A47 Wansford to Sutton Dualling

Scheme Number: TR010039

Volume 6
6.1 Environmental Statement
Chapter 5 – Air Quality

APFP Regulation 5(2)(a)

Planning Act 2008

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

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Infrastructure Planning

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

A47 Wansford to Sutton Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT
Chapter 5 – Air Quality

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5.1. Introduction

5.1.1. Highways England (the Applicant) has submitted an application for a development consent order (DCO) for the A47 Wansford to Sutton Scheme (hereafter referred to as 'the Proposed Scheme'). The Proposed Scheme comprises the dualling of a section of the A47 between Wansford to Sutton; improvements to the A47 Wansford junction; creation of the A47 Sutton Heath roundabout to replace the Nene Way roundabout; associated side road alterations; and walking, cycling and horse-riding connections.

5.1.2. This section of A47 road is currently unable to cope with the high traffic volume and there are limited opportunities to overtake slower moving vehicles on the single carriageway. The Proposed Scheme aims to reduce congestion related delay, improve journey time reliability and increase the overall capacity of the A47. Full details of the Proposed Scheme are provided in Environmental Statement Chapter 2 (The Proposed Scheme) (**TR010039/APP/6.1**).

5.1.3. The key elements of the Proposed Scheme include:

- approximately 2.6km of new dual carriageway constructed largely offline of the existing A47, including the construction of two new underpasses
- a new free-flow link road connecting the existing A1 southbound carriageway to the new A47 eastbound carriageway
- a new link road from the Wansford eastern roundabout to provide access to Sacrewell Farm, the petrol filling station and the Anglian Water pumping station
- closure of the existing access to Sacrewell Farm with a new underpass connecting to the farm from the link road provided
- a new slip road from the new A47 westbound carriageway also providing access to the petrol filling station
- a link road from the new A47 Sutton Heath roundabout, linking into Sutton Heath Road and Langley Bush Road
- new junction arrangements for access to Sutton Heath Road and Langley Bush Road
- closure of the existing accesses to the A47 from Sutton Heath Road, Sutton Drift and Upton Road
- new passing places and limited widening along Upton Drift (also referenced as Main Road)
- new walking and cycling routes, including a new underpass at the disused railway
- new safer access to the properties on the A1, north of Windgate Way
- installation of boundary fencing, safety barriers and signage
- new drainage systems including:
    - two new outfalls to the River Nene

  - a new outfall to Wittering Brook
  - extension of the A1 culvert at the Mill Stream
  - realignment and extension of the A47 Wansford sluice
  - drainage ditch interceptors
  - new attenuation basins, with pollution control devices, to control discharges to local watercourses
- River Nene compensatory flood storage area
- works to alter or divert utilities infrastructure such as electricity lines, water pipelines and telecommunications lines
- temporary compounds, material storage areas and vehicle parking required during construction
- environmental mitigation measures

5.1.4. Under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, the Proposed Scheme is an Environmental Impact Assessment (EIA) development and as such requires submission of an Environmental Statement (ES) presenting the likely significant environmental effects of the Proposed Scheme.

5.1.5. Air quality is a consideration when the introduction of a scheme results in a change of emissions in the air. Air quality is assessed by measuring concentrations of select pollutants in the air, and the impact these pollutants have on sensitive receptor locations at relevant human and ecological exposure. These pollutants include nitrogen oxides (NO_x) nitrogen dioxide (NO_2) and particulate matters (PM_{10} and $PM_{2.5}$), all which originate from vehicle exhaust emissions.

5.1.6. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter reports the potential significant effects for Air Quality as a result of the Proposed Scheme. This assessment includes a review of the existing baseline conditions and considers the potential impacts of air quality associated with the Proposed Scheme on human health and ecosystems.

5.1.7. The approach to this assessment follows the Scoping Report (February 2018) (**TR010039/APP/6.5**) and subsequent issued Scoping Opinion (March 2018) (**TR010039/APP/6.6**) for the Proposed Scheme. The approach follows the most up to date guidance in the Design Manual for Roads and Bridges (DMRB), LA 105 Air Quality (hereafter referred to as LA 105).

5.1.8. The main chapter text is supported by appendices 5.1 to 5.3 (**TR010039/APP/6.3**) which contain:

- 5.1 – Air quality modelling process

- 5.2 – Air quality verification and model adjustment
- 5.3 – Receptor results

5.2. Competent expert evidence

5.2.1. The competent expert for this chapter and all supporting appendices is an air quality specialist (BSc, Member of the Institute of Air Quality Management (MIAQM) and a Full Member of the Institution of Environmental Sciences (MIEnvSc)) with over 25 years' experience in the air quality field. They have prepared multiple road traffic assessments following best practice for EIA over the length of their career and have used their EIA knowledge and professional judgement in identifying the likely significant impacts associated with the Proposed Scheme and providing technical guidance through the assessment process.

5.3. Legislation and policy framework

5.3.1. Throughout this assessment EU limit values have applied notwithstanding the UK's withdrawal from the European Union and the end of the Transition Period. The limit values continue to have legal effect by virtue of EU Exit legislation. It is understood that the Environment Bill should receive Royal Assent in Autumn 2021 and that a new framework for air quality will be developed following that although it is not known if a different approach to limit values will be taken. Therefore, EU limit values will continue to apply unless and until Parliament legislates otherwise. The protection of public health is covered by the following criteria:

- Legally binding mandatory limit values set by the European Union (EU) – implemented by the Air Quality Standards Regulations 2010.
- Objectives outlined in the UK National Air Quality Strategy (NAQS) where local authorities are required to achieve the limit values set by the EU – implemented by the 2015 Air Quality (England) Regulations.
- The air quality limit values relevant to this assessment are outlined in Table 5.1. The National air quality objectives (AQO) for nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) are the same for the EU limit values.

Table 5.1: Air quality objectives for NO_2 and PM_{10} for protection of human health

Pollutant	Air quality objectives	
	Concentration	Averaging time
NO_2	200 µg/m^3	One-hour mean concentration should not be exceeded greater than18 times a year
	40 µg/m^3	Annual mean concentration
PM_{10}	50 µg/m^3	Twenty-four-hour mean concentration should not exceed greater than 35 times a year

Pollutant	Air quality objectives	
	Concentration	Averaging time
	40 µg/m^3	Annual mean concentration
$PM_{2.5}$	25 µg/m^3	Annual mean concentration
NOx	30 µg/m^3	Annual mean concentration (target value for the protection of vegetation and ecosystems)

5.3.2. Table 5.2 summarises the legislation, regulatory and policy framework applicable in this assessment and air quality.

Table 5.2: Summary of legislation, regulatory and policy framework

Scale	Legislation or regulation	Summary
European	EU Directive on ambient air quality (2008/50/EC)	The EU directives outlines the mandatory limit values for different pollutants including NO_2 and PM_{10}, which are considered key pollutants related to traffic. The directive supersedes previous air quality directives (excluding the Fourth Daughter Directive) and outlines a new regulatory framework for $PM_{2.5}$. Member states can postpone attainment deadlines under the directive. Defra assesses and reports annually on compliance with the limit values to the European Commission. The UK is divided into 43 zones, where the status of each zone in relation to the EU limit values is determined by the maximum measured or modelled concentration of that zone. The key pollutants of concern are NO_2 and PM_{10}. Zones can achieve compliance when everywhere within the zone does not exceed the EU limit value, there are exceptions to where the EU limit value applies.
National	Part IV of the Environment Act 1995	Sets guidelines for managing and protecting air quality within the UK and for local air quality management. It requires local authorities to regularly review and assess their local air quality and identify any exceedances of the Air Quality Strategy (AQS). The AQOs only apply to locations where members of the public may be regularly exposed. Where an AQMA has been declared, it requires local authorities to prepare an air quality action plan (AQAP) describing the pollutant reducing measures which have been put in place.

Scale	Legislation or regulation	Summary
	The National Policy Statement for National Networks (NPS NN)	The NPS NN sets out planning guidance for promoters of nationally significant infrastructure projects (NSIPs), and the basis for the examination by the Examining Authority and decisions by the Secretary of State It recognises that *"increases in emissions of pollutants during the construction or operation phases of projects on the national networks can result in the worsening of local air quality (though they can also have beneficial effects on air quality, for example through reduced congestion). Increased emissions can contribute to adverse impacts on human health, on protected species and habitats."* The environmental statement for a proposed project should describe: • The existing air quality levels • Air quality forecast at the time of the Proposed Scheme opening, assuming the Proposed Scheme is not built and then taking into account the impact of the Proposed Scheme • Detail any significant air quality effects, their mitigation and any residual effects discussing both the operational and construction stages and the impacts of road traffic generated by the project. Paragraphs 5.12 and 5.13 of the NPS NN provides advice for decision makers: "*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."* *"the secretary of State should refuse consent where, after taking into account mitigation, the air quality impact 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 a European Commission at the time of the decision."*
	The Air Quality Strategy (AQS)	Outlines air quality standards and objectives to protect people's health and the environment.
	The Air Quality (Standards) Regulations 2010 (SI 2010/2001)	Provides statuary backing to the UK National Air Quality Standards (AQS) in England.
	Clean Air Strategy 2019	National strategy outlining the actions required from both the government and society to improve air quality. It includes updated goals to reduce public exposure to $PM_{2.5}$ as recommended by the World Health Organisation
	Highways England Air Quality Strategy 2017	Outlines Highways England's approach to improving air quality as part of the 2015 to 2020 Road Investment Strategy. The strategy details the following actions to improve air quality: • Exploring new and innovative approaches to improve air quality, such as air quality barriers.

Scale	Legislation or regulation	Summary
		• Working with key stakeholders such as DfT and Defra to develop and deliver policies to improve air quality. • Where appropriate, designing out or mitigating poor air quality for Highways England road schemes. • Improving air quality monitoring across the Highways England road network for example by installing 50 new continuous air quality monitoring stations. • Working to optimise use of the road network for example by informing customers of alternative routes for journeys to avoid sensitive area.
	UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations 2017	This plan details the government's plan to reduce NO_2 concentrations within statutory limits within the shortest possible time. The plan identifies several local authorities with exceedances of the NO_2 objective and requires them to undertake a local assessment to consider the best options to achieve compliance.
Local (refer to 5.7.3 which lists the administrative boundaries relevant to the Proposed Scheme)	Peterborough Local Plan 2016 – 2036	The Peterborough Local Plan contains planning policies for the growth and regeneration of Peterborough and its surrounding villages up to 2036. The plan outlines objectives and policies detailing what and how much development should take place to achieve the targeted growth. The plan contains the following policy, Policy LP13: Transport and states: *"Major development proposals adjacent to international and nationally designated biodiversity sites will require an air quality assessment to demonstrate no significant adverse effect on sensitive features. Major development located not immediately adjacent, but within the vicinity of, such designated sites, may also require an air quality assessment if there is the possibility of a significant adverse effect arising."*
	Huntingdonshire's Local Plan to 2036	Huntingdonshire's Local Plan to 2036 sets out the Council's approach to securing sustainable development from 2011 and 2036 in order to meet identified needs. It identifies key areas for land development and includes policies against which all planning applications are considered. Policy LP 36: Air Quality states: *"A proposal will need to be accompanied by an Air Quality Assessment where:* *a. it is for large scale major development, defined in the 'Glossary';* *b. it would potentially conflict with an Air Quality Action Plan;* *c. any part of the site is located within 50m of an Air Quality Management Area (AQMA) or a Clean Air Zone (CAZ);* *d. a significant proportion of the traffic generated would go through an AQMA or a CAZ; or* *e. any part of the site is located within 100m of a monitoring site where the annual mean level of nitrogen dioxide exceeds 35µg/m^3* *An Air Quality Assessment should be proportionate to the nature and scale of the proposal and the level of concern about air quality, but should assess:* *f. the existing state of air quality surrounding the site;* *g. how the proposal could affect air quality during construction and operational phases;*

Scale	Legislation or regulation	Summary
		h. the extent to which people could be exposed to poor air quality; and *i. how biodiversity could be affected by changes in air quality as a result of the proposal.* *A proposal will need to be accompanied by a low emissions strategy where the air quality assessment shows that the proposal would:* *j. have a significant adverse effect on air quality;* *k. have an adverse effect on the air quality factors that led to the affected AQMA being designated;* *l. cause a significant increase in the number of people that would be exposed to poor air quality; or* *m. lead to a designated nature conservation site or protected species that is sensitive to poor air quality being adversely affected by changes in air quality* *The low emissions strategy will include measures that mitigate the impacts of the proposed development by contributing to the improvement of air quality and/ or the reduction of emissions relating to the designation of the affected AQMA/ CAZ, prioritising actions identified in relevant Air Quality Action Plans/ CAZ action plans or equivalent documents.* *In other circumstances, where identified as necessary based on a transport assessment/ statement, measures to reduce air pollution arising from traffic and traffic congestion may also be required.*
	East Northamptonshire Local Plan Part 2 (2011-2031	The East Northamptonshire Local Plan Part 2 sets out a vision for East Northamptonshire, building on the proposals and land use allocations as set out in the Joint Core Strategy. It includes significant proposals to support the growth and diversification of business opportunities across the district. Policy EN24 mentions air quality: The following sites are allocated for housing development at Oundle as shown on the Policies Map and in the site specific maps under Policies EN25 to EN27: i) Land rear of Cemetery, Stoke Doyle Road – around 70 dwellings; ii) Cotterstock Road/ St Peter's Road – around 130 dwellings; and iii) St Christopher's Drive – around 100 dwellings. Key considerations to be taken into account for each of the sites along with appropriate Local Plan policies are: a) transport impact – including vehicular access points, visibility, pedestrian and cycle links and impact on the existing road network; b) amenity – impact of existing uses and operations upon new development, including issues noise, odours and air quality; c) impact upon community infrastructure; e.g. schools and NHS services; d) impact on the surrounding landscape and street scene, to be

Scale	Legislation or regulation	Summary
		addressed through site design, mix and layout; e) the management of water resources – flood risk, drainage, water supply and sewerage; f) impact on designated and non-designated heritage assets and their settings; and g) biodiversity impacts.

5.4. Assessment methodology

5.4.1. This section describes the methodology which has been used for the assessment of air quality for both the construction and operational phase of the Proposed Scheme. The assessment methodology for the air quality assessment is based on the following guidance:

- DMRB LA 105 Air Quality published by Highways England, November 2019 now superseeding HA207/07 and corresponding IANs
- The Department for Environment, Food and Rural Affairs' (DEFRA) Local Air Quality Management (LAQM) technical guidance (hereafter referred to as LAQM.TG(16))

5.4.2. The level of assessment was identified using the "flow chart for the determination of simple or detailed assessment" given in LA 105. The traffic scoping criteria was applied to the Traffic Reliability Area (TRA) to identify all roads triggering the highest change with receptors within 200m of the Proposed Scheme boundary. A desk-based study was undertaken to determine the availability of sufficient baseline air quality data for the assessment. This allowed for the level of assessment to be classified, which is based on the risk potential of the project with the sensitivity of the receiving environment. The project's risk potential was classified as high risk as the Proposed Scheme falls into the category of "major bypass and motorway junction improvements". The receiving environmental sensitivity was also classified as high due to the large numbers of human and ecological receptors identified within 50m of the roads triggering the traffic screening criteria (over 143 receptors). Based on this assessment it was determined that a detailed assessment was required.

5.4.3. Sensitive human receptor locations and designated sites within 200m of the road links triggered by the screening criteria were selected to be included in the air quality assessment. Sensitive receptors include residential properties, schools and hospitals closest to the road junction and anticipated to experience highest pollutant concentrations.

5.4.4. The air quality assessment, following the outlined guidance, includes:

- the discussion of existing baseline conditions
- the identification of sensitive receptors and Air Quality Management Areas (AQMA), shown on constrainsts maps
- a qualitative assessment of the effect on air quality during the construction phase
- a detailed assessment of the changes in pollutant concentrations on local air quality, including nitrogen deposition rates, during the operational phase at selected sensitive receptors
- the determination of significant air quality effects, including a compliance assessment with the EU Air Quality Directive
- the identification of mitigation measures where appropriate

Construction phase

5.4.5. Following a review of the new DMRB standard, the construction dust methodology outlined in the Scoping Opinion (**TR010039/APP/6.6**), which follows the Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction, has now been superseded by LA 105.

Construction dust

5.4.6. A qualitative assessment of potential dust effects was undertaken in accordance with Section 2.56 onwards in LA 105. The assessment determined the construction dust risk potential of the Proposed Scheme to the receiving environment. The receiving environment sensitivity to construction dust was also determined. The appropriate measures were identified to support mitigation, outlined in Section 5.9.1.

Construction traffic

5.4.7. LA 105 advises where construction activities are programmed to last less than two years, it is unlikely there will be a significant effect on air quality or affect the UK's ability to comply with the Air Quality Directive. As construction activities are programmed to last less than two years the assessment of construction activities on traffic movements were screened out, in line with paragraph 2.60 in LA 105.

Operational phase – local air quality

Assessment scenarios

5.4.8. The local air quality assessment was undertaken using the Atmospheric Dispersion Modelling System (ADMS) Roads Dispersion modelling software (version 5.0.0.1) and focuses on concentrations of air pollutants which can have an impact at local level. The assessment considered emissions of NO_x, NO_2 and PM_{10}. The key scenarios included in the assessment were:

- baseline year 2015 - for model verification
- projected base year 2025 – for long term trends assessment

- opening year without the Proposed Scheme – Do-Minimum (DM) 2025
- opening year with the Proposed Scheme – Do-Something (DS) 2025

5.4.9. Where there are no PM_{10} exceedances of the air quality annual mean objective observed in the base year, no further assessment of PM_{10} in the Do-Minimum and Do-Something scenarios is required.

5.4.10. LA 105 states that there is 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 annual mean objective. Therefore, PM_{10} can be used to demonstrate that the project does not impact on the $PM_{2.5}$ air quality objectives. Where there are no exceedances of PM_{10} annual mean concentrations in the base year, the concentrations can be compared against the $PM_{2.5}$ air quality annual mean objective. Where the PM_{10} concentrations are lower than the threshold, it can be assumed there is no risk of the $PM_{2.5}$ threshold being exceeded and therefore can be screened out from further assessment.

5.4.11. The baseline conditions were determined by reviewing air quality information in annual status reports, published by the local authorities. Information provided in these reports include historic monitoring data and current air quality concerns such as pollution hotspots reporting exceedance of the NO_2 and PM_{10} annual mean objectives within the local authority. This information has allowed current baseline pollutant concentrations within the study area to be mapped. This data was used to verify the model against air quality monitoring data. A model verification year of 2015 has been used in accordance with the traffic data provided for the Proposed Scheme.

5.4.12. The local air quality assessment has been undertaken for the opening year. This is when pollutants are expected to be worst-case in terms of local air quality impacts, continued improvements in emissions are expected in future years. The local air quality assessment has compared the predicted NO_2 and PM_{10} annual mean concentrations against the relevant air quality objectives, this approach is consistent with LA 105.

Traffic data

5.4.13. Outputs from a strategic transport model developed for the Proposed Scheme have been used for this assessment. A summary of the transport model used can be found in the Transport Assessment (**TR010039/APP/7.3**). Data on vehicle flows, speed bands and percent HDVs were available for the following periods in the assessed scenarios:

- 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)

5.4.14. The hourly diurnal traffic flow characteristics were used to estimate the emissions data using the Highways England Speed Band Emissions Factors Toolkit (EFT V3.1). This spreadsheet used the hourly flows of both heavy duty vehicles (HDV) and light duty vehicles (LDV) for each time period along with speed data for each speed band category to derive the emissions data. In addition, information on road alignment, road width and local meteorological data (taken from Wittering for the base year 2015) were input into the dispersion model.

Background concentrations

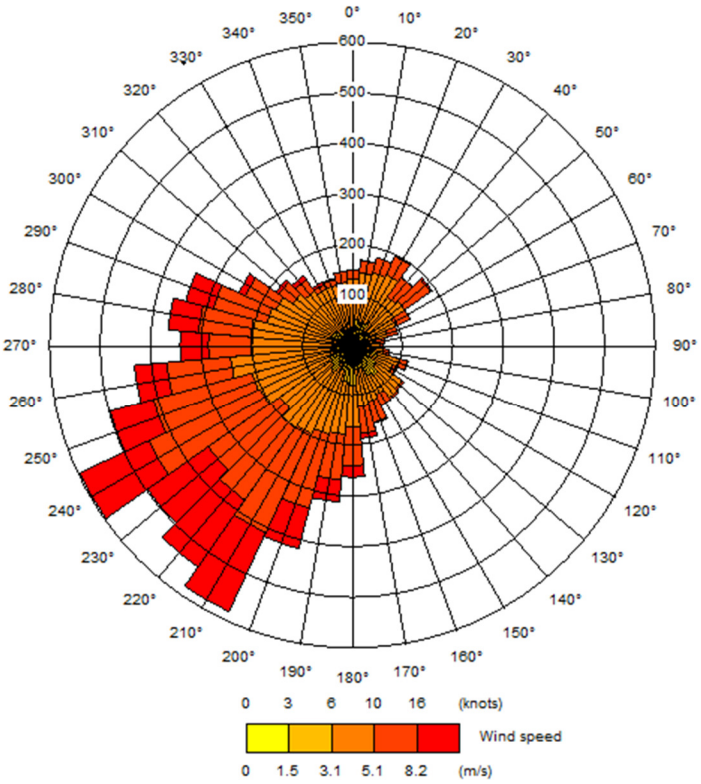
5.4.15. The results output from the air quality dispersion model estimates the contribution from road traffic emissions to annual mean concentrations of NO_x and PM_{10} at selected sensitive receptors. These concentrations are combined with background concentration estimates, to account for other sources of air pollution not being modelled. This derives a total annual mean concentration which can then be compared against the relevant air quality objective.

5.4.16. Background concentrations have been taken from Defra's background maps, further details can be found in Section 5.7.15.

Met data

5.4.17. Hourly sequential meteorological data for the base year of 2015, measured at the closest meteorological site at Wittering was used for the air quality assessment. The wind rose for 2015 is presented in Diagram 5-1 which highlights predominant wind directions from the west and south-west, which are associated with the highest wind speeds. For full details on the model input parameters for this study see Appendix 5.1 Air Quality Dispersion Modelling process (**TR010039/APP/6.3**).

Diagram 5-1 Wittering 2015 wind rose



NO_x to NO_2 conversion

5.4.18. NO_2 annual mean concentrations were derived from the modelled road NO_x concentrations using the most up to date version, at the time of the assessment, of Defra's NO_x to NO_2 calculator (version 7.1.1 for Highways England). The City of Peterborough was selected as the local authority data used for the conversion, as this is where most selected receptors are located. "All other urban UK traffic" was selected for the traffic mix.

Verification

5.4.19. The model verification process has been conducted in accordance to the guidance outlined in LAQM.TG (16). The annual mean NO_2 concentrations for the 2015 base year were verified by comparing against available monitored data.

The modelled road NO_x was adjusted accordingly in line with the guidance to account for systematic bias. The adjustment factor produced by the model verification has been applied to the modelling outputs. For full details on verification see Appendix 5.2 – Air quality verification and model adjustment (**TR010039/APP/6.3**).

5.4.20. Due to the absence of monitored PM_{10} concentrations within the study area, the adjustment factor derived from the modelled road NO_x was applied to the modelled PM_{10} concentrations. This approach is consistent with the guidance outlined in LAQM TG (16).

Long-term trends

5.4.21. To ensure that the modelled roadside NO_2 concentrations are not too optimistic and to account for uncertainties in predicted future roadside nitrogen dioxide concentrations, a process known as "gap analysis" is completed, as outlined in LA 105. An additional scenario is included within the air quality assessment to enable the gap analysis. Gap analysis is the application of adjustment factors which take into account the assumed roadside rates of reduction in NO_x and NO_2 within Defra's modelling tools when compared to observed roadside monitoring trends.

5.4.22. The additional scenario is called the projected base year and is modelled using the base year traffic data with the opening year vehicle emission factors and background concentrations. The final results for the opening year are then 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) is used to produce the gap factor and adjust the opening year results.

Compliance with EU Directive on ambient air quality

5.4.23. Evaluation of compliance with EU limit values has been undertaken in accordance with guidance outlined in LA 105. The compliance risk assessment is based on identifying qualifying features which meet Defra's interpretation of the Air Quality Directive. This includes public access and sensitive receptors (residential properties, schools & hospitals) which reside within 15m of the running lane/kerbside, but not within 25m of a junction.

5.4.24. Where qualifying features along each Pollution Climate Mapping (PCM) link are identified, the air quality assessment will model NO_2 concentrations for:

- the nearest qualifying feature along the PCM link where concentrations are highest
- a 4m point from the running lane in the same location as the qualifying feature to be compared against the national PCM modelled point

Update to guidance and scope of assessment

5.4.25. The scope of this assessment has been updated from the Scoping Report (February 2018) following changes to DMRB guidance in 2019 from HA207/07 to LA 105. A summary of key changes has been provided in Table 5.3. The key change is with regards to the designated sites and compliance risk assessments.

Table 5.3: Update to guidance and scope of assessment

Scoping Report (old DMRB HA207/07)	Update (new DMRB LA 105)
Screening criteria for study area for local assessment: • Road alignment will change by 5m or more • Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more • Heavy duty vehicles (HDV) flows will change by 200 AADT or more • Daily average speed will change by 10km/hr or more • Peak hour speed will change by 20km/hr or more	Screening criteria for study area for local assessment: • Road alignment will change by 5m or more • Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more • Heavy duty vehicles (HDV) flows will change by 200 AADT or more • A change in speed band
Guidance from IANs published by Highways England	Now superseded by LA 105
Compliance risk assessment (outlined in IAN 175/13): • All road links which intersect the PCM model to be considered • Identify opening year NO_2 concentrations from the PCM model • Calculate total NO_2 concentrations with formula • Scheme NO_2 calculated by modelling receptors within 200m of road links intersecting PCM model • Identify any exceedances of EU limit value with increases greater than 0.4 µg/m^3 as a result of the project in the opening year	Compliance risk assessment: • Only road links which trigger the screening criteria on PCM links to be considered • Selection of nearest qualifying features to be modelled • The area 25m around junctions shall be excluded from the compliance risk assessment, irrespective of whether there are any sensitive receptors or public access within 15m of the edge of the roads within the junction. • Local model 4m point validation to compare against the national PCM modelled output • Identify any exceedances of EU limit value with increases greater than 0.4 µg/m^3 as a result of the project in the opening year
Designated site assessment: • Identify all sites sensitive to nitrogen within 200m of study area • Obtain total average nitrogen deposition for 5km grid square • Calculate NO_2 for all transects in habitats • Estimate dry deposition of NO_2 in transects • Compare deposition rates with critical loads	Designated site assessment: • Identify all sites sensitive to nitrogen within 200m of study area • Additional designated habitats to be assessed • Calculate road NO_x & NO_2 of all transects in habitats • Convert road NOx into nitrogen deposition rate • Identify if N deposition with the project is less than the applicable lower critical load

Scoping Report (old DMRB HA207/07)	Update (new DMRB LA 105)
	• Identify if change in nitrogen deposition with and without the project is less than 1% of the lower critical load
Regional assessment	No longer required in LA 105

5.4.26. The most recent baseline traffic data available for the assessment was for a baseline year of 2015. It was concluded the most recent available tools at the time of undertaking the assessment will be used alongside the 2015 baseline traffic data.

Assessment criteria

Human health

5.4.27. LA 105 outlines guidance for evaluating significant air quality effects for a project for sensitive human receptors.

5.4.28. Only sensitive receptors where the outputs from the air quality modelling predict an exceedance in the Do-Minimum (opening year without Proposed Scheme) and / or the Do-Something (opening year with Proposed Scheme) scenario are assessed for significance. The differences in concentrations between the DM and DS scenarios, along with the numbers of receptors, are used to determine the level of significance as outlined in Table 5.4.

Table 5.4: Judgement of significant air quality effects

Magnitude of change in concentration (µg/m^3 *)	Value of change in annual average NO_2 and PM_{10}	Total Number of receptors with:	
		Worsening of an air quality at sensitive receptor above the air quality threshold or the creation of a new exceedance	Improvement of an air quality at sensitive receptor above the air quality threshold or the removal of an existing exceedance
Large	Greater than 4 µg/m^3		
Medium	Greater than 2 µg/m^3		
Small	Greater than 0.4µg/m^3		
Total change		Sum of above	Sum of above

5.4.29. A conclusion of no likely significant effect for human health receptors can be determined if:

- modelled concentrations for human health are less than the air quality thresholds
- the difference in the concentrations between the Do-Minimum and Do-Something scenarios are imperceptible (less than 1% (or 0.4 µg/m^3)) of the air quality threshold

5.4.30. LA 105 outlines a framework to provide guidance on the number of receptors which might result in a significant effect for each category within the magnitude of change criteria. Should the change in concentrations be greater than 1% of the air quality threshold then sensitive receptors will be assigned to the select criteria in Table 5.5.

Table 5.5: Guidance to the number of properties informing a judgment of significant air quality effects

Magnitude of change in annual mean NO_2 or PM_{10} (µg/m^3)	Guideline bands for number of receptors with:	
	Worsening of an air quality objective already above the objective or the creation of a new exceedance	Improvement of an air quality objective already above the objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

5.4.31. The guidelines set out in Table 5.5 provide a guide to the change in concentrations at receptors along with the numbers of receptors affected. Consideration of both has determined whether the Proposed Scheme is likely to trigger a significant effect.

- Where the number of properties resides between the lower and upper guideline bands for any of the magnitude of change bands, as outlined in Table 5.5 the following criteria has been used:
  - The absolute concentration at each receptor is the modelled concentration 40 µg/m^3 or 60 µg/m^3
  - How many receptors are there in each of the magnitude of change criteria ie does the project create more worsening than improvements
  - The magnitude of change in concentration at each receptor e.g. 0.6 µg/m^3 or 1.8 µg/m^3

5.4.32. Where the total number of receptors are greater than the upper guideline band in any of the magnitude categories the project is likely to trigger a significant air quality effect.

5.4.33. Where the numbers of receptors are less than the guideline band for each magnitude of change then the project is unlikely to trigger a significant air quality effect for human health.

5.4.34. The air quality assessment has therefore determined the number of properties residing between the lower and upper guideline bands for any magnitude of change criteria.

5.4.35. The compliance of the Proposed Scheme with EU limit values will be assessed using guidance outlined in Figure 2.79 in LA 105. Should the project trigger the traffic change criteria on any PCM links, then validation of the modelling results will occur to determine if any exceedances of the EU limit value, with increases of greater than 0.4µg/m^3, will result with the Proposed Scheme in place.

Ecological

5.4.36. Following guidance outlined in LA 105, all designated sites within 200m of the affected road network (ARN) and sensitive to nitrogen (N) deposition have been assessed within the air quality assessment. The professional judgment of the competent expert for biodiversity has been used to determine which habitats are sensitive to N deposition.

5.4.37. Transects were created on designated sites which are nearest roads triggering the highest change in flows with the Proposed Scheme. These transects represented the most sensitive areas to changes in air quality concentrations and subject to the highest pollutant concentrations. A transect was created within each qualifying designated site at 10m from roadside at the closest location within the designated site. Then at 10m intervals up to a maximum distance of 200m. This approach is consistent with LA 105.

5.4.38. An assessment of significant impacts shall be determined if the N deposition with the project exceeds the lower critical load, or the change in nitrogen deposition with and without the project is greater than 1% of the lower critical load. The competent expert for biodiversity shall assess the air quality attribute of the designated site to confirm whether it should be restored or maintained. The determination of a likely significant effect shall be concluded by the biodiversity expert.

5.5. Assessment assumptions and limitations

5.5.1. Air quality modelling predictions will be based on the most reasonable, robust, and representative methodologies in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with model predictions:

- Uncertainties with traffic forecasts.

- Uncertainties with vehicle emissions predictions.
- At the time of undertaking the air quality assessment the most recently available tools were used.
- 2017 background maps were back casted to the year 2015, using a factor produced by Defra. This factor may add a margin of error to the background maps used in this assessment. A comparison of the background maps can be found in paragraph 5.7.16.
- The suitability of meteorological data.
- Simplifications made within modelling calculations or post processing of the data that represent atmospheric dispersion or chemical reactions.
- Whilst there are these uncertainties in the air quality modelling. The modelling has been verified against baseline year measurement data in accordance with LAQM TG(16). This verification factor is applied to the baseline and Do-Minimum and Do-Something scenarios.
- The identification of sensitive receptors was based on OS Address Base Plus data. There is the possibility that these data do not contain properties which have been recently built and therefore may not been considered within the air quality assessment. All efforts were made to identify and consider such properties within the assessment.

5.6. Study area

Construction phase

5.6.1. The following criteria, outlined in LA 105, was used to determine the construction dust risk potential of the project:

Table 5.6: Construction dust risk potential

Risk	Examples of the types of project
Large	large smart motorway projects, bypass and major motorway junction improvements.
Small	junction congestion relief project i.e. small junction improvements, signalling changes. short smart motorway projects.

5.6.2. The dust risk potential for the project was classified as large due to the nature of the improvements of the Proposed Scheme, involving major bypass and motorway junction improvements.

5.6.3. Once the construction dust risk potential has been classified, the receiving environment sensitivity was determined using the criteria outlined in Table 5.7. The receiving environment sensitivity for the project was classed as high due to the presence of receptors within 50m and 100m from construction activities. A constraints map identifying sensitive receptors within 0-50m, 50-100m and 100-200m of construction activities can be found in Figure 5.1 (**TR010039/APP/6.2**).

Table 5.7: Receiving environment sensitivity to construction dust

Construction dust risk potential	Distance from construction activities		
	0-50m	50-100m	100-200m
Large	High	High	Low
Small	High	Low	Low

5.6.4. The dust risk potential and receiving environment sensitivity was used to inform the measures to support the proposed mitigation.

Operational phase – local air quality

5.6.5. The location of the Proposed Scheme can be found in Figure 5.2 Location of the Proposed Scheme (**TR010039/APP/6.2)**.

5.6.6. The following screening criteria, outlined in LA 105, were used to identify roads which are likely to be impacted by the Proposed Scheme. Roads which triggered the screening criteria below are required to be considered within the air quality assessment:

- An annual average daily traffic (AADT) flow change of 1,000 or more
- A heavy duty vehicle (HDV) flow change of 200 or more
- A change in speed band
- A change in carriageway alignment by greather than 5m

5.6.7. Once the road links triggering the screening criteria are identified, all adjoining roads, with modelled traffic data, within 200m are required to be selected. This forms the air quality study area and is known as the Affected Road Network (ARN). The ARN is shown in Figure 5.3. (**TR010039/APP/6.2)**.

5.6.8. The ARN was selected from the traffic model known as the Traffic Reliability Area (TRA). The TRA spanned a large spacial extent and covered all areas sensitive to changes in air quality appropriate for this assessment.

5.6.9. The level of assessment was identified using guidance outlined in LA 105 and the flow diagram in Figure 2.10 of LA105. The level of assessment is based on the risk of the project with the sensitvity of the receiving environment. The project's risk potential was classified as high risk as the Proposed Scheme fell into the category of "major bypass and motorway junction improvements" given in LA105. The receiving environmental sensitivity was also classified as "high" due to 143 sensitive receptors identified within 50m of the roads triggering the traffic

screening criteria. Based on this assessment it was determined that a detailed assessment was required.

5.6.10. The locations which represent human exposure for each triggered link were identified. These were predominantly residential receptors, but also include hospitals and schools. The receptor locations are shown in Figure 5.4 (**TR010039/APP/6.2**).

5.6.11. All designated sites which include Special Areas of Conservation (SAC), Ramsar and Special Protection Areas (SPAs). Local wildlife sites, ancient woodland and veteran trees within 200m of the triggered links were also identified. Designated sites contain features which may be sensitive to pollutants in the air which have the potential to adversley affect vegetation. The designated sites were assessed by the competent expert for biodiversity for those sensitive to nitrogen deposition and included in the assessment. The designated sites identified for this air quality assessment are shown in Figure 5.5 (**TR010039/APP/6.2**).

5.6.12. The modelled road NO_x concentration for each ecological transect was converted to road NO_2 for every point along the transect in the base, Do-Minimum and Do-Something scenarios. The road NO_2 was then converted to dry nutrient nitrogen (N) deposition rate (kg N/ha/yr) and assessed.

5.7. Baseline conditions

5.7.1. To determine the significance of an impact, it is important to outline and understand baseline conditions in and around the study area. This allows a comparison to be drawn against any potential changes in the assessment of the air quality.

5.7.2. For the purpose of this assessment, a desk-based study was undertaken where air quality data were obtained from the following sources:

- Department for Environment, Food and Rural Affairs (Defra) – LAQM 1km x 1km grid background maps
- Peterborough City Council Annual Status Reports
- East Northamptonshire Council Annual Status Reports
- Huntingdonshire District Council Annual Status Reports
- Norwich City Council
- Defra Pollution Climate Mapping (PCM)
- Defra Air Quality Management Areas (AQMA) interactive map

Local air quality

5.7.3. The Proposed Scheme is located within the administrative boundary of Peterborough City Council. However, the ARN spans over three administrative

boundaries: Peterborough City Council, North Northamptonshire Council and Huntingdonshire District Council.

5.7.4. There are no AQMAs within the ARN. The nearest AQMA is located 6km to the east within Peterborough City Council.

Air quality monitoring

Local authority monitoring

5.7.5. For the purpose of this assessment, a baseline year of 2015 has been modelled in accordance with the baseline traffic data provided.

5.7.6. For a full summary of the three Local Authority's monitoring data ranging from years 2015 to 2018, please refer to Appendix 5.1 (**TR010039/APP/6.3**). At the time of the assessment, 2018 was the most recent year of published monitoring data.

5.7.7. There were no automatic monitoring stations within Peterborough City Council for the year 2015. The nearest automatic monitoring station is a roadside station located in Huntingdon, approximately 24km south of the ARN. Due to the distance from the Proposed Scheme, and the extent of the ARN, this automatic monitoring station was not included within the assessment.

5.7.8. In 2015, Peterborough City Council undertook non-automatic diffusion tube monitoring at 16 sites to assess compliance with the annual mean NO_2 air quality. Huntingdonshire District Council undertook non-automatic diffusion tube monitoring at 44 sites, with East Northamptonshire undertaking monitoring at 23 sites. There are two sites located within the ARN and representative of the study area. The closest to the Proposed Scheme is a roadside site located on Great North Road along the A1 (measured by Huntingdonshire District Council). The other diffusion tube is another roadside location in Wittering, north of the Proposed Scheme (measured by Peterborough Council). There were no exceedances of the NO_2 annual mean objective in the year 2015. Both sites reported a concentration below the annual mean objective of 40 $\mu g/m^3$. Full details of the local authority monitoring locations and 2015 NO_2 annual mean concentrations used within this assessment can be found in Table 5.8

5.7.9. The monitoring outlined in Table 5.8 below was used for verification purposes, as outlined in Appendix 5.2 (**TR010039/APP/6.3**). The locations of these monitoring points can be found in Figure 5.6 (**TR010039/APP/6.2**).

Table 5.8: 2015 non-automatic monitoring sites

Site ID	Location	Site classification	National grid		2015 annual mean NO_2 concentration (µg/m^3)
			X	Y	
5	Wittering	Roadside	505698	302775	21.9
Stibbington 1	7 Great North Road	Roadside	508326	298684	29.6

Scheme specific monitoring

5.7.10. To determine the current baseline conditions around the study area, a six-month nitrogen dioxide survey was conducted for the purpose of this air quality assessment. The diffusion tube survey ran from September 2019 to March 2020. This monitoring was conducted to supplement the existing monitoring in place by Peterborough City Council and Huntingdonshire District Council.

5.7.11. The monitoring was measured and reported at three locations around the Proposed Scheme (two roadside and one urban background), with an additional triplicate co-located at the automatic monitoring site at Castle Meadow in Norwich. This co-located automatic site was identified as being representative of the Wansford study and was selected as an appropriate co-location site for all of the wider A47 schemes. This follows LAQM TG(16) best practice. The locations of all monitoring sites in relation to the Proposed Scheme are shown in, Figure 5.7 (**TR010039/APP/6.2**).

5.7.12. The results from the monitoring locations were bias adjusted and annualised in accordance with LAQM.TG(16) to provide a 2019 annual mean NO_2 concentration. The monitoring survey concluded that there were no exceedances of the annual mean NO_2 objective within the vicinity of the Proposed Scheme. The highest concentration measured within the study area was 25.6 µg/m^3 at Wansford 4, located on Old North Road directly adjacent to the Proposed Scheme. This is below the NO_2 annual mean objective of 40 µg/m^3. Final bias adjusted and annualised results for the monitoring survey can be found in Table 5.9. The full methodology for bias adjustment and annualisation can be found in Appendix 5.2. (**TR010039/APP/6.3**).

Table 5.9: Diffusion tube monitoring results for 2019

Site	Location	Site classification	National grid		2019 annual mean NO_2 concentration ($\mu g/m^3$)
			X	Y	
Wansford 4	Old North Road	Roadside	507380	299826	25.6
Wansford 5	Black Swan Spinney	Urban background	507474	299689	14.6
Wansford 6	Sutton Drift	Roadside	509735	298928	11.2
Colocation 1	Norwich Castle Meadow Automatic Station	Roadside	623202	308615	39
Colocation 2		Roadside	623202	308615	39
Colocation 3		Roadside	623202	308615	40

5.7.13. The results of the 2019 monitoring survey were factored backwards to 2015 in line with the baseline year and used for model verification purposes. The full methodology for producing the back-casting factor can be found in Appendix 5.2 (**TR010039/APP/6.3**) The results from this monitoring survey were also used to determine 2015 equivalent pollutant concentrations around the Proposed Scheme and assess whether there were any areas close to the NO_2 annual mean objective. The back casted 2015 monitoring survey results are presented in Table 5.10.

5.7.14. The highest concentration around the Proposed Scheme was predicted to be 34.4 $\mu g/m^3$ in 2015, which is below the annual mean objective of 40 $\mu g/m^3$.

Table 5.10: Diffusion tube monitoring results for 2015

Site	Location	Site classification	National grid		2015 annual mean NO_2 concentration ($\mu g/m^3$)
			X	Y	
Wansford 4	Old North Road	Roadside	507380	299826	34.4
Wansford 5	Black Swan Spinney	Urban background	507474	299689	19.6
Wansford 6	Sutton Drift	Roadside	509735	298928	15
Colocation 1	Norwich Castle Meadow Automatic Station	Roadside	623202	308615	53
Colocation 2		Roadside	623202	308615	52
Colocation 3		Roadside	623202	308615	53

Background mapping

5.7.15. Background pollutant maps provide estimates of background concentrations for specific pollutants. They are used to better understand the contribution of local sources to pollutant concentrations. Defra provides estimates of background pollution concentrations for NO_x, NO_2 and PM_{10} across the UK for each 1km grid square for every year from 2017 to 2030. Background pollution maps have been obtained from Defra for this assessment.

5.7.16. The most recent 2017 based background maps were used for this assessment. Due to a baseline year of 2015, the DEFRA background back-casting factor was used to produce 2015 concentrations from 2017 based background maps. A comparison between the back casted 2015 background values against the concentrations recorded at the urban background monitoring site at Lakenfields in Norwich can be found in Table 5.11. To demonstrate the robustness of the background maps, the table includes a percentage difference between the back-casted and measured concentrations. Full details of the factor used can be found in Appendix 5.1 (**TR010039/APP/6.3**)

Table 5.11: Background concentration comparison

Grid square	NO_x (µg/m^3)			PM_{10} (µg/m^3)		
	Back-casted 2015 concentration	Measured NO_x concentration	% Difference	Back-casted 2015 concentration	Measured PM_{10} concentration	% Difference
623500_306500	20.0	16.0	-20%	13.3	15.0	12.7%

5.7.17. The range of background NO_x and PM_{10} concentrations for the study area and around the Proposed Scheme can be found in Table 5.12. Concentrations for the base year (2015) and opening year (2025) have been presented. A more detailed breakdown of background concentrations per 1km grid square can be found in Appendix 5.1 (**TR010039/APP/6.3**).

Table 5.12: Background mapped concentrations for baseline and opening year

Year	Range	NO_x (µg/m^3)	PM_{10} (µg/m^3)
2015	Across the study area	10.4-33.8	11.9-18.1
2025	Across the study area	7.7-24.3	11.6-18.3

Pollution climate mapping model

5.7.18. Defra's Pollution Climate Mapping (PCM) is used to report compliance with the EU Directive (EU directive 2008/50/EC) and provides NO_2 concentrations for several roads across the UK for a selection of futures. The PCM model projections used in the assessment were released in 2019, with a reference year of 2017. This was the most recent dataset available at the time of the assessment.

5.7.19. To determine whether the project is at risk of compliance with the EU directive, the study area is compared with the PCM network published by Defra. There were no road links from the PCM model in the study area for the project and therefore the project does not affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible.

Selected sensitive receptors

5.7.20. Sensitive receptors have been chosen following the guidance outlined in LA 105. For each scenario a mixture of residential, hospitals and schools have been chosen for this assessment. A degree of professional judgement was used when selecting the receptors, where receptors located nearest to the roads triggering the screening criteria were selected. For each triggered link only one receptor representing the closest receptor was chosen. These receptors were considered the most sensitive to changes in air quality concentrations, and subject to the highest road traffic emissions. A summary of the number and types of receptors per scenario is detailed in Table 5.13. A full detailed summary of receptor locations can be found in, Appendix 5.3 (**TR010039/APP/6.3**).

Table 5.13: Receptor summary

Modelled scenario	Receptor type	Count	Total
Base – 2015 DM & DS 2025	Residential	20	23
	School	2	
	Hospital	1	

Ecological receptors

5.7.21. Of all the ecological sites identified being within 200m of a triggered link, there were four designated ecological sites sensitive to nitrogen deposition:

- Thorpe Wood – Ancient Woodland
- Sibson Flood Meadows – County Wildlife Site

- Roadside Nature Reserve – County Wildlife Site
- Sutton Heath and Bog - SSSI

5.7.22. The location of these ecological transects can be found in Figure 5.8. (**TR010039/APP/6.2**), along with the full transect results in Appendix 5.3 (**TR010039/APP/6.3**).

5.8. Potential impacts

5.8.1. This section presents the findings of the assessment of potential impacts on air quality.

Operation

Local air quality: human health

NO_2 results

5.8.2. This section presents the potential impacts of the Proposed Scheme on local air quality within the study area. The presentation of annual mean NO_2 concentrations include sensitive receptors along locations with the greatest change resulting with the Proposed Scheme in place. Modelled sensitive receptors can be found in Figure 5.4 (**TR010039/APP/6.2**).

5.8.3. Modelling has been undertaken using the approach outlined in LA 105, using the Interim HA Long Term Gap Analysis Calculator v1.1 (LTTE6). The gap analysis applies a set of adjustment factors which take into account the assumed roadside rates of reduction in NO_x and NO_2. This is done by comparing Defra's modelling tools to observed roadside monitoring trends. This approach is considered the most robust in projecting and estimating the future concentrations in 2025 and considers the uncertainty associated in long-term trends. These results have formed the basis in estimating the impact and significance of the Proposed Scheme on selected sensitive receptors, alongside determining compliance with the EU directive for annual mean NO_2 concentrations.

5.8.4. The full set of results for annual mean concentrations and the changes (increases and decreases) in NO_2 concentrations between the DM 2025 and DS 2025 opening years can be found in Table 5.14.

Table 5.14: modelled receptor results

Receptor ID	X	Y	Address	Property type	NO_2 ($\mu g/m^3$)				PM_{10} ($\mu g/m^3$)
					Base 2015	DM 2025	DS 2025	DS-DM 2025	Base 2015
R_01	507319	300523	12 Great North Road,	Residential	36.53	27.93	28.40	0.47	18.76

Receptor ID	X	Y	Address	Property type	NO_2 (µg/m³)				PM_{10} (µg/m³)
					Base 2015	DM 2025	DS 2025	DS-DM 2025	Base 2015
			Thornhaugh, Peterborough, PE8 6HJ						
R_02	507374	299832	41 Old North Road, Wansford, Peterborough, PE8 6LB	Residential	24.58	18.70	19.01	0.32	16.68
R_03	507379	299697	1 Black Swan Spinney, Wansford, Peterborough, PE8 6LE	Residential	22.97	16.92	17.04	0.12	16.52
R_04	507488	299713	6 Black Swan Spinney, Wansford, Peterborough, PE8 6LE	Residential	28.38	21.80	21.56	-0.24	17.12
R_05	507335	299472	19 Old North Road, Wansford, Peterborough, PE8 6LB	Residential	19.79	14.21	14.28	0.07	16.22
R_06	507366	299331	1 Peterborough Road, Wansford, Peterborough, PE8 6LA	Residential	21.90	15.48	15.59	0.11	16.48
R_07	507447	299342	21 Peterborough Road, Wansford, Peterborough, PE8 6JN	Residential	19.34	14.40	14.46	0.06	16.14
R_08	507533	299456	20 Nene Close, Wansford, Peterborough, PE8 6JJ	Residential	21.40	16.17	16.19	0.03	16.37
R_09	508051	298744	The Bungalow Great North Road, Stibbington, Cambridgeshire, PE8 6LN	Residential	24.04	18.03	17.98	-0.05	17.70
R_10	508338	298686	7 Old Great North Road, Stibbington, Cambridgeshire, PE8 6LN	Residential	34.01	26.22	26.06	-0.16	18.87

Receptor ID	X	Y	Address	Property type	NO_2 ($\mu g/m^3$)				PM_{10} ($\mu g/m^3$)
					Base 2015	DM 2025	DS 2025	DS-DM 2025	Base 2015
R_11	508489	298615	Stibbington Centre For Environmental Education Great North Road, Stibbington, Cambridgeshire, PE8 6LP	Education	27.67	20.99	20.91	-0.08	18.11
R_12	513222	295395	29 Great North Road, Chesterton, Cambridgeshire, PE7 3UJ	Residential	24.01	18.45	18.45	0.00	16.13
R_13	515997	294915	125 Wingfield, Peterborough, Peterborough, PE2 5TJ	Residential	26.19	19.75	19.67	-0.08	17.00
R_14	517065	295246	20 Malus Close, Peterborough, Peterborough, PE7 8DU	Residential	21.31	15.71	15.66	-0.05	16.28
R_15	517068	295428	Phoenix Upper School Malborne Way, Peterborough, Peterborough, PE2 5PH	School	30.54	22.90	22.76	-0.14	17.32
R_16	508967	299720	Station House Sutton Heath Road, Sutton, Peterborough, PE5 7XP	Residential	16.96	12.46	12.69	0.23	14.65
R_17	514158	298552	Temple Hill Lodge Milton Park, Peterborough, Peterborough, PE6 7AB	Residential	19.81	14.72	15.16	0.44	13.93
R_18	515233	298531	Thorpe Lodge Milton Park, Peterborough, Peterborough, PE6 7AB	Residential	21.24	15.70	16.40	0.70	14.03
R_19	516062	298818	86 Apsley Way, Peterborough,	Residential	26.36	19.70	20.83	1.13	14.24

Receptor ID	X	Y	Address	Property type	NO_2 (µg/m³)				PM_{10} (µg/m³)
					Base 2015	DM 2025	DS 2025	DS-DM 2025	Base 2015
			Peterborough, PE3 9PF						
R_20	516142	299007	8 Artis Court, Peterborough, Peterborough, PE3 6FE	Residential	24.64	18.25	19.02	0.77	14.32
R_21	516576	299631	Macmillan Day Centre Cavell Close, Peterborough, Peterborough, PE3 9GX	Hospital	24.44	18.05	18.82	0.77	14.29
R_22	516489	299798	39 Middleton, Peterborough, Peterborough, PE3 9XQ	Residential	23.23	17.12	17.70	0.58	14.17

5.8.5. The total annual mean NO_2 concentrations were estimated for the opening year with and without the Proposed Scheme at 22 sensitive human receptors. The NO_2 concentrations were adjusted following verification outlined in Appendix 5.2 (**TR010039/APP/6.3**). The final concentrations were compared to the AQOs to determine whether there are any exceedances.

5.8.6. There are no exceedances of the NO_2 annual mean objective at any of the selected sensitive human receptors in the opening year with and without the Proposed Scheme. Annual mean NO_2 concentrations were below the AQO of 40 µg/m³ across all modelled receptors in the DM 2025 and DS 2025 scenarios.

5.8.7. The maximum modelled annual mean NO_2 concentration in the DM scenario was 27.93 µg/m³ at receptor 1 on Great North Road north of the Proposed Scheme. The maximum modelled concentration in the DS scenario was 28.40 µg/m³ also at receptor 1 also on Great North Road. The predicted annual mean NO_2 is below the AQO of 40 µg/m³.

5.8.8. The greatest increase in annual mean NO_2 concentration is expected to occur at receptor 19 located on Apsley Way Peterborough adjacent to the A47. The receptor indicates an increase in annual mean NO_2 concentrations from 19.70 µg/m³ to 20.83 µg/m³, an increase of 1.13 µg/m³. The receptor is located adjacent to the A47 which triggers a higher level of flow change (an increased

AADT of 1325) with the Proposed Scheme in place. However, the predicted annual mean concentration is below the AQO of 40 µg/m^3 in both the DM and DS scenarios.

5.8.9. The greatest improvement in annual mean NO_2 concentrations is expected to occur at receptor 4 (located on Black Swan Spinney, adjacent to the A1 on Great North Road). Receptor 4 indicates a decrease in annual mean NO_2 concentrations from 21.80 µg/m^3 in the DM scenario to 21.56 µg/m^3 in the DS scenario showing a small decrease of 0.24 µg/m^3. This change in concentration is due to the re-aligned A47 north of the receptor moving further away with the Proposed Scheme in place. The predicted annual mean concentration is below the AQO of 40 µg/m^3 in both the DM and DS scenarios.

5.8.10. Overall, 14 of the 22 receptors are expected to show a deterioration in air quality, with 7 showing an improvement in air quality with the Proposed Scheme in place. 1 receptor are predicted to experience no change in air quality. All predicted air quality concentrations are below the AQO.

PM_{10} results

5.8.11. The PM_{10} concentrations were adjusted according to the methodology outlined in Appendix 5.2 (**TR010039/APP/6.3**). There are no predicted exceedances of the PM_{10} annual mean AQOs in the baseline year. The highest concentration was recorded at receptor 10 at 18.87 µg/m^3. All annual mean concentrations are predicted to be below the 40 µg/m^3 AQO. In line with LA 105, with no exceedances being reported in the baseline scenario, PM_{10} was not modelled in the Do-Minimum and Do-Something scenarios.

5.8.12. If assumed, as worst case, that all of the predicted PM_{10} concentrations are $PM_{2.5}$ for the baseline scenario at all specified receptors, this would also indicate that there would be no exceedances of the $PM_{2.5}$ air quality objective of 25 µg/m^3.

Ecological receptors

5.8.13. A nitrogen deposition assessment was conducted to assess whether there was potential for a significant impact to be predicted. The background nitrogen deposition rates (kg N/ha/yr) were sourced from the Air Pollution Information System (APIS). The APIS website was used and the competent expert for biodiversity was consulted to identify which feature of the identified designated habitats were sensitive to nitrogen deposition.

5.8.14. The relevant nitrogen critical load values and background information used in this assessment is presented in Table 5.15.

Table 5.15: Background nitrogen deposition rates and critical load values

Designated habitat	Nitrogen critical load class	Critical Load (kg N/ha/yr)	Average background nitrogen deposition rate (kg N/ha/yr)	Species sensitive to nitrogen deposition?
Thorpe Wood	Broadleaved, mixed and yew woodland	10-20	23.5	Yes
Sibson Flood Meadows	Coastal and floodplain grazing marsh	10-20	18.2	Yes
Roadside Nature Reserve	Calcareous grassland	5-10	21.3	Yes
Sutton Heath and Bog	Calcareous grassland	15-25	19.7	Yes

5.8.15. The modelled road NO_x was converted to road NO_2 using the NO_x-NO_2 calculator. The following equations, taken from paragraph 2.43 onwards in LA 105, outlines the steps taken to obtain a total receptor nitrogen deposition rate.

$$1a.\ Conversion\ rate\ for\ grassland\ and\ similar\ habitats = 0.14\ kg\frac{\frac{N}{ha}}{yr}\ (obtained\ from\ LA105)$$

$$1b.\ Conversion\ rate\ for\ forests\ and\ similar\ habitats = 0.29\ kg\frac{\frac{N}{ha}}{yr}\ (obtained\ from\ LA105)$$

$$2.\ Road\ NO_2\ x\ conversion\ rate = dry\ nutrient\ (N) deposition\ rate\ (\frac{kg\frac{N}{ha}}{yr})$$

$$3.\ Dry\ nutrient\ (N)\ deposition\ rate + background\ nitrogen\ deposition\ rate = \boldsymbol{total\ receptor\ nitrogen\ deposition\ rate}$$

5.8.16. The total receptor nitrogen deposition rate was compared against the critical load values of the most sensitive site feature for the designated habitat. The change in nitrogen deposition was also compared against the lower critical load value for each designated habitat. This approach is consistent with LA 105.

5.8.17. The comparison of the total nitrogen deposition rate to the critical load is presented in Table 5.16. The first point of each modelled transect is presented as this represented the highest and worst-case concentrations.

Table 5.16: Comparison of total nitrogen deposition to critical load

Transect receptor ID	Total nitrogen deposition rate (kg N/ha/yr)			DM-DS as % of lower critical load
	DM 2025	DS 2025	DS-DM	
Thorpe_Wood_AW_01	25.452	25.546	0.084	0.841%
Sibson_Flood_Meadows_01	19.427	19.406	-0.021	-0.21%
Roadside_Nature_Reserve_01	22.405	22.265	-0.14	-2.80%
1_SH_SSSI_1	20.035	20.317	0.282	**1.89%**

5.8.18. The nitrogen deposition assessment concluded the total nitrogen deposition rate with the project was above the applicable lower critical load for each designated site.

5.8.19. The change in nitrogen deposition with the project was less than 1% of the lower critical load for three of the four designated sites assessed. In line with the criteria outlined in Figure 2.98 in LA 105, no significant effects on these +designated sites were identified.

5.8.20. The change in nitrogen deposition with the project at the Sutton Heath and Bog SSSI was greater than 1% of the lower critical load for the first four modelled transect points. Results for the comparison against the lower critical load values for the SSSI transect can be found in Table 5.17.

Table 5.17: SSSI transect results

Transect receptor ID	Total nitrogen deposition rate (kg N/ha/yr)			DM-DS as % of lower critical load
	DM 2025	DS 2025	DS-DM	
1_SH_SSSI_1	20.035	20.317	0.282	**1.89**
1_SH_SSSI_2	20.007	20.228	0.221	**1.47**
1_SH_SSSI_3	19.983	20.163	0.18	**1.20**
1_SH_SSSI_4	19.965	20.114	0.149	**1.00**
1_SH_SSSI_5	19.949	20.077	0.128	0.85
1_SH_SSSI_6	19.935	20.046	0.111	0.74
1_SH_SSSI_7	19.924	20.021	0.097	0.64
1_SH_SSSI_8	19.913	20.000	0.087	0.58

Transect receptor ID	Total nitrogen deposition rate (kg N/ha/yr)			DM-DS as % of lower critical load
	DM 2025	DS 2025	DS-DM	
1_SH_SSSI_9	19.904	19.981	0.077	0.51
1_SH_SSSI_10	19.896	19.966	0.07	0.47
1_SH_SSSI_11	19.889	19.953	0.064	0.43
1_SH_SSSI_12	19.882	19.941	0.059	0.39
1_SH_SSSI_13	19.875	19.931	0.056	0.37

5.8.21. In line with Figure 2.98 in LA105, the competent expert for biodiversity was contacted to identify whether the site air quality attribute will be restored or maintained.

5.8.22. The Sutton Heath and Bog SSSI supports grassland communities of two main types, namely calcareous grassland and neutral grassland of the base-poor marsh type, both of which are uncommon in Cambridgeshire. The southern extent of the site comprises semi natural broadleaved woodland. Air quality modelling highlighted an impact of nitrogen deposition 40m north of the proposed road alignment at Station House. The habitat within this 40m area is deciduous woodland comprising pedunculate oak (Quercus robur), and sycamore (Acer pseudoplatanus) abundant with hawthorn (Crataegus spp) and elder (Sambucus nigra) understory. None of the species listed are noted as particularly nitrogen vulnerable in this case. Nitrogen deposition would typically affect more coniferous species and species such as lichens/mosses/ferns rather than the species that are listed. As the core grassland habitat which is listed on the citation is approximately 150m further north-east of the 40m impact area, it is not considered to be impacted by nitrogen disposition from the proposed road alignment. No significant effects have therefore been identified.

Assessment of significant effects

Construction

5.8.23. As construction activities are programmed to last less than two years, it is unlikely there would be a significant effect on air quality or affect the UK's ability to comply with the Air Quality Directive. The construction traffic assessment was therefore screened out of the assessment.

5.8.24. With the recommendation of best practice construction mitigation measures in place, the impact of construction dust is considered highly unlikely to trigger a

significant air quality effect. Therefore, in accordance with LA 105, no significant effects on sensitive receptors have been identified.

Operation

5.8.25. There are no receptors expected to exceed the annual mean NO_2 AQO in the opening year scenarios, all modelled receptors have predicted annual mean NO_2 concentrations below the objective. The nitrogen deposition assessment concluded the change in nitrogen deposition with and without the project less than 1% of the lower critical load for all three designated sites assessed. In accordance with LA 105, no significant effects on human health or ecological receptors have been identified as a result of the Proposed Scheme in place.

5.9. Design mitigation and enhancement measures

Construction

5.9.1. The construction dust assessment has concluded there are no significant effects with the Proposed Scheme for human and ecological receptors. The assessment has been used to inform the best practice mitigation measures in the environmental management plan. Based on a construction dust risk potential of high for the project, the following activities are recommended to monitor the effectiveness of the proposed mitigation measures which will be included in the Enviromental Management Plan (EMP (**TR010039/APP/7.5**)):

1. Development of dust management plan with measures to monitor effectiveness of mitigation as part of the EMP

2. Daily on-site and off-site inspections to be included in EMP

3. Record of complaints/exceptional dust events to be included in EMP

Operation

5.9.2. The air quality assessment has concluded there are no significant adverse effects with the Proposed Scheme for human health and ecological receptors. With no significant effects being reported, no mitigation measures have been proposed.

5.10. Assessment of likely significant effects

5.10.1. The findings of this air quality assessment are consistent with the requirements in Sections 5.12 and 5.13 in the NPS NN and the relevant Council's local development policy plan. As no significant effects have been identified in the air quality assessment, and no mitigation measures been recommended, there will not be any significant residual effects on sensitive human and ecological receptors.

5.11. Monitoring

5.11.1. As no significant effects on human health receptors have been identified as a result of the Proposed Scheme in place, additional air quality monitoring is not required.

5.12. Summary

5.12.1. A detailed air quality assessment has been undertaken to assess the air quality impact during the operational phase of the Proposed Scheme.

5.12.2. A baseline desk study identified there are no AQMAs within the ARN. The nearest AQMA is located 6km east of the ARN within Peterborough City Council. A review of the local monitoring data showed that there are no exceedances of the annual mean NO_2 AQO. There were no monitoring sites measuring PM_{10} data within the study area. A six-month monitoring study was conducted to supplement current available monitoring data and identify pollutant conditions. There were no exceedances of the annual mean NO_2 AQO observed from the monitoring study.

5.12.3. The air quality assessment predicted concentrations at all human health receptors to be below the AQS objective of 40 µg/m^3. Overall, 14 of the 22 receptors are expected to show a deterioration in air quality, with 7 showing an improvement in air quality with the Proposed Scheme in place. 1 receptors are predicted to experience no change in air quality. All predicted air quality concentrations are below the AQO.

5.12.4. The greatest increase in annual mean NO_2 concentration is expected to occur at receptor 19 located on Apsley Way Peterborough adjacent to the A47. The receptor indicates an increase in annual mean NO_2 concentrations from 19.70 µg/m^3 to 20.83 µg/m^3, an increase of 1.13 µg/m^3. The receptor is located adjacent to the A47 which triggers a higher level of flow change (an increased AADT of 1325) with the Proposed Scheme in place. However, the predicted annual mean concentration is below the AQO of 40 µg/m^3 in both the DM and DS scenarios.

5.12.5. At the time of undertaking the assessment, the most recently available tools were used however since completion of the assessment new tools have been made available. It is unlikely that the conclusions discussed in this report would change the significance, had the assessment used these latest versions. Particularly given the maximum impact from the Proposed Scheme is 1.1 µg/m^3, and all concentrations were below the AQO.

5.12.6. Baseline results have shown annual mean PM_{10} concentrations to be below the AQO. As a result, PM_{10} was not included in the opening year modelling scenarios. The baseline PM_{10} concentrations were compared against the $PM_{2.5}$

annual mean objective. There were no concentrations exceeding the $PM_{2.5}$ objective, therefore it was assumed there was no risk of exceedance of the $PM_{2.5}$ threshold.

5.12.7. The nitrogen deposition assessment concluded the change in nitrogen deposition with and without the project less than 1% of the lower critical load for three of the four designated sites assessed. The SSSI habitat showed a change in nitrogen deposition of greater than 1% of the lower critical load. Upon consultation with the competent expert for biodiversity, it was identified the core grassland habitat which is listed on the citation and sensitive to nitrogen deposition is 190m further north-east of the modelled transect zone, therefore the transect area does not contain any of the nitrogen critical load class, so the habitat is not considered to be impacted by nitrogen deposition. No significant effects on ecological receptors have been identified as a result of the Proposed Scheme in place.

5.12.8. The air quality assessment has concluded there would be no significant effects on air quality at human and ecological receptors as a result of the Proposed Scheme.

5.13. References

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- Peterborough City Council. Air Quality Annual Status Reports (ASR) 2015-2019
- The Air Quality (England) Regulations 2015. Statutory Instruments 2015 No. 0000
- The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland, 2007.

5.14. Glossary

Term	Definition
AADT	Annual Average Daily Traffic
HDV	Heavy Duty Vehicles defined as vehicles with gross weight above 3.5 tonnes
ARN	Affected Road Network
Air Quality Management Area (AQMA	An area identified by a local authority where the local air quality objectives not being achieved or are not likely to be achieved within the relevant period. As required by Part IV of the Environment Act 1995.
Air Quality Standards (AQS) objectives	Ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale
Air Quality Strategy	The Government's air quality policy document for England, Scotland, Wales and Northern Ireland
Diffusion Tube	Simple monitoring device for air pollutants that absorbs substances from the air by diffusion (e.g. nitrogen dioxide) into a liquid film coated onto the inside of a plastic tube.
Exceedance	Infringement environmental protection standards by exceeding allowable limits or concentration levels.
Nitrogen oxides (NOx)	Nitrogen oxides (NOx): Nitrogen oxides is a term used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO2), referred to collectively as NOx. These are primarily formed from atmospheric and fuel nitrogen as a result of high temperature combustion. The most important sources in the UK are road traffic and power generation.
Particulate Matter (PM10)	Particulate Matter (PM10): Particulate Matter less than 10 microns, tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the air sacs in the lungs where they may be deposited, resulting in adverse health effects.
Particulate Matter (PM2.5)	Particulate matter less than 2.5 microns, tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols.