of 40 µg/m^3 for NO_2. This demonstrates that the Scheme would not affect the UK's reported ability to comply with the Air Quality Directive[1] in the shortest timescales possible. The Scheme is therefore considered to meet the requirements set out in paragraph 5.9 of the 2015 NPSNN.

5.6 Assessment assumptions and limitations

5.6.1 The assessment has been based on the Scheme description and construction strategy presented in Chapter 2 (The Scheme) of this ES and has taken into account the lateral limits of deviation illustrated on the Works Plans [REP3-002] and vertical limits of deviation secured under Article 10 of the draft DCO [REP6-004] in order to establish a realistic worst case assessment scenario.

5.6.2 The air quality modelling predictions are based on the most reasonable assumptions and most robust and representative inputs in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with the model predictions, including:

- Uncertainties with model input parameters, such as surface roughness length and minimum Monin-Obukhov length[39]
- Uncertainties with traffic data
- Uncertainties with vehicle emission predictions
- Uncertainties with background air quality data
- Uncertainties with recorded meteorological data
- Simplifications made within post processing of the data that represent atmospheric dispersion or chemical reactions
- Uncertainties with assessing the NH_3 contribution to nitrogen deposition from road traffic emission. The tools used to undertake this assessment are provided by National Highways but are not currently included in DMRB LA 105.

5.6.3 In order to best manage these uncertainties, the air quality assessment has been undertaken with model verification against the latest available monitoring data for 2022 (both Scheme-specific and local authority monitoring data). The verification has been undertaken in line with TG22[18] produced by Defra. The verification process is done by comparing modelled and monitored pollutant concentrations and if necessary adjusting the model output to account for systematic bias. The adjustment factor derived in the model verification has then been added to the NO_2 and PM_{10} modelling outputs for the base year of the Scheme (2022) and NO_2 modelling outputs for the opening year of the Scheme (2028).

[39] Monon-Obukhov length describes the effect of buoyancy on atmospheric turbulence, and is described as the height at which turbulence is generated more by buoyancy than by wind shear.

5.6.4 The assessment has been verified using local authority monitoring data for 2022 and the air quality measurements from the Scheme-specific monitoring survey that was completed in November 2022.

5.6.5 Following the verification process for this Scheme, an overall Root Mean Square Error value of less than 10% is achieved, which is considered robust according to Defra TG22[18]. On this basis, the modelled results are considered appropriate to allow a robust professional judgement of significance to be determined. The model verification for this Scheme is presented in Appendix 5.4 (Air Quality Model Verification Report) of the ES Appendices [APP-131].

5.6.6 Further to this, the uncertainties associated with the model predictions for future years have also been addressed through applying LTT gap analysis factors to uplift opening year modelled concentrations, as described in paragraph 5.5.52 to 5.5.54 of this Chapter.

5.7 Study area

Construction phase

Construction dust

5.7.1 During the construction phase there would potentially be dust generating activities, such as earth moving and demolition. The distances from the emission source at which significant construction dust effects are likely to occur are dependent on the extent and nature of mitigation measures, the prevailing wind conditions, rainfall and the presence of screening. However, in accordance with DMRB LA 105, effects from construction activities that generate dust are generally limited to within 200 metres of the construction site boundary.

5.7.2 Therefore, following the advice set out in DMRB LA 105 and as agreed as part of the Scoping Opinion, sensitive features within 200 metres of any construction activities and site compounds have been identified, as part of the construction dust assessment. A total of approximately 2,150 sensitive human receptors and 20 designated sites (LWSs and veteran trees) were identified. The construction phase study area for the Scheme is presented within Figure 5.3 (Air Quality Construction Dust Buffer) of the ES Figures [AS-030] and the construction dust assessment is presented in Section 5.9 of this Chapter.

Construction traffic

5.7.3 During the construction phase, the Scheme would introduce new emission sources in the form of site plant, traffic from construction vehicles and the implementation of traffic management measures.

5.7.4 As detailed in the Outline Traffic Management Plan (TMP) [REP6-018], the traffic management measures include the following which are relevant to air quality considerations:

- Temporary overnight road closures between 21:00 and 06:00 on the A46 between Farndon Roundabout and Cattle Market Roundabout, Cattle Market Roundabout and Brownhills Roundabout, Friendly Farmer Roundabout and Brough Junction. The number of overnight road closures between these sections will vary. The greatest number of closures is expected to be on the A46 between Farndon roundabout and Cattle Market roundabout, where there will be approximately 22 closures throughout the 3 years.
- Temporary overnight road closures between 21:00 and 06:00 on a number of local roads, including Fosse Road, Farndon Road, A617 Kelham Road, A1133 and Drove Lane between Gainsborough Road junction and Winthorpe Roundabout. These road closures will be in place approximately four times a year for 3 years.
- Weekend closure of the A1 between North Muskham and Brownhills and Friendly Farmer roundabouts between 21:00 Friday to 05:00 Monday.
- The diversion routes for the road closures on the A46 would follow the current emergency diversion routes. These include the use of:

    - The A52 (between the A46 Saxondale junction and the A1 at Grantham) and the A1 (between Grantham and Brownhills and Friendly Farmer roundabouts).
    - The A616, B6325 Great North Road (between the Cattle Market Roundabout and the A1 at North Muskham) and the A1 (between North Muskham and Brownhills and Friendly Farmer roundabouts.
    - The A1 and A57 (between the Markham Moor junction and Saxilby Road Roundabout).

- Speed limit reductions across the A46 and nearby roads. This includes:

    - A temporary speed reduction from 60 miles per hour to 50 miles per hour on the A46 between a point 90 metres south of Farndon Roundabout and a point approximately 50 metres north of the Friendly Farmer Roundabout, throughout the construction duration of approximately 3 years.
    - A temporary speed reduction from 70 miles per hour to 50 miles per hour on the A46 between a point 50 metres north of the Friendly Farmer Roundabout and a point approximately 400 metres north of Winthorpe Roundabout throughout the construction duration of approximately 3 years.
    - A temporary speed reduction from 50 miles per hour to 40 miles per hour on the A617 Kelham Road between Cattle Market Roundabout and a point approximately 200 metres west, as well as on the A616 Great North Road, between Cattle Market Roundabout to a point approximately 150 metres north, for approximately 3 years.
    - Temporary speed reductions from 60 miles per hour to 40 miles per hour on Drove Lane between Newark Showground junction and Winthorpe Roundabout, as well as on the A1133 between Gainsborough Road junction and Winthorpe Roundabout, all for approximately 3 years.

- A temporary speed reduction from 60mph to 40mph on A17 between Godfrey Drive Roundabout and Friendly Farmer roundabout, for approximately 3 years.
- A temporary speed reduction from 60mph to 30mph on the B6326 between the Cattle Market Roundabout and the junction with Kelham Road, all for approximately 3 years.

5.7.5 As identified in DMRB LA 105, these traffic management measures have the potential to affect air quality at properties and designated sites within 200 metres of those locations. Appendix A of the Outline TMP [REP6-018] shows the locations of these traffic management measures. The impact of the traffic management measures on sensitive receptors have been considered qualitatively in Section 5.11.

Operational phase

5.7.6 The Scheme would alter parts of the existing road network through the widening of the A46 between Farndon and Winthorpe roundabouts, grade separation of the Cattle Market Roundabout and enlargement of the Winthorpe Roundabout. This would move emission sources closer to some receptors and further away from others in the vicinity of the Scheme. In addition, the Scheme would change the characteristics of traffic flows on the existing road network as the Scheme is predicted to increase capacity on the A46 between Farndon and Winthorpe.

5.7.7 Changes on the road network are predicted to increase traffic flows and reduce congestion on the A46, particularly between Farndon Roundabout and Brownhills Roundabout, as well as decreasing traffic on the A46 between Brownhills Roundabout and Friendly Farmer Roundabout, and in Newark town centre. Further detail on these changes, and reasons why they are expected to occur, are provided below in paragraphs 5.7.12 to 5.7.16 of this Chapter.

5.7.8 In accordance with paragraph 2.1 of DMRB LA 105 and as presented in paragraph 5.5.24, the following criteria have been applied to the DM and DS scenario traffic flows. These criteria have been used in order to identify which roads are likely to be affected by the Scheme (referred to as affected roads) to a degree that they require consideration within the air quality assessment.

5.7.9 The criteria are based on the changes between the DS traffic compared to the DM traffic in the opening year of 2028 and are as follows:

5.7.10 The criteria are:

- AADT >=1,000; or
- HDV AADT >=200; or
- a change in speed band; or
- a change in carriageway alignment by >=5 metres

5.7.11 Following a review of traffic data for the opening year (2028) of the Scheme, the affected roads identified for the air quality assessment include the section of the A46 between Bingham and Thorpe on the Hill (which is a distance of approximately 40 kilometres), as well as sections of other A roads connected to the A46 such as the A1, A17, A616, A617, and some local roads surrounding the Scheme such as in Newark town centre. These affected roads (the ARN) are all located within the area of detailed traffic simulation and are presented in Figure 5.4 (Air Quality Affected Road Network) of the ES Figures [AS-031]. Modelled traffic data used for the ARN has been provided in Appendix 5.2 (SATURN Traffic Data Report) of the ES Appendices [APP-129] and Figure 5.5 (Air Quality Summary of Traffic Data) of the ES Figures [AS-032].

5.7.12 The majority of roads in the ARN are expected to experience traffic changes of greater than 1,000 AADT and these primarily occur along the A46. The highest AADT increases of approximately 11,800 to 13,100 are predicted on the A46 between Farndon Roundabout and Brownhills Roundabout. These changes are due to increased capacity and reduced congestion on this section of the A46 as a result of the Scheme. The Scheme will provide a dual carriageway on the A46 between these two roundabouts as well as a new section of off-line dual carriageway to bypass the existing Brownhills Roundabout and Friendly Farmer Roundabout. This makes this section of the A46 a more favorable route than the nearby local roads, once the Scheme is operational.

5.7.13 There is also an increase in AADT traffic flows of more than 1,000 on Moor Lane and Haddington Lane, which are not connected to the main ARN. This has occurred due to the increase in traffic on the A46 as a result of the Scheme, which has subsequently led to increased delays at the Halfway House Roundabout for traffic travelling towards Newark-on-Trent on the A46. To avoid this, vehicles are expected to exit the A46 at the junction with Haddington Lane, travel along this road and Moor Lane, and then rejoin the A46 at Witham St Hughes via the Halfway Houses Roundabout.

5.7.14 Further to this, the ARN extends up to the border of the Traffic Reliability Area (TRA) in the vicinity of Bingham. The TRA is the area covered by the traffic model that the competent expert for traffic has identified as reliable for inclusion in the assessment and therefore where the traffic scoping criteria in this assessment has been applied. Up to the TRA boundary, in the vicinity of Bingham, there are expected to be changes of approximately 3,500 AADT and 380 HDV AADT on the A46. Beyond the TRA boundary, to the south of Bingham, the predicted change in traffic on the A46 is expected to exceed the DMRB LA 105 criteria between the A6097/A46 intersection and the A606 Melton Road/ A46 roundabout, which is an approximate 14 kilometres section of the A46. The competent expert for traffic has confirmed that this section of the A46 should not be included in the

study area as it is not within the TRA. Nonetheless, given that no significant effects (see Section 5.11 for further detail) at any of the sensitive human health and ecological receptors have been predicted within the study area, where changes in traffic flows and speeds are greatest, it is not expected that there would be any significant effects at predicted pollutants concentrations at human health and ecological receptors along this section of the A46.

5.7.15 The existing local road network is predicted to experience maximum decreases in AADT flows of approximately 21,400 on the A46 between the Brownhills Roundabout and Friendly Farmer Roundabout, and of approximately 18,200 on the A46 to the south of the new dual carriageway that will bypass these two roundabouts. Decreases are predicted at this section due to the dual carriageway bypass being a more attractive route for vehicles to take when travelling between Cattle Market Roundabout and Winthorpe Roundabout, due to its increased capacity and reduced congestion. This means that more vehicles are expected to use the dual carriageway bypass and fewer are expected to travel between the Brownhills Roundabout and Friendly Farmer Roundabout.

5.7.16 Decreases in AADT flows are also expected to occur in Newark-on-Trent, due to the A46 being a more appealing route for vehicles to take when travelling between Farndon and Winthorpe, as a result of lower levels of congestion.

5.7.17 There are predicted changes in speed on the A46 between Farndon Roundabout and Cattle Market Roundabout, which is due to the higher national speed limit for dual carriageways compared to the existing single lane, and reduction in congestion. On this section, speeds are predicted to increase by up to approximately 34 miles per hour (as a daily average) from approximately 34 miles per hour to 68 miles per hour.

5.7.18 The ARN for the operational phase of the air quality assessment is displayed in Figure 5.4 (Air Quality Affected Road Network) of the ES Figures [AS-031], whilst the modelled traffic data used to determine the ARN has been provided in Appendix 5.2 (SATURN Traffic Data Report) of the ES Appendices [APP-129].

5.7.19 The assessment has considered the effects at worst-case sensitive human health receptors (residential properties, a school and a hospital) and designated sites for ecology within 200 metres of affected roads, as presented in Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028]. Details of the receptors modelled can be found in Section 5.5 of this Chapter. A total of 30 human health receptors were selected from the 118 sensitive receptors located within 200 metres of the ARN, as these were the receptors predicted to experience the highest NO_2 concentrations and greatest change in NO_2.

5.7.20 Additional road links within 200 metres of affected roads have been included in the air quality dispersion model where their emissions contribute to total concentrations at identified receptors. These are presented in Figure 5.4 (Air Quality Affected Road Network) of the ES Figures [AS-031], and this approach is consistent with DMRB LA 105.

5.8 Baseline conditions

5.8.1 Information on air quality in the UK can be obtained from a variety of sources including local authorities, national network monitoring sites and other published sources. For this assessment, data has been obtained from Newark & Sherwood District Council, National Highways and Defra.

5.8.2 The most recent full year of monitoring data available for Newark & Sherwood District Council at the time of writing is for 2022. The monitoring data for the two years prior to this, 2020 and 2021, is unlikely to be representative of 'normal' conditions at the monitoring sites, due to the effects associated with the coronavirus (Covid-19) pandemic during those years when England was subject to periods of lockdowns and the influences this had on traffic. Therefore, this data is presented for reference only.

5.8.3 Local authority data for the year 2022 however is expected to be representative of 'normal' conditions, as it is not considered to have been affected by the coronavirus (Covid-19) pandemic. Therefore 2022 local authority data has been used to determine baseline conditions.

5.8.4 In addition to this, a Scheme-specific air quality monitoring survey that was undertaken for six months between May 2022 and November 2022, by the Applicant, has also been used to inform the baseline and to verify the detailed dispersion modelling assessment.

Local air quality management

5.8.5 There are no current or historical AQMAs declared within the administrative area of Newark & Sherwood, indicating Newark & Sherwood District Council has not monitored or modelled any exceedances of the air quality objectives at locations where there is relevant human exposure.

5.8.6 The closest AQMA to the Scheme is the Lincoln AQMA, located approximately 19 kilometres to the north-east of the Scheme, within Lincoln City Council's administrative area. As well as this, the Nottinghamshire City Council AQMA is located approximately 20 kilometres south-west of the Scheme, which encompasses the entirety of the Nottinghamshire City Council administrative area, and the South Kesteven District Council No 6 AQMA is located in the centre of Grantham, approximately 20 kilometres south-east of the Scheme. All of these AQMAs are declared for exceedances of NO_2 air quality

objectives. The ARN for the Scheme does not extend into any of these AQMAs (see Figure 5.2 (Air Quality Constraints) of the ES Figures [AS-029]). The nearest AQMA to the ARN is the Lincoln AQMA located approximately 7.5 kilometres north-east of the A46, outside of the study area for this assessment.

Automatic monitoring

5.8.7 Newark & Sherwood District Council does not undertake any automatic monitoring within the study area situated within Newark & Sherwood District Council's administrative boundary. PM_{10} was monitored at one location within Newark & Sherwood District Council in the centre of Newark-on-Trent until 2018. There were no monitored exceedances of PM_{10} at this site during the monitoring period and concentrations were well below annual and daily air quality objective levels.

Local authority diffusion tube monitoring

5.8.8 Newark & Sherwood District Council undertakes air quality monitoring using diffusion tubes at 13 sites within its administrative area. Of these sites, 12 are located within 0.6 kilometres of the Scheme or the ARN. The monitoring data collected at these locations between 2018 and 2022 are presented below in Table 5-7 of this Chapter. Further details on the diffusion tube monitoring undertaken is provided in Appendix 5.3 (Air Quality Monitoring Report) of the ES Appendices [APP-130].

5.8.9 As discussed in paragraph 5.8.2 of this Chapter, data for 2020 and 2021 appears to have been affected by national lockdowns implemented during the Covid-19 pandemic, as there is a large decrease from concentrations monitored in 2019. Concentrations monitored in 2022 are similar to those monitored in 2020 and 2021, however they are considered to be representative of 'normal' conditions post-coronavirus lockdowns.

5.8.10 There were no exceedances of the NO_2 annual mean air quality objective in 2022. The highest concentration of 26.6 µg/m^3 was monitored at location 16N, which is located on Brunel Drive/Lincoln Road. This tube is located less than 10 metres away from the Scheme alignment and 20 metres away from the closest receptor. The locations of the local authority monitoring sites are presented in Figure 5.6 (Air Quality Monitoring Locations) of the ES Figures [AS-033].

Table 5-7: Local authority diffusion tube monitoring

Site ID	British National Grid Co-ordinates		Site Type	Data Capture 2022 (%)	Annual Mean NO_2 Concentration (µg/m^3)				
	X	Y			2018[a]	2019[b]	2020[c]	2021[d]	2022
1N	479853	353696	Roadside	100.0	31.4	31.2	24.3	24.5	25.4
3N	481681	351500	Suburban	87.5	17.6	16.4	12.3	12.9	12.6
4N	477200	351900	Suburban[e]	100.0	14.8	14.4	10.8	10.8	10.4
5N	480400	355000	Roadside	100.0	29.9	29.0	21.0	22.9	22.3
6N	480006	353892	Urban Centre[f]	100.0	21.6	21.2	16.0	16.9	16.5
7N	480153	353320	Kerbside	87.5	30.3	28.5	21.8	25.9	25.2
9N	479778	353617	Roadside	100.0	28.6	27.9	19.7	22.7	22.1
10N	479859	354223	Urban Background	100.0	21.2	20.6	14.7	16.6	16.0
11N	481460	355900	Urban Background[g]	100.0	32.5	30.3	21.0	24.3	22.6
12N	479676	354016	Urban Centre	100.0	18.6	18.5	12.0	13.0	13.9
16N	481160	355585	Roadside	91.7	35.3	35.4	23.3	27.9	26.6
21N	480276	354029	Roadside	100.0	26.8	25.1	18.7	21.1	21.3

Source: Monitoring data between 2018 and 2021 has been obtained from 2022 Annual Status Report, Newark & Sherwood District Council. Monitoring data for 2022 has been obtained directly from Newark & Sherwood District Council.
Note: Results have been bias adjusted by Newark & Sherwood District Council to correct diffusion tube measurements. A national bias adjustment factor of 0.93 was used for 2018 and 2019 results, 0.81 for 2020, 0.84 for 2021 and 0.83 for 2022.
[a] Data capture for 2018 was between 25% and 100%. Data capture was 25% for diffusion tube 7N, 33.3% for 21N, 91.7% for 12N and 100% for the remaining diffusion tubes.
[b] Data capture for 2019 was between 79.2% and 100%.
[c] Data capture for 2020 was between 33.2% and 66.8%, data capture affected by Covid-19 pandemic.
[d] Data capture for 2021 was between 82.1% and 100%.
[e] Location is considered to be more representative of a 'urban background' location than 'suburban'. Therefore, this diffusion tube has been used for the background adjustment.
[f] Location is considered to be more representative of a 'roadside' location than 'urban centre'. Therefore, this diffusion tube has been used for the model verification.
[g] Location is considered to be more representative of a 'suburban' location than 'urban background'. Therefore, this diffusion tube has not been used for the background adjustment or model verification.

National Highways diffusion tube monitoring

5.8.11 A Scheme-specific diffusion tube monitoring survey was undertaken in 2022 to support the assessment and to update the Applicant's monitoring survey that had been undertaken previously in 2016. Monitoring was undertaken at 27 locations along the Scheme alignment and surrounding areas. The monitoring survey commenced in May 2022 and was completed in November 2022. Further detail on the monitoring survey is presented in Appendix 5.3 (Air Quality Monitoring Report) of the ES Appendices [APP-130].

5.8.12 The results from the 2022 survey were bias adjusted and annualised in accordance with Defra's LAQM TG(22)[18]. The results from this survey are presented below in Table 5-8.

5.8.13 There were no exceedances of the NO_2 annual mean air quality objective, with all concentrations below 40 µg/m^3. The greatest annual mean NO_2 concentration of 33.0 µg/m^3 was monitored at site A46_006, located on the A113 adjacent to Winthorpe Roundabout. The closest sensitive receptor to this monitoring site is R28, located approximately 310 metres to the north-east, adjacent to the A46. At this location, the annual mean NO_2 concentration for 2022 is predicted to be 24.6 µg/m^3 in the base year modelling. The annual mean NO_2 concentration for 2022 is predicted to be lower at the receptor than at the monitoring site due to its distance away from the roundabout.

5.8.14 The locations of the Scheme-specific monitoring sites are presented in Figure 5.6 (Air Quality Monitoring Locations) of the ES Figures [AS-033].

Table 5-8: Scheme-specific monitoring data undertaken by the Applicant

Site ID	British National Grid Co-ordinates		Site Type	Survey Period Data Capture	2022 Annual Mean Concentration (µg/m^3)[(a)]
	X	Y			
A46_001	481086	355814	Roadside	100.0	22.7
A46_002	481091	356285	Kerbside	100.0	26.0
A46_003	481396	356245	Urban background	100.0	14.5
A46_004	481775	356679	Urban background	100.0	15.3
A46_005	482495	356736	Roadside	100.0	19.5
A46_006	482247	356867	Roadside	100.0	33.0
A46_007	483292	357913	Roadside	100.0	12.6
A46_008	481111	355550	Roadside	100.0	29.6
A46_009	480619	355992	Urban background	100.0	16.2
A46_010	480392	355222	Roadside	100.0	17.4
A46_011	480731	355556	Roadside	100.0	15.2
A46_012	480893	355321	Roadside	100.0	21.2
A46_013	480565	355533	Roadside	66.7	15.4
A46_014	480670	354846	Kerbside	83.3	16.5
A46_015	480350	354727	Kerbside	100.0	24.5
A46_016	479781	354525	Urban background	100.0	14.3
A46_017	479321	354501	Roadside	100.0	16.5
A46_018	479177	354336	Urban background	100.0	12.7
A46_020	480069	354230	Roadside	100.0	24.7
A46_021	479553	353828	Roadside	100.0	23.9
A46_022	479214	353376	Roadside	100.0	16.9
A46_023	478240	352829	Urban background	100.0	14.6
A46_024	478287	352639	Roadside	100.0	22.9

Site ID	British National Grid Co-ordinates		Site Type	Survey Period Data Capture	2022 Annual Mean Concentration (µg/m^3)[(a)]
	X	Y			
A46_025	477807	352216	Roadside	100.0	16.7
A46_026	477295	351780	Urban background	100.0	11.3
A46_027	477014	351649	Urban background	100.0	10.4
A46_028	476463	354507	Kerbside	100.0	10.1

Note: Results have been bias adjusted and annualised.
[(a)] A national bias adjustment factor of 0.87 has been applied to the results to correct the diffusion tube measurements.

Defra background concentrations

5.8.15 Defra provides mapped future year projections of background pollution concentrations for NOx, NO_2, PM_{10} and $PM_{2.5}$ for each one kilometre grid square across the UK for all years between 2018 to 2030.[40] The maps include a breakdown of background concentrations by emission source, including road and industrial sources, which have been calibrated against 2018 (the baseline year) UK monitoring data. The maximum raw concentrations from across the grid cells containing the modelled human health receptors in the base year of 2022 are presented below in Table 5-9. The adjusted concentrations for the grid cell that each human health receptor is located within is provided in Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128] for NO_2 and PM_{10} for the base year of 2022 and for NO_2 for the opening year of 2028. There are no exceedances of air quality objectives.

Table 5-9: Maximum raw Defra background concentrations across the grid cells containing the modelled human health receptors

Year	Pollutant			
	NOx	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
2022	19.0	14.0	17.9	9.7

Source: Defra (2018)
Note: The background concentrations shown are for the following 1 kilometre squares: X 480500 Y 351500 for NOx, X 480500 Y 351500 for NO_2 and $PM_{2.5}$ and X 476500 Y 359500 for PM_{10}.

Limit value compliance

5.8.16 Defra uses the PCM model to report compliance with limit values as transposed into UK Law from Directive 2008/50/EC.[41] PCM projections are available for all years from 2018 to 2030 from the base year of 2018. In general, the model suggests NO_2 concentrations decline into the future, mainly in response to cleaner vehicles and technologies, and actions in Defra's Air Quality Action Plan. The most recent PCM model was published in 2020.

5.8.17 There are road links from the PCM model within the study area for the Scheme but none that intersect the ARN (see Figure 5.2 (Air Quality Constraints) of the ES Figures [AS-029]). The predicted concentrations for the closest PCM model link to the ARN is 16.1 µg/m^3 for 2022 (the assessment base year) and 12.0 µg/m^3 for 2028 (the assessment opening year), which are both below the annual

[40] Defra Background maps (2018) [online]. Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps. (Last accessed December 2023).

[41] European Union. (April 2008). Directive on Ambient Air Quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044 [online]. Available at: Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (legislation.gov.uk) (Last accessed December 2023).

mean limit value of 40 µg/m^3 for NO_2. This demonstrates that the study area is predicted to be compliant in the opening year.

Ecological designated sites

5.8.18 The habitat type, critical loads and background nitrogen deposition rates for designated sites sensitive to nitrogen within 200 metres of the ARN are presented below in Table 5-10. The background deposition rates reflect the 2019-2021 APIS data, which is the latest data available.

Table 5-10: Habitat type, critical loads and background nitrogen deposition for designated sites

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2019-21 background N-dep rate (average) (kg N/ha/yr)
Devon Park Pastures	LNR	Low and medium altitude hay meadows	20	21.76
Spring Wood, Kelham	Ancient woodland and LWS	Broadleaved, mixed and yew woodland	10	38.92
Beaconsfield Drive	Veteran Tree	Broadleaved, mixed and yew woodland)	10	38.94
The Grange	Veteran Tree	Broadleaved, mixed and yew woodland)	10	45.28
St Nicholas's Church	Veteran Tree	Broadleaved, mixed and yew woodland)	10	38.92
East of Gainsborough Road	Veteran Tree	Broadleaved, mixed and yew woodland)	10	40.93
Close to Winthorpe Service Area	Veteran Tree	Broadleaved, mixed and yew woodland)	10	40.93
East of Great North Road 1	Veteran Tree	Broadleaved, mixed and yew woodland)	10	38.74
East of Great North Road 2	Veteran Tree	Broadleaved, mixed and yew woodland)	10	38.74
East of Great North Road 3	Veteran Tree	Broadleaved, mixed and yew woodland)	10	38.74
South Scaffold Lane, Collingham	LWS	Hedgerow (APIS: Broadleaved deciduous woodland)	10	36.69
Flintham Park	LWS	Broadleaved, mixed and yew woodland	10	36.29
Potter Hill Plantation	LWS	Broadleaved, mixed and yew woodland	10	36.69
Valley Farm Grassland	LWS	Low and medium altitude hay meadows	20	21.76
Kelham Road Grassland II	LWS	Low and medium altitude hay meadows	20	21.76
Lowfield Grassland, Balderton	LWS	Low and medium altitude hay meadows	20	21.92
Balderton Dismantled Railway South	LWS	Neutral grassland	20	21.92
Great North Road Grasslands	LWS	Low and medium altitude hay meadows	20	21.76
Beacon Hill Gypsum Workings	LWS	Low and medium altitude hay meadows	20	21.92
Coneygre Wood	LWS	Broadleaved, mixed and yew woodland	10	36.29
Newark Golf Course	LWS	Non-Mediterranean dry acid and neutral closed grassland	10	21.74
Langford Moor Area	LWS	Dry Heaths	10	21.31
Newark Grassland	LWS	Low and medium altitude hay meadows	20	21.76
The Fleet, South Muskham	LWS	Rich Fen	15	25.56
Dairy Farm Railway Strip, Newark	LWS	Broadleaved deciduous woodland	10	38.74

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2019-21 background N-dep rate (average) (kg N/ha/yr)
Devon Park, Newark	LWS	Low and medium altitude hay meadows	20	21.76
Kelham Road Grassland	LWS	Low and medium altitude hay meadows	20	21.76
Queen's Sconce, Newark	LWS	Non-Mediterranean dry acid and neutral closed grassland	10	21.76
Kelham Road Redoubt	LWS	Low and medium altitude hay meadows	20	21.76
Kelham Road Redoubt	LWS	Low and medium altitude hay meadows	20	25.56
Newark Dismantled Railway	LWS	Broadleaved Deciduous Woodland	10	38.74
Newark (Beet Factory) Dismantled Railway	LWS	Low and medium altitude hay meadows	20	21.76
Newark Trent Grassland	LWS	Low and medium altitude hay meadows	20	21.76
Kelham Road Redoubt Grassland	LWS	Low and medium altitude hay meadows	20	21.76
Hill Holt	LWS	Broadleaved, mixed and yew woodland	10	36.69

Summary

5.8.19 There are no AQMAs in close proximity to the Scheme and the available monitoring data for the area show no exceedances of air quality objectives. A Scheme-specific NO_2 monitoring survey was undertaken in 2022 which indicated that air quality concentrations in the vicinity of the Scheme are all below the air quality objectives.

5.8.20 The Defra predictions also indicate that background concentrations at the Scheme do not exceed the relevant air quality objectives for all relevant pollutants.

5.8.21 Ambient pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ are generally predicted to decrease into the future, due to the uptake of cleaner vehicles and technologies; as such it is considered that air quality conditions in the vicinity of the Scheme are likely to improve and continue to meet the air quality objectives in future years.

5.9 Potential impacts

5.9.1 The following potential impacts from the Scheme have been identified for both the construction and operational stages.

Construction phase

Construction dust

5.9.2 During the construction phase there would potentially be dust generating activities, such as earth moving and demolition, within 200 metres of the construction site boundary. A construction dust assessment has therefore been undertaken in line with Table 2.58a and Table 2.58b of DMRB LA 105 in order to determine the construction dust risk potential of the Scheme to the receiving environment. This will subsequently be used to inform the measures required to support the mitigation required.

5.9.3 In accordance with Table 2.58a of DMRB LA 105, the construction dust risk potential of the Scheme is classified as ‘Large’, due to the Scheme being a *‘bypass improvement project’.*

5.9.4 The receiving environment sensitivity has been determined by identifying all sensitive human health receptors and designated habitats within 0-50 metres, 50-100 metres and 100-200 metres of the construction activity and site compounds, as presented in Table 5-11 below.

5.9.5 Based on the ‘Large’ construction dust risk potential of the Scheme, and the proximity of the human health and ecological receptors to the Scheme, the construction dust risk is considered to be ‘high’.

Table 5-11: Receiving environment sensitivity to construction dust

Receptor type	Distance from construction activities		
	0-50m	50-100m	100-200m
Human health	444	550	1,162
Ecological sites (LWSs and veteran trees)*	16	3	4

* Note - the ecological receptors have been included to the closest bands in which they fall, i.e. they may be present in more than one band.

Operational phase

5.9.6 The operational phase of the Scheme has the potential to directly affect air quality at human health receptors (residential properties, schools and hospitals) and ecological receptors and regional air quality as:

- The change in road layout and alignment associated with the Scheme has the potential to change the distance between vehicular emissions and receptors.
- The Scheme has the potential to change the flow, speed and composition of traffic on the road network, and so affect air quality beyond the physical extent of the Scheme.

5.10 Design, mitigation and enhancement measures

Mitigation measures – construction

5.10.1 Mitigation measures of relevance during construction are included within the First Iteration EMP [REP6-012] which will be developed into a Second Iteration EMP for implementation during construction of the Scheme. An Air Quality and Dust Management Plan will also be prepared in full as part of the Second Iteration EMP prior to construction commencing. Detail on the First and Second Iteration EMPs, including how mitigation is secured within the draft DCO [REP6-004], is provided within Section 4.4 of Chapter 4 (Environmental Assessment Methodology) of this ES. Those mitigation measures of relevance to air quality are detailed below.

5.10.2 Construction works would be carried out in accordance with the best practicable means, as described in Section 79 (9) of the EPA 1990, to reduce fumes or emissions which may impact upon air quality. Further details can also be found in the Statement Relating to Statutory Nuisances [APP-186]. As a minimum, the following measures are secured to prevent significant adverse effects during the construction phase:

- Avoid double handling of materials.
- Minimise height of stockpiles and profile to minimise wind-blown dust emissions and risk of pile collapse.

- Locate stockpiles out of the wind (or cover, seed or fence) to minimise the potential for dust generation.
- Ensure that all vehicles with open loads of potential dusty materials are securely sheeted or enclosed.
- Provide a means of removing mud and other debris from wheels and chassis of vehicles leaving the site. This may involve a simple coarse gravel running surface or jet wash, or in the case of a heavily used exit point, wheel washers.
- Maintain a low speed limit on site to prevent the generation of dust by fast moving vehicles.
- Damp down surfaces in dry conditions.
- Water to be sprayed during cutting/grinding operations.
- All vehicle engines and plant motors to be switched off when not in use.
- High dust generating activities within site compounds should be located as far away from nearby receptors as possible.

5.10.3 Further to this, as stated in Chapter 2 (The Scheme) of this ES, car sharing will be encouraged, and the main compound will also include bicycle storage, and bicycle and pedestrian access routes, to promote sustainable and active travel options.

Mitigation measures – operation

5.10.4 The results of the air quality assessment completed for this Scheme (presented in Section 5.11 of this Chapter) demonstrate that the Scheme would not have a significant air quality impact. This is because there will be no exceedances of the air quality objectives, no significant impacts at designated habitats or human health receptors and the Scheme would not affect reported compliance with the Air Quality Directive. On the basis of these conclusions no air quality mitigation is required.

Enhancement Measures

5.10.5 No enhancement measures have been identified for air quality.

5.11 Assessment of likely significant effects

5.11.1 The assessment of likely significant effects considers effects on air quality receptors, during construction and operation. These effects are determined following the incorporation of the essential mitigation measures outlined in Section 5.10 of this Chapter.

Construction

Assessment of construction dust

5.11.2 As mentioned in paragraph 5.9.5, the construction dust risk is considered to be ‘high’, due to the ‘large’ construction dust risk potential of the Scheme, and the close proximity of the human health

and ecological receptors to the Scheme. Nonetheless, the implementation of mitigation measures presented in paragraph 5.10.2 of this Chapter would minimise construction dust effects so that they are unlikely to result in significant effects at nearby receptors.

Assessment of traffic management

5.11.3 The assessment of construction phase effects has focused on the traffic management measures associated with the Scheme. Full details of all the construction traffic management measures discussed below can be found in the Outline TMP [REP6-018].

Temporary main carriageway closures

5.11.4 To allow for the installation of traffic management measures (such as contraflows, temporary road markings and installation/removal of the temporary earthworks), temporary overnight road closures between 21:00 and 06:00 hours would be implemented on the A46 between Farndon Roundabout and Cattle Market Roundabout, Cattle market roundabout and Brownhills roundabout, Friendly Farmer roundabout and Brough junction. The number of overnight road closures between these sections will vary. The greatest number of closures is expected to be on the A46 between Farndon roundabout and Cattle Market roundabout, where there will be approximately 22 closures throughout the 3 years.

5.11.5 As well as this, a weekend closure of the A1 between North Muskham and the Brownhills and Friendly Farmer roundabouts would be implemented between 21:00 Friday to 05:00 Monday for the installation of the new A1/A46 bridge deck.

5.11.6 The diversion routes for the road closures would follow the current emergency diversion routes. These include the use of:

- The A52 (between the A46 Saxondale junction and the A1 at Grantham) and the A1 (between Grantham and Brownhills and Friendly Farmer roundabouts).
- The A616, B6325 Great North Road (between the Cattle Market Roundabout and the A1 at North Muskham) and the A1 (between North Muskham and Brownhills and Friendly Farmer roundabouts).
- The A1 and A57 (between the Markham Moor junction and Saxilby Road Roundabout).

5.11.7 There are several towns, clusters of residential properties and a school within 200 metres of the diversion routes, as well as LWSs and veteran trees.

5.11.8 Overall, the longest anticipated road closure in terms of duration would be the weekend closure of the A1 between North Muskham and Brownhills and Friendly Farmer roundabouts (see paragraph 5.11.5 of this Chapter). It is anticipated that the closure and diversion routes would be implemented continuously between 21:00 Friday to 05:00 Monday, but would only occur once over the 3-year construction

period. As this traffic management measure is only expected to be in operation overnight for a small proportion of the construction period, it would not have a significant effect on AADT flows. Therefore, this traffic management measure would not have a significant effect on air quality at nearby sensitive receptors.

5.11.9 As such, due to the short-term and temporary nature of these road closures, it is unlikely that there would be a significant air quality effect associated with these traffic management measures.

Temporary local road closures

5.11.10 Temporary overnight road closures between 21:00 and 06:00 hours are proposed during the construction phase on a number of local roads, including Fosse Road, Farndon Road, A617 Kelham Road, A1133 and Drove Lane between Gainsborough Road junction and Winthorpe Roundabout. These road closures would be in place approximately four times a year for 3-years.

5.11.11 The air quality impact on all of these local roads associated with their closure and subsequent vehicle diversions would not result in any exceedances. This is because current annual mean NO_2 and PM_{10} concentrations in the study area (as presented in Section 5.7 of this Chapter and Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128]) are well below the relevant objectives and the road closures will only be in place for a small proportion of the construction period. Therefore, the temporary closures on these roads would not result in significant effects.

Speed limit reductions

5.11.12 A temporary speed reduction from 60 miles per hour to 50 miles per hour is proposed on the A46 between a point 90 metres south of Farndon Roundabout and a point approximately 50 metres north of the Friendly Farmer Roundabout, throughout the construction duration of approximately 3 years. As well as this, a temporary speed reduction from 70 miles per hour to 50 miles per hour is proposed on the A46 between a point 50 metres north of the Friendly Farmer Roundabout and a point approximately 400 metres north of Winthorpe Roundabout throughout the construction duration of approximately 3 years. Between Farndon Roundabout and Winthorpe Roundabout, AADT flows in the DM scenario are up to approximately 30,200. There are clusters of residential properties along and within 200 metres of the A46, as well as LWSs and veteran trees. However, the reduction in speeds would not affect total emissions for this section of carriageway and therefore the sensitive receptors in its vicinity, as vehicles travelling between 50 and 70 miles per hour are assigned the same emission rate in accordance with DMRB LA 105.

5.11.13 A temporary speed reduction from 50 miles per hour to 40 miles per hour is proposed on the A617 Kelham Road between Cattle Market Roundabout and a point approximately 200 metres to the west for 3

years. On this road, the AADT flows for the DM scenario are approximately 16,900. There are three LWSs but no sensitive human health receptors along this stretch of road. However, there are several residential receptors further away from the road which are within 200 metres. Further to this, a temporary speed reduction from 50 miles per hour to 40 miles per hour is proposed on the A616 Great North Road, between Cattle Market Roundabout and a point approximately 150 metres north, for approximately 3 years. On this road, the AADT flows for the DM scenario are approximately 13,300. There are three LWSs but no sensitive human health receptors along this stretch of road. However, there is a residential receptor further away from the road which is within 200 metres.

5.11.14 Temporary speed reductions from 60 miles per hour to 40 miles per hour are proposed on some roads. This includes Drove Lane between Newark Showground junction and Winthorpe Roundabout, and on the A1133 between Gainsborough Road junction and Winthorpe Roundabout, both for approximately 3 years. These roads have relatively low amounts of traffic, with the AADT flows in the DM scenario being approximately 2,900 and 7,800 respectively on Drove Lane and the A1133. There are no sensitive receptors within 200 metres of Drove Lane but there are sensitive human health receptors further away from the A1133, within 200 metres. In addition to this, the temporary speed reduction from 60 miles per hour to 40 miles per hour also includes the A17 between Godfrey Drive Roundabout and Friendly Farmer Roundabout, where AADT flows in the DM scenario are approximately 10,700 and sensitive human receptors and a veteran tree are located within 200 metres.

5.11.15 A temporary speed reduction from 60 miles per hour to 30 miles per hour is also proposed on the B6326 between the Cattle Market Roundabout and Kelham Road for approximately 3 years, where AADT flows in the DM scenario are approximately 13,400 and residential receptors are located within 200 metres.

5.11.16 The reduction in speeds from 50 and 60 miles per hour to 30 and 40 miles per hour would not have a significant effect on air quality. At these locations, existing pollutant concentrations are low, with the maximum annual mean NO_2 concentration recorded being 33.0 µg/m^3 at diffusion tube A46_006, located on the A113 adjacent to Winthorpe Roundabout. In addition, the emissions from LDVs are lower at 30 miles per hour whilst emissions from HDVs are higher. Considering the speed reductions are for short distances and would have the effect of reducing acceleration and engine load at these locations, there would be minimal change in overall emissions such that ambient concentrations would not change materially.

Significance of air quality effects associated with traffic management

5.11.17 Overall, the impacts associated with the traffic management measures which would be implemented during the construction phase

are not expected to result in significant air quality effects. This is because:

- The temporary road closures and diversions would only occur for very short periods of time and therefore would not affect annual NO_2 or PM_{10} concentrations.
- Speed limit reductions will result in a constant free flow speed which would likely result in lower vehicle emissions than during normal operation.

Operation

Overview - human health

5.11.18 Total NO_2 concentrations were predicted for the base year, opening year DM and DS scenarios. The total concentrations of NO_2 predicted in all scenarios and at receptors with the highest NO_2 concentrations and greatest change in NO_2 are shown below in Table 5-12.

5.11.19 The Scheme is predicted to cause both increases and decreases in NO_2 concentrations at modelled receptors due to changes in traffic characteristics on the ARN as well as changes in the distance between receptors and the main A46 carriageway. The changes in traffic flows are primarily due to traffic rerouting from local roads onto the A46 due to the improvements in road capacity and reductions in congestion as a result of the Scheme.

5.11.20 Across all modelled receptors annual mean NO_2 concentrations are well below 40 µg/m^3 in both the DM and DS scenarios. The greatest DS concentration is predicted at the residential receptor R53, which has a predicted annual NO_2 concentration in 2028 of 31.9 µg/m^3.

5.11.21 In accordance with Defra's TG22 guidance,[18] as all predicted annual mean concentrations on NO_2 are well below 60 µg/m^3, no exceedances of the 1-hour NO_2 objective are predicted.

5.11.22 Air quality effects at the receptors with the highest NO_2 concentrations and greatest change in NO_2 are discussed in detail in paragraphs 5.11.23 to 5.11.32 below. The locations of the receptors discussed are presented in Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028].

Table 5-12: Air quality assessment results at human receptors for NO_2 (µg/m^3) in Base, DM and DS scenario

Receptor ID	X	Y	Base Year (2022)		Opening Year (2028)			Change
			Background	Total	Background	DM Total	DS Total	
R19	478854	357007	11.7	19.6	10.0	18.0	18.7	0.7
R22	475127	355483	10.5	15.9	9.2	14.6	15.2	0.6
R24	477252	355723	11.4	30.6	10.0	28.0	29.0	1.0
R25	477496	355678	11.4	21.8	10.0	19.8	20.3	0.5
R26	478794	356089	11.6	17.8	10.1	16.4	16.9	0.5
R30	481032	356231	13.7	20.2	11.7	18.7	19.2	0.5
R33	480509	355936	15.8	19.7	13.8	18.0	18.5	0.5
R36	481020	355893	15.7	24	13.7	22.0	20.1	-1.9
R37	481456	355909	15.7	32.5	13.7	30.0	27.9	-2.1
R38	481469	355871	15.7	33.1	13.7	30.6	29.6	-1.0
R39	481126	355761	15.7	25.6	13.7	23.5	21.6	-1.9
R49	480197	354544	17.1	24.6	15.0	23.0	21.5	-1.5
R51	479519	354296	14.9	22	13.0	20.1	22.1	2.0
R52	479935	354283	14.9	27.9	13.0	26.2	24.4	-1.8
R53	479614	354162	14.9	30.8	13.0	28.0	31.9	3.9
R55	479763	354059	14.9	28.3	13.0	26.1	25.1	-1.0
R57	479578	353829	16.3	27	14.2	25.0	23.2	-1.8
R58	479504	353788	16.3	26	14.2	25.4	21.8	-3.6
R59	479416	353706	16.3	22.5	14.2	21.1	19.6	-1.5
R60	479306	353577	16.3	20.8	14.2	19.3	18.1	-1.2
R61	479554	353617	16.3	20.1	14.2	17.9	19.0	1.1
R64	479092	353283	16.3	24.3	14.2	21.2	19.5	-1.7
R65	479828	353720	16.3	27.2	14.2	24.9	23.3	-1.6
R66	479853	353679	16.3	25.4	14.2	22.7	21.5	-1.2
R80	482361	354332	13.6	31.1	11.8	29.5	28.9	-0.6
R91	478153	352837	12.6	18.8	10.9	17.3	18.3	1.0
R92	478028	352627	12.6	16.5	10.9	15.1	15.6	0.5
R95	478197	352326	12.6	17.9	10.9	16.3	16.9	0.6
R105	482812	351986	12.1	28	10.4	27.5	26.4	-1.1
R113	472148	344691	11.2	18.8	9.5	18.0	18.5	0.5

Note: A height of 1.5m has been modelled for all human health receptors

Scheme extent - human health

5.11.23 The section of the A46 and surrounding roads is located between Farndon and Winthorpe, encompassing the full extent of the Scheme. Along this section, there are increases in vehicle flows of approximately 13,000 AADT, from approximately 30,000 AADT to 43,000 AADT (see Appendix 5.2 (SATURN Traffic Data Report) of the ES Appendices [APP-129] for further details).

5.11.24 The alignment of the main A46 carriageway is different between the DM and DS scenario; the A46 carriageway alignment (and therefore the emission source) is closer to some receptors in the DS scenario than DM scenario, such as Receptor 30 which is close to Brownhills Junction. This is demonstrated in Figure 5.5 (Air Quality Summary of Traffic Data) of the ES Figures [AS-032].

5.11.25 Furthermore, on this section of the A46, the change in annual mean NO_2 concentrations at receptors is primarily due to changes in AADT, with the impacts of changes in speed bands and distance of the A46 carriageway from receptors being less widespread. For example, the Scheme would reduce congestion near Winthorpe and between Farndon Roundabout and Cattle Market Roundabout, which would result in speed bands changing due to the speeds increasing from approximately 43 miles per hour to 65 miles per hour. However, between Cattle Market Roundabout and Brownhills Roundabout, there are no changes in speed bands, although the speeds are predicted to increase slightly from approximately 43 miles per hour to approximately 47 miles per hour.

5.11.26 The greatest increase in annual mean NO_2 concentrations in the opening year for the Scheme extent is predicted at Receptor 51 on B6326 Great North Road, where there is predicted to be an increase in annual mean NO_2 concentrations of 2.0 µg/m^3 between the DM and DS scenarios. This is because the receptor is located approximately 3 metres away from the edge of Great North Road where there is an expected increase of approximately 4,400 AADT on this road as a result of the Scheme, from approximately 13,400 to 17,800. Nevertheless, predicted concentrations remain below the air quality objective.

5.11.27 The greatest improvement in annual NO_2 concentrations in the opening year is predicted at Receptor 37 which is located approximately 15 metres to the south of the A46, in between the Friendly Farmer Roundabout and Brownhills Roundabout (the receptor is approximately 70 metres to the west and approximately 260 metres to the east of each roundabout respectively). At this receptor, it is predicted that there will be a decrease in annual NO_2 concentrations of 2.1 µg/m^3 between the DM and DS scenarios. Reductions of approximately 21,400 AADT are predicted on the A46 approximately 15 metres to the north of the receptor, which includes approximately 3,250 HDVs. As mentioned in paragraph 5.7.15 of this Chapter, this is

the largest decrease in AADT flows, which is expected due to the new bypass being a more attractive route for vehicles to take when travelling between Cattle Market Roundabout and Winthorpe Roundabout, due to its increased capacity and reduced congestion. This means that more vehicles are expected to use the new bypass and fewer are expected to travel between the Brownhills Roundabout and Friendly Farmer Roundabout. However, it is considered that the predicted decrease in annual NO_2 concentrations of 2.1 µg/m^3 between the DM and DS scenarios is relatively small given the large changes in AADT flows on this section of the A46. This could be due to the predominant wind direction, which is from the south-west, and would mean that the air pollutants from the A46 would be transported away from the receptor. However, this also means that the air pollutants from the A1 slip road approximately 55 metres to the south of the receptor (expected to increase by 1,350 AADT between the DM and DS scenarios) would be transported towards the receptor.

5.11.28 Annual mean NO_2 concentrations at all modelled receptors within the Scheme extent are expected to be well below the annual objective in both the DM and DS opening year scenarios. The maximum annual mean NO_2 concentration of 29.6 µg/m^3 is predicted at Receptor 38 in the DS scenario. This receptor has the highest modelled concentrations in the DS due its proximity to the A1 and A46 (it is located approximately 15 metres to the north of the A1 slip road and approximately 55 metres to south of the A46 between the Friendly Farmer Roundabout and Brownhills Roundabout) and the predominant wind direction being from the south-west, which transport air pollutants from the road towards the receptor. As the receptor is also located close to the Friendly Farmer roundabout, it is affected by additional emissions generated by congested traffic in the DM scenario. Nevertheless, due to the Scheme, annual mean NO_2 concentrations are predicted to decrease at Receptor 38, from 30.6 µg/m^3 in the DM scenario to 29.6 µg/m^3 in the DS scenario. This is due to vehicles being expected to use the new bypass with fewer vehicles being expected to travel along the A46 between the Brownhills Roundabout and Friendly Farmer Roundabout to the north of the receptor.

Wider study area - human health

5.11.29 This section discusses the air quality impacts for the wider study area, which covers the ARN beyond the Scheme extent. This includes the A46 south of Farndon down to Bingham and to the north of Winthorpe up to Thorpe on the Hill, and also on major and local roads to the north-west and south-east of the A46). In the wider study area on the A46, there are increases in traffic flows of approximately 1,000 to 4,800 AADT. In other sections of the wider study area in Newark-on-Trent, the traffic flow reduces by approximately 1,200 to 4,700 AADT. There are very few changes in the speed bands along these sections of road between the DM and DS because they are outside

the Scheme extent. Therefore, changes in NO_2 concentrations are mostly associated with changes in AADT and not changes in speeds.

5.11.30 The greatest increase in annual mean NO_2 concentrations in the opening year across the whole study area is predicted at Receptor 53 on B6326 Great North Road, which is the road Receptor 51 is also located on, as mentioned above in paragraph 5.11.26. At Receptor 53, there is predicted to be an increase in annual mean NO_2 concentrations of 3.9 µg/m^3 between the DM and DS scenarios. This is because the receptor is located approximately 5 metres away from the edge of Great North Road where there is an expected increase of approximately 4,400 AADT on this road as a result of the Scheme, from approximately 13,400 to 17,800. The receptor is also located to the north-east of the roadside, and as the predominant wind direction is from the south-west, the air pollutants from the vehicles on the road would be transported towards the receptor. Nevertheless, predicted concentrations remain below the air quality objective.

5.11.31 The greatest improvement in annual NO_2 concentrations in the opening year for the wider study area is predicted at Receptor 58 on Mill Gate where there is predicted to be a decrease in annual NO_2 concentrations of 3.6 µg/m^3 between the DM and DS scenarios. There is a decrease in AADT flows of approximately 800 and a decrease in HDV AADT flows of approximately 190. As well as this, despite there being few changes in the speed bands in the wider study area, there is a change in speed in the AM, Inter-Peak (IP) and PM peak periods from heavy congestion to light congestion on Mill Gate, with the speeds increasing from between 2.7-4.3 miles per hour to 13.9-14.3 miles per hour. The increase in speeds is due to the level of congestion being lower in the DS scenario, as a result of traffic flows in central Newark-on-Trent being rerouted onto the A46.

5.11.32 Annual mean NO_2 concentrations at all modelled receptors within the wider study area are expected to be well below the annual objective in both the DM and DS opening year scenarios. A maximum DS concentration of 31.9 µg/m^3 is predicted at Receptor 53 on Great North Road, where the greatest increase in concentrations is also predicted, as described above.

Designated habitats

5.11.33 Nitrogen deposition calculations were undertaken for all modelled ecological receptors in line with DMRB LA 105 and included contributions of ammonia from traffic. Figure 5.1 (Air Quality Receptors) of the ES Figures [AS-028] shows the locations of the modelled ecological receptors.

5.11.34 A summary of the nitrogen deposition results with contributions of ammonia from traffic are presented in Table 5-13, whilst the full set of results with and without contributions is presented in Appendix 5.1 (Air Quality Receptor Results) of the ES Appendices [APP-128].

5.11.35 The nitrogen deposition results in the opening year (2028) DS scenario show that with contributions of ammonia from traffic, there are 14 designated habitats that have a predicted change in nitrogen deposition of more than 0.4kg N/ha/yr and a predicted total deposition rate above the lower critical load. These designated habitats consist of two veteran tree locations and 12 LWSs (one of which includes an area of ancient woodland), as presented in Table 5-13 below. As these designated habitats have the potential to be adversely affected by changes in nitrogen deposition, they have been assessed by the competent expert for Biodiversity in Section 8.11 of Chapter 8 (Biodiversity) of this ES, which found that changes caused by the Scheme were not significant. The increase in nitrogen deposition during the operation of the Scheme is not anticipated to affect the integrity of any of the nitrogen sensitive habitats within designated sites, or, subsequently, the animal species they support.

Table 5-13: Summary of ecological receptors with potential significant effects, with ammonia emissions from traffic considered

Designated site name	Receptor ID with greatest change in N deposition	Lower critical load (CL) (kg N/ha/yr)	Average background N deposition	DM total N deposition (kg N/ha/yr)	DS total N deposition (kg N/ha/yr)	Change in N deposition (DS-DM) (kg N/ha/yr)
Flintham Park	Eco_01	10	36.3	59.9	62.0	2.1
Coneygre Wood	Eco_20	10	36.3	45.3	46.1	0.8
Dairy Farm Railway Strip, Newark	Eco_106	10	38.7	46.6	54.1	7.6
Great North Road Grasslands	Eco_190	20	21.8	30.4	32.4	1.9
Valley Farm Grassland	Eco_208	20	21.8	28.5	29.0	0.5
Kelham Road Grassland	Eco_232	20	21.8	29.5	30.1	0.6
Spring Wood, Kelham	Eco_259	10	38.9	45.7	46.8	1.1
Newark Grassland	Eco_296	20	21.8	31.4	32.9	1.5
Kelham Road Grassland II	Eco_301	20	21.8	28.0	28.7	0.7
Newark (Beet Factory) Dismantled Railway	Eco_336	20	21.8	24.1	24.6	0.5
Newark Dismantled Railway	Eco_346	10	38.7	41.9	42.5	0.5
South Scaffold Lane, Collingham	Eco_392	10	36.7	45.5	46.1	0.5
Veteran tree close to east of Great North Road 1	VT_03	10	38.7	43.3	43.9	0.6
Veteran tree close to east of Great North Road 3	VT_04	10	38.7	43.2	43.8	0.7

Note: Arithmetic discrepancies occur due to rounding of results. N refers to nitrogen.

Significance of air quality effects

Human health

5.11.36 Table 5-14 presents the number of properties within each magnitude of change category for the Scheme.

Table 5-14: Number of properties above the annual mean NO_2 objective with a change in air quality

Magnitude of change in annual mean (µg/m^3)	Number of receptors with:	
	Worsening of an air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4 µg/m^3)	0	0
Medium (>2 µg/m^3 to 4 µg/m^3)	0	0
Small (>0.4 µg/m^3 to 2 µg/m^3)	0	0

5.11.37 As discussed in paragraph 5.11.20, there are no receptors which are expected to experience exceedances of the annual mean NO_2 objective in the DM or DS scenario in the opening year (2028) of the Scheme; all modelled receptors are expected to experience annual mean NO_2 concentrations which are well below 40 µg/m^3.

Compliance risk assessment

5.11.38 As detailed in paragraph 5.5.82 of this Chapter, there are road links from the PCM model within the study area for the Scheme but none that intersect the ARN (see Figure 5.2 (Air Quality Constraints) of the ES Figures [AS-029]). The predicted concentrations for the closest PCM model link to the ARN are 16.1 µg/m^3 for 2022 (the assessment base year) and 12.0 µg/m^3 for 2028 (the assessment opening year). These concentrations are below the annual mean limit value of 40 µg/m^3 for NO_2 and are expected to continue declining in the future. This demonstrates that the Scheme would not affect the UK's reported ability to comply with the Air Quality Directive[1] in the shortest timescales possible.

Designated habitats

5.11.39 The nitrogen deposition results show that with contributions of ammonia from traffic, ecological receptors within two veteran tree locations and 12 LWSs (one of which includes an area of ancient woodland), have a predicted change in nitrogen deposition of more than 0.4kg N/ha/yr and a predicted total deposition rate above the lower critical load.

5.11.40 As these designated habitats have the potential to be adversely affected by changes in nitrogen deposition, they have been assessed

by the competent expert for Biodiversity in Section 8.11 of Chapter 8 (Biodiversity) of this ES, which found that changes caused by the Scheme were not significant The increase in nitrogen deposition during the operation of the Scheme is not anticipated to affect the integrity of any of the nitrogen sensitive habitats within designated sites, or, subsequently, the animal species they support.

Summary

5.11.41 Overall, it is concluded that there are no significant air quality effects as a result of the Scheme. This is due to there being no adverse small, medium or large impacts where an air quality objective is already exceeded or where an exceedance is created as a result of the Scheme. The highest annual mean NO_2 concentration is 31.9 µg/m^3 in the DS scenario, which is well below the objective. The Scheme also does not affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible.

5.11.42 Ecological receptors that have the potential to be adversely affected by changes in nitrogen deposition have been assessed by the competent expert for Biodiversity in Chapter 8 (Biodiversity) of this ES who found that changes caused by the Scheme were not significant.

5.12 Monitoring

5.12.1 During the construction phase of works, and in accordance with Requirement 3 of the draft DCO [REP6-004] a Second Iteration EMP will secure the monitoring requirements and procedures to reduce or eliminate impacts on the environment.

5.12.2 No significant adverse effects are anticipated as a result of the Scheme, therefore no additional air quality monitoring for significant effects is required.

5.13 Conclusions

5.13.1 A qualitative assessment of potential dust effects for the Scheme has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200 metres of the study area. Potential dust impacts would be suitably controlled using the best practice mitigation measures set out within the First Iteration EMP [REP6-012] which will be developed into the Second Iteration EMP prior to and for implementation during construction. A qualitative assessment of the impacts associated with the construction traffic management measures has also been undertaken and concluded that, due to the temporary nature of the measures, there are not expected to be significant air quality effects at nearby receptors during the construction phase.

5.13.2 An assessment has been undertaken to assess the air quality impact during the operation of the Scheme at receptors, using an atmospheric dispersion model. The model has been verified against air quality monitoring data and has been used to estimate the air quality impacts of changes in traffic associated with the Scheme.

5.13.3 Concentrations across human health receptors are expected to be well below the NO_2, PM_{10} and $PM_{2.5}$ air quality objectives. The predicted effects from the operation of the Scheme on air quality at human health receptors are therefore concluded to be not significant, so no mitigation measures are proposed. The Scheme also does not affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible.

5.13.4 Ecological receptors that have the potential to be adversely affected by changes in nitrogen deposition have been assessed by the competent expert for Biodiversity in Chapter 8 (Biodiversity) of this ES which found that changes caused by the Scheme were not significant.

5.13.5 Considering the results presented in this assessment the Scheme is consistent with national and local planning policy with respect to air quality.

5.14 References

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